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Advancing Health Education With Telemedicine

Mildred Vanessa López Cabrera

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Advancing Health Education With Telemedicine

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Tecnologico de Monterrey, Mexico

A volume in the Advances in Medical Education, Research, and Ethics (AMERE) Book Series

Published in the United States of America by
IGI Global
Medical Information Science Reference (an imprint of IGI Global)
701 E. Chocolate Avenue
Hershey PA, USA 17033
Tel: 717-533-8845
Fax: 717-533-8661
E-mail: cust@igi-global.com
Web site: http://www.igi-global.com

Library of Congress Cataloging-in-Publication Data

Names: López Cabrera, Mildred Vanessa, 1987- editor.
Title: Advancing health education with telemedicine / Mildred Vanessa López Cabrera, editor.
Description: Hershey, PA : Medical Information Science Reference, [2022] | Includes bibliographical references and index. | Summary: "This book provides relevant theoretical frameworks and the latest empirical research findings on how to leverage technologies and infrastructure of telehealth, telemedicine, and e-health to advance health professions education"-- Provided by publisher.
Identifiers: LCCN 2021033919 (print) | LCCN 2021033920 (ebook) | ISBN 9781799887836 (hardcover) | ISBN 9781799887843 (ebook)
Subjects: MESH: Telemedicine--methods | Education, Professional | Health Promotion--methods
Classification: LCC R855.3 (print) | LCC R855.3 (ebook) | NLM W 83.1 | DDC 610.285--dc23
LC record available at https://lccn.loc.gov/2021033919
LC ebook record available at https://lccn.loc.gov/2021033920

This book is published in the IGI Global book series Advances in Medical Education, Research, and Ethics (AMERE) (ISSN: 2475-6601; eISSN: 2475-661X)

British Cataloguing in Publication Data
A Cataloguing in Publication record for this book is available from the British Library.

Advances in Medical Education, Research, and Ethics (AMERE) Book Series

ISSN:2475-6601
EISSN:2475-661X

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This book is dedicated to my partner in crime, Cesar, with love.

Editorial Advisory Board

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Detailed Table of Contents

In the last 20 years, telenutrition has gained popularity and visibility. This term refers to the incorporation of tools and skills of telecommunication into nutritional management. Telenutrition already had many reported uses even before the COVID-19 pandemic. In the present chapter, Telenutrition will be addressed considering important aspects such as differences with traditional care, the most relevant findings in pathologies relevant to the area, some suggestions for tools and marketing, as well as some ethical aspects.

Existing research on improving antenatal care—using information and communication technologies and related technology—has focused on mobile phones to support SMS alerts and the implementation of a tool for booking appointments. The SMS alert system is limited in many ways, especially in addressing the conflicts in schedule and time for appointment and visit. Even with the reported tool(s) implemented, activities in the software development process, especially the design specifications, were not correctly followed and documented to justify the solutions proposed. By means of a qualitative research approach, a face-to-face oral interview with both pregnant women and obstetricians and a brainstorming session with the obstetricians were achieved. The chapter approach harnesses course-plotting technology to determine the most suitable obstetrician based on proximity and route with Google Map's aid. The result is presented from both analytical and technical perspectives to prevent and reduce the high rate of maternal and neonatal loss.

The use of technology in healthcare became a prevailing necessity during the COVID-19 pandemic. The sanitary services oriented in mental health broadened their way of interaction due to the increase in the need for these services. Healthcare professionals had to develop different learning skills and adapt their abilities to the virtual clinical practice through a digital interface, where communication represented the biggest challenge. The objective of the study was to identify the different adjustments, especially in the communication skills, made by those who provide psychological services by the Virtual Clinic in Psychology and others and clinical psychologists. The authors considered adequate qualitative methodology for the

study with an exploratory, descriptive design. The data gathering tool was a semi-structured interview and the word analysis method. The participants are professors that provide psychological care in the Virtual Clinic in Psychology of a nonprofit institution of higher education in Mexico and professionals providing mental health attention.

The training of the clinical psychologist requires the development of competencies in the fields of mental health prevention, health promotion, diagnosis, and treatment of mental illness. This training has undergone many changes due to the pandemic, evolution of education, and the translation of clinical practices to an online format. The present proposal focuses on making a review and reflection on the best practices derived from the adaptation of the training of these professionals with a future-oriented look. This chapter seeks to address two critical questions: What practices are necessary for the acquisition of the disciplinary competencies of clinical psychologists? and What didactic strategies were integrated during the COVID-19 pandemic? In the light of the lessons learned from the pandemic, the main tasks to be faced by the clinical psychologist in the face of the new demands of practice that require the creation of programs of psychological intervention and psychosocial support to the community are pointed out.

Currently, professional training goes beyond the discipline itself and focuses also on being able to improve our society. Professionals have a great responsibility as active participants in the local, regional, national, or global community they belong to. In the healthcare area, all disciplines must contribute to a deep transformation of the quality of life of all the people in the society, not limited to the patients themselves, but embracing their context, with relatives, friends, etc. The healthcare professional, and professionals of all other areas must, therefore, be competent in their discipline and other transversal components to become an effective change agent. Transversal competencies or soft skills, including citizenship, can also be seen as power skills for all professionals, as they empower them to have a greater impact in their community. Activities focused on the development and self-awareness of these contribute to the training of better professionals in our universities.

Diabetes mellitus (DM) has shown growing global morbidity, thus becoming a public health priority. In 2017, approximately 425 million people suffered from diabetes, and it is estimated that by 2045 the number will increase to 629 million. Type 2 diabetes mellitus (DM2), with 90% of reported cases, is the most common type and is followed by type 1. In 2018, 8.6 million people over 20 years of age were diagnosed with diabetes in Mexico. This represents 10.6% of the population. In some states with a higher incidence such as Nuevo León, it is estimated that 12.6% of the population above 20 years has been diagnosed with DM. This chapter seeks to inform about type 2 Diabetes Mellitus, its way of acting and complications that it entails, and how social media can be advantageous in patient education.

Dyslipidemias are a group of disorders characterized by abnormal blood lipid levels, which can present with a different course and impair significantly the quality of life. In recent years, the disease has had a peak in its incidence being an entity poorly treated in clinical practice; thus, the purpose of this intervention was to create an awareness campaign in Instagram to educate the community about this condition. As a result, 20 posts were created, and an overall engagement of 112 followers showed that the objective was successfully achieved, and it is a growing area for extensive research in the context of future prevention and treatment.

Hypothyroidism is a condition characterized by a deficit of thyroid hormones that leads to a low metabolic rate, typically associated with lethargy. The causes are diverse and may vary from congenital defects and autoimmune disorders to iodine deficiency, the latter being easily preventable with the appropriate strategies. For this chapter, the authors documented a social media awareness campaign via Instagram, whose purpose was to do popular science about hypothyroidism's symptoms to promote early detection and prevention. This campaign took place from October to November 2020 amid the COVID-19 pandemic. The campaign consisted of informative posts and engaged the audience via questionnaires through Instagram stories. Lastly, an online questionnaire was shared to assess the gained knowledge of the viewers and evaluate the campaign's efficacy. The social media awareness campaign showed to be a feasible way to educate the community, enabling efficient health promotion strategies through digital platforms.

Public awareness campaigns have played a crucial role in improving the health of communities, as they directly affect people's perception and behavior towards a specific topic, especially on disease prevention and health promotion. This can be seen in campaigns focused on, for example, infectious disease prevention such as HIV, tuberculosis, dengue, and more recently, COVID-19. Formerly, awareness campaigns took a very traditional approach using printed promotional materials, in-person conferences, and television and radio commercials as their primary way of reaching their target audience. This chapter describes an alternative method for reaching new audiences, in a society where social media has taken over as the public's main source of information and entertainment. These platforms can be used to extend important public health information to connect with and educate the public. The authors believe that this approach may increase the public's response towards emerging public health concerns as well as aid the digitalization of medicine through the evolution of telemedicine.

Section 2
Applications in Health Education

Medical education has changed dramatically since its inception, from informal medical education without defined objectives or techniques to a formal medical education regulated by the government and academic groups. Now, a structured curriculum with well-defined goals and objectives, appropriate educational strategies, and the incorporation of digital tools will efficiently contribute to future health professionals facing their challenges in their practice. Surely the technological advancement that occurred due to the pandemic is here to stay. Although there are still challenges to be solved, the first steps are for them to be acknowledged and documented. This chapter's objective is to show how to structure an online theoretical course and its curriculum and discuss the implementation of hybrid models of education and virtual simulation in health programs.

This chapter briefly reviews the literature that explores the training technique of deliberate practice and the related constructs, training outcomes of achievement goal orientation, self-efficacy, perceived instrumentality, and reflective practice. This work explains how educators can use and measure these variables to enhance current training methodologies. As part of creating more effective training, the TARGET model, developed by Ames, will be utilized to discuss potential ways to enhance training outcomes in a post-COVID-19 world. Specifically, suggestions are offered for enhancing online training using deliberate practice combined with the TARGET model within a medical setting where there are limited resources.

Clinical simulation is a teaching strategy that replicates medical situations in controlled environments. The COVID-19 pandemic created disruptions for healthcare simulation centers. As a response, the Universidad Anáhuac designed online clinical simulation practices and assessments. The pre-intervention survey showed skeptical medical students (59.15%) to continue this learning format. The intervention included neurology, cardiology, and gynecology topics supported by five faculty members and staff. Instruments were examination checklists to evaluate the clinical competence based on a 100 score and the Debriefing Assessment for Simulation in Healthcare (DASH) with a 1 (extremely ineffective) to 7 (extremely effective) score. Students received individual training by Zoom, including simulation practices, debriefing, and assessment. Even though it seemed impossible to address clinical skills by distance, simulation practices continued with online resources. Collaborative participation between faculty, students, and staff facilitated learning during the COVID-19 conditions.

Foreword

I picked up (digitally) a working final draft of this book with eagerness and anticipation, attracted by the promise of its title. Containing two main sections 1) Caring for Patients and Communities and 2) Application (of Telemedicine) in Health Education, the first section with ten chapters and the second section with seven chapters, this well planned and edited book offers *both* breadth and depth, with each chapter a self contained extended essay, on topics ranging from the application of telemedicine in health-*care* (with Chapters covering topics addressing needs of Underprivileged Populations, globally in Nutrition, Antenatal Care, Disease Awareness Campaigns, public education in type 2 Diabetes Mellitus, Dyslipidemia awareness, and Social Media campaigns for Hypothyroidism, and Osteoporosis); as well as health-*education* (accelerated by COVID-19, remote learning in the field, teaching clinical skills using online simulation, communication skills in undergraduate medical training - from face to face to virtually, globalising residency training and professional education, tele-simulation, and continuing professional development).

Each chapter is a self contained, well written review of a topic, both thought provoking and useful, in expanding thinking, and offering an overview of the topic, illustrative mental models, and a useful reference list. Whilst the majority of the co-authors of each Chapter are from Mexico, the key ideas and messages are written for and applicable to an international audience. I can imagine this book forming part of the core reading list in medical schools, residency programs, and in faculty development courses on these important, and timely topics and themes in the foreseeable future. Telemedicine, and judicious, informed use of Technology to advance Health Education are increasingly being piloted, prototyped, planned for, and programs rolled out globally; and will be integral for our future medical practice, including advancing our engagement with the public to educate them and raise public awareness to mitigate illness, and promote health, not to mention engage and train our future health professionals at undergraduate, postgraduate and continuing professional and faculty development settings. I have enjoyed reading this book, and learnt much from engaging with it, and can imagine many other readers will do so too.

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Preface

Several terms have been used interchangeably, such as telehealth, telemedicine, and digital health, but these are not. Telehealth refers to the comprehensive and broader strategy of providing care, training for developing health professionals, administrative meetings or electronic patient records, and other patient services. Telemedicine is a specific application of telehealth that enables clinical care delivery at a distance, with technology being a means and not an end. Digital health is enriched by technology trends such as augmented reality, robots, artificial intelligence, and big data to analyze information and propose treatments, although it does not necessarily mean direct contact with patients.

This book focuses on telemedicine as a social, digital, and connectivity strategy that utilizes telecommunications and technologies to enable new healthcare formats in the broadest sense. It integrates different forms of transmission: voice, sound, video, images, and text; also, communication technologies: telephone lines, satellite networks, and the Internet; and it does so through different user interaction interfaces: computers, physical telephones, cell phones, robots, and some other peripherals.

Some of its benefits are receiving care at home, which is a need especially for people who cannot easily travel to private offices and care centers, and the professional "portability," which refers to having access to care by specialized health professionals who are in a distant location. Additionally, one benefit is receiving care at special schedules, when a medical emergency arises in the middle of the night or during weekends. It also enables increased communication with health care providers, for example, patient monitoring, and the most obvious, the lower cost for the patient, since virtual visits make it possible to optimize costs in the management and logistics of the care process.

Their applications are varied; for example, to care for a patient with diabetes, providers can use a cellphone to document food, medications, blood sugar levels for nursing staff to do electronic monitoring in a database and suggest specific strategies. As health professionals, we can use a mobile app to estimate the amount of insulin needed based on diet and physical activity level. In addition, the healthcare team could provide videos that support an educational strategy to improve the level of adherence to management or treatment.

Although its benefits are vast and recognized, there are some barriers to its mass adoption, such as the lack of ethical and legal regulations, the lack of resources and infrastructure to offer a sustained telehealth service, and the lack of evidence to demonstrate the impact it has on the relationship between the health care provider and the patient. The latter refers to health professionals from different disciplines, nurses, nutritionists, physicians, psychologists, and the administrative team immersed in clinics, hospitals, and other health care centers.

THE CHALLENGES

International news agencies have labeled the COVID-19 pandemic the most significant challenge we face as humanity since World War II. Since its appearance at the end of 2019, this virus has spread to all corners of the globe. The costs have been huge, more than 200 million people have been infected with the virus, and we have lost over four million people who died from COVID-19 related complications. As a result, the new "normal" of doing things demands urgent changes in our relationship with the community.

The challenge of caring for the health of patients and their families, and our surrounding communities, is titanic. How do we provide quality health care during this crisis? How do we continue caring for chronically ill patients while avoiding exposing them to unnecessary risk? One of the most popular solutions is telemedicine, which we will address in this book.

Although telemedicine existed before the pandemic, it was more like a dreamy proposal used in limited conditions such as rural communities that access care remotely as part of a health system and in elite hospitals that can afford to experiment with high tech. It was a trend that could be opted in or out. However, the current adoption has proven that telemedicine is no longer optional and is here to stay. Health professionals need to adapt and learn to be competent providers in presence-based or distant models. For them, this book is a practical guide to structure training and include telemedicine as a feasible alternative to care for patients.

The need emerged amid the pandemic to provide patients with support and guidance, but it also brought opportunities for students to continue training and be involved in this once-in-a-lifetime experience. Although institutions were not prepared for a crisis of this magnitude, the challenges have made them thrive as a community learning from the experience. Many innovative proposals were developed to accompany the students in their first encounters with patients, other developed simulated scenarios where students could experiment with the dynamics and critical decision-making on public health and recreated virtual laboratories. Through the different chapters, the readers could examine and contrast the different experiences to develop their alternatives on maximizing the potential of available technologies and infrastructure of telehealth, telemedicine, and e-health.

ORGANIZATION OF THE BOOK

This book is organized into two sections: 1) "Caring for Patients and Communities" and 2) "Applications in Health Education." The first section analyzes experiences and reflections on how different specialties incorporate telemedicine to deliver care.

Chapter 1, "Telemedicine: A Bridge to Unprivileged Populations," challenges the incorporation of telemedicine to reach vulnerable communities, particularly low-income, rural communities and minorities who often lack access to comprehensive health. The authors call for the development of cooperation programs between the different parties and sectors within the health system to use technology as a feasible way to bridge the gaps of care. The chapter integrates a critical analysis of applications in different specialties and includes its contributions to patient-centered care.

Chapter 2, "Telenutrition: The Fine Line Between Nutritional Coaching and an Effective Professional Practice," describes a model to develop an effective nutritional practice that can help patients take control of their health. First, the authors describe how the traditional steps in nutritional care: assessment and reassessment, diagnosis, intervention, and monitoring and evaluation, take place in a telemedicine format.

Next, the chapter presents a critical review of previous experiences to manage obesity, diabetes type 1 and type 2, arterial hypertension, celiac disease, epilepsy, chronic kidney disease, and malnutrition. To finalize, the authors discuss the application of bioethical aspects to telenutrition, for both nutritionists and patients.

Chapter 3, "Design Specification for an M-Health Solution to Improve Antenatal Care: Analytical and Technical Perspective," presents the process of development and validation of a Mhealth solution. First, the authors describe how limited the use of technology was. Its uses would be on booking and managing appointments. However, through a participatory process with patients, practitioners, and developers, they designed a feasible solution to improve the quality of care. Next, the chapter describes the development and evaluation methodology of the solution. A significant contribution is an analysis of how the technical and conceptual needs are addressed. To finalize, the authors discuss future projects such as the opportunity to predict health risks in pregnancy through data analytics and its documentation in health records.

Chapter 4, "Going Online! A New Model for Telepsychology Considering Adjustments for Online Clinical Interventions," presents the alterations that psychology went through to offer mental health interventions despite COVID. Although telepsychology existed before the pandemic, it broadened the interaction amid the sustained isolation enduring during this period. The authors describe the challenges for health professionals to develop new skills and the need to include those in the undergraduate educational programs.

Chapter 5, "The Challenges of Training in Psychology: Lessons Learned During COVID-19 With a View to the Future of Psychology Education," reflects on the evolution of paradigms on psychology. These conceptions are not only part of the clinicians' practice but are reflected as well in how universities train the new generations. The author describes educational practices that were implemented during the COVID-19 pandemic and analyzes how these can be integrated into the curriculum. Finally, this chapter discusses the new demands of the creation of new educational programs in psychology.

Chapter 6, "Disease Awareness Campaigns: Education for Citizenship in Medical Schools," explains the need for health sciences programs to develop both disciplinary and transversal skills. Although these transversal skills, often called soft skills, have always been an essential part of the character of physicians, psychologists, odontologists, and nutritionists, the pandemic has amplified the need to prepare graduates for uncertainty. Citizenship, in particular, has made thousands of health sciences students graduate early or take volunteer roles to help battle the pandemic. Finally, this chapter discusses a proposal for engaging students in disease awareness campaigns focusing on different health problems.

Chapter 7, "They Won't Teach You This in School: Education in Type 2 Diabetes Mellitus, a Social Media Campaign," discusses the need to educate in Type 2 Diabetes Mellitus. As the number of patients battling to control the disease during adulthood increases, awareness of the risk factors needs to grow. At first, the authors describe the complexity of the problem and the health implications. Later, they describe traditional strategies for patient education and analyze advantages for different formats. Finally, the chapter describes a campaign using social media to reach the younger generations in a format and tone that sparks awareness.

Chapter 8, "Dyslipidemia Awareness Campaign: A Beautiful Day to Save Lives," describes the challenge that health professionals face in changing from *managing the disease* paradigm to *caring for health*. For example, at-risk patients with high cholesterol and triglyceride levels often receive dietary and lifestyle changes once detected. However, the problem is more complex, as dyslipidemias, or lipid and cholesterol metabolism alterations, might also be present. The chapter presents how innovative solu-

tions in telemedicine leverage emergent technologies and connectivity as an intervention to strengthen awareness and inform the public about dyslipidemias.

Chapter 9, "Ending Health Promotion Lethargy: A Social Media Awareness Campaign to Face Hypothyroidism," presents strategies based on social media to describe the often missed signs of hypothyroidism. In addition, the authors describe that, either congenital or that symptoms occur later in life, complications might arise. The proposed digital strategy of patient education has two phases: digitalization of multiple learning activities and evaluation and assessment strategies.

Chapter 10, "Social Media Campaign as a Tool for Patient Education of Disease Prevention and Health Promotion: Digital Health Campaign on Osteoporosis Knowledge," depicts the results of an Instagram-based campaign to reach youth and inform them about health. The topic that the authors targeted was osteoporosis. The intervention proved to be effective in translating journal articles, evidence-based research, and health consensus in a validated ut simple way to reach the communities where we work, serve and live.

The second section reflects on how the transformation in health sciences and technology is changing education. Universities and academic health centers need to foster learning environments that are an academic challenge and a safe place to grow as professionals and individuals.

Chapter 11, "The Revolution of Education Accelerated as a Consequence of the Pandemic," describes the transitions and transformation that medical education faced during the COVID-19 pandemic. The authors categorize the changes in theoretical and more hands-on experiences such as simulation. Finally, the chapter proposes recommendations for complementing clinical training as an immediate response to assure academic continuity.

Chapter 12, "Updating Training in the Medical Field: The TARGET Model and Its Applications to Remote Learning," presents a framework to analyze the curriculum transformation to remote learning. The authors argue that focusing on maximizing mastery, self-efficacy, reflective practice, and deliberate practice must be part of the training model of new generations of health professionals.

Chapter 13, "Teaching Clinical Skills During Pandemic Times: Online Clinical Simulation," presents a framework for online simulation practices. First, the authors assess the readiness for online practices and present instruments to guide the process. The last part of the chapter discusses the implementation and provides valuable recommendations for newcomers and experienced educators that decide to embark on the online clinical simulation.

Chapter 14, "Undergraduate Medical Training in Communication Skills: From Face-to-Face to Virtual Environments," shows the need to train medical professionals in communication skills to offer accurate identification to patients, improve treatment adherence, and increase the effectiveness of the health team dynamics. Through sharing an experience in Colombia, the authors highlight different elements of how communication was taught in the presence-based format and how those practices were transformed in the distance model.

Chapter 15, "The Role of Telemedicine and Globalization in Medical Education," reflects on the changes that the pandemic made in residency programs. The critical part of the training is acquiring complex skills, such as surgical procedures, which brought an additional challenge for instruction. The authors describe strategies such as globalization groups in e-learning and telemedicine in the programs to reflect the professional practices that graduates will face.

Chapter 16, "Telesimulation and Academic Continuity of Health Professions Education," presents definitions of key terms associated with telesimulation. The authors describe specific processes and re-

sources to enable this practice in health sciences. Finally, the chapter gives examples of implementations that the authors have made and provides guidance on how readers can implement their own.

Chapter 17, "Focusing on Continuous Professional Development for Health Professionals: The Inward Transformation," describes the vital need for professionals to engage in life-long learning. After graduation and specialization, the educational journey is mainly settled by the employer, either the university or the hospital. In it, the professionals continue training the skills and knowledge that are a need for their jobs. Few question if that is the pathway they want to pursue or if it will prepare them to fulfill their professional and personal dreams. The chapter proposes a model to analyze and develop a continuous professional development plan.

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Acknowledgment

First and foremost: Cesar, thank you for making coffee, pouring tequila, and stroking my hair every night and weekend dedicated to this book. Thank you for reading and commenting on every page of this several hundred pages project. Your love and patience kept me going all this year.

Special thanks to my parents, Juanjo and Letty. Dad thank you for reading to me, whether it was the Bible, contemporary mexican literature or a fairy tale, all the stories that you have told me, I carry with me. Mom thank you for pushing me to start over everytime that I thought all was lost, your sight focusing on the hope for a better future inspire me daily to innovate in education. Thanks a lot to my sister Adriana, my brother Carlos, and my beautiful nieces Roberta and Mila, for constantly daring me to pursue my hopes and dreams. You are a vivid example of how everything works in your favor when you are fulfilling your purpose.

On a similar note, my friends Belinda, Aniela and Silvia, deserve a special shoutout. They are exceptional professionals and even better human beings. They picked up the phone every time I needed to discuss the book; they shared memes and gave fantastic advice to tackle the different difficulties that appeared along the way. Many of you do not know, but thanks to Silvia, I got my first job, and I got inspired to pursue a Ph.D. in the first place.

Stefanie, my friend, you are the strongest person I have ever met; thank you for making the hard questions that I did not dare to do. This book exists because you did not let me stay in an *ok-ish* place. Samira, thank you for starting the whole *por-qué-no* campaign; many of my editorial endeavors are rooted in the accompaniment you gave me this year. Also, my friend Eduardo applied every ninja mind trick he knows to stop imposter syndrome from kicking in; thank you for your words and silences. Mauricio, my dearest and most demanding critic. I want to recognize all the time and energy that you spent with me analyzing all the possibilities. My friends, you are a special kind of tribe.

I want to recognize the work of the Editorial Advisory Board. From different corners of the world, they identified quality proposals that contribute to advancing health education with telemedicine. In addition, they helped to highlight the strengths of each chapter and offered feedback to many of them. This editorial team was as good as it gets.

Thank you, everyone at IGI Global, for being a diversity, equity and inclusion champion; editors like me would not have a place without your support and encouragement. The work of the developer and marketing team of IGI Global is invaluable. Special mention to Genevieve Robinson and Jan Travers,

who took me in *baby steps* to develop this book. Thank you for providing a house for this project and helping us reach like-minded individuals worldwide to enjoy this book.

I also want to acknowledge the leadership of my Dean, Jorge, who sees things that are not as though they were and then motivates everyone around to create those. A program, a book, you name it, he makes us believe we can. Then he creates the conditions for us to do it. Also, I want to acknowledge the support of my boss, Arturo. Thank you for mentoring me on what I need to, one day, be as awesome as you!

The most significant acknowledgment goes for every person that contributed to writing the book, patients and their families, undergraduate students, residents, professionals in every field, engineering, education, and health. All the research and innovation projects you have done are valuable, meaningful, and impact lives worldwide. I particularly acknowledge the work you share on these pages. Despite the COVID-19 pandemic and the thousand complications that it carried, you made time to share these experiences to inspire learners, practitioners, and researchers everywhere. Because of these efforts, we contribute to the quality of education and the quality of care.

Thank you,

Mildred López

Section 1

Caring for Patients and Communities

Chapter 1
Telemedicine:
A Bridge to Unprivileged Populations

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ABSTRACT

Using telemedicine systems, physicians around the world have been able to provide health access to their own communities and others abroad. Telemedicine is still a developing field in the health sciences, but much progress has been made with the advent of new communication technologies. Today, telemedicine offers an alternative to traditional physician consultations, especially for those patients with different needs. Patients with mobility issues, low socioeconomic standing, and far away from big cities have seen benefits from this form of patient care. Not only has telemedicine been able to just bridge these gaps, but it has also provided a new way for the international community of health practitioners to cooperate and aid areas in need of specialized care in the developing world. New cooperation programs between developed and developing countries have been developed to bring specialist knowledge to areas that otherwise would not have access to it. Telemedicine is a way to take care of patients in this technological area and perhaps will become the new standard of care.

INTRODUCTION

Telemedicine is defined by the World Health Organization (WHO) as "the delivery of health care services, where distance is a critical factor, by all health professionals using information and communication technologies […]" used primarily for the exchange and transmission of valuable information over long

DOI: 10.4018/978-1-7998-8783-6.ch001

distances for prevention, diagnosis and treatment of disease, research, and education for health professionals (WHO Global Observatory for eHealth, 2010).

In this chapter, we'll discuss how telemedicine has evolved throughout the years, the technological advances that made a change in the way health care professionals can treat diseases, both the advantages and disadvantages in the assessment of health, the solution of limitations through telemedicine and its significance in patient care, the impact made in several medical specialties such as radiology, pathology and dermatology, the treatment and follow up of chronic disorders with the implementation of health monitoring in homes and institutions, making tertiary care centers readily available for patients that may surpass nation's borders and enable international cooperation to receive patients from around the globe and shorten the time needed for patients to receive attention, and what does the advancements in telemedicine mean for both rural and urban areas and its implications on how patients access to medical attention facilitating its access to a larger portion of the population

Finally, we will analyze the multidisciplinary implications of telemedicine, solutions and recommendations we consider for current problems regarding the state of this ever-changing field of study and the prospect of telemedicine becoming the main modality for medical consultation, with the recent advances in communication technologies and further research that can be done to establish a better relationship between clinicians, technology, and patients.

BACKGROUND

First referred to as *Telegnosis*, telemedicine has evolved through the years, since its origins as a simple method of remote consultation and physical examination used for the transmission of heart sounds, plain radiologic images, and other simple studies.

The first record of telehealth is dated from 1948 where radiological images were sent via telephone. This event demonstrated to the medical community how useful using communication devices allowed accelerating the transfer process of health data (Teledochealth, 2021).

The evolution of telehealth can be divided into four major stages: delivery diagnosis, clinical service, and integration into healthcare. Healthcare delivery started with in house visits and later expanded unto in office visits to the doctor. Now, with the capacity of electronic history charts and the internet, it is possible to share a universal medical history per patient with attached files as images or PDF files (Martin-Khan et al., 2017).

Telehealth as teleconsult is an opportunity to improve clinical care and ensure both patient and provider safety. In 1960, the department of Psychiatry in Nebraska, US used a closed-circuit TV for consultations. By broadcasting live on television psychiatrists could interact with their patients overcoming distance (Teledochealth, 2021). Teleconsult overcoming distance barriers became available to remote communities by projects managed by NASA, such as the Space Technology Applied to Rural Papago Advanced Health Care (STARPHAC) (Shirzadfar, 2017).

Telehealth made a huge step when the National Aeronautics and Space Administration (NASA) started playing a big role towards its development, by creating programs that began with project Mercury during the 60's and continued with NASA's Applications Technology Satellite (ATS-1), which allowed the utilization of satellite communication to provide healthcare access between remote small rural communities and larger hospitals (Nesbitt & Katz-Bell, 2018).

Telehealth enabled remote diagnosis in various clinical fields, being introduced in radiology, laboratory, and pathology and subsequent elaboration of care plans for people over larger distances, as technology continues to progress new equipment and services become readily available for both clinicians and patients having a more complex level of connectivity and information processing capabilities.

Telehealth, as an integrated healthcare system, has offered an increase in efficiency and diminished costs. During the 1990's, the interconnected computer network with the internet allowed health professionals to receive and send information between colleagues and patients. Later in 2010 regulations were established based on the use of electronic health records, electronic pharmaceutical prescription, and coverage by medical insurance (Teledochealth, 2021). Some key factors in the ongoing Telemedicine transition, provoked by the surge of the internet, include: the ubiquity of the Internet, ready access to Internet-enabled computing devices and the growing technical savvy population (Shirzadfar, 2017). The most prominent emerging device being smartphones with their limitless potential, able to send images, sounds and even have a record of various parameters such as heart rate and oxygen saturation, since smartphones are owned by a significant portion of the population, they represent an opportunity for further development of telemedicine.

TELEMEDICINE BASED UPON SERVICE

Patient Health Monitoring at Home or Institution

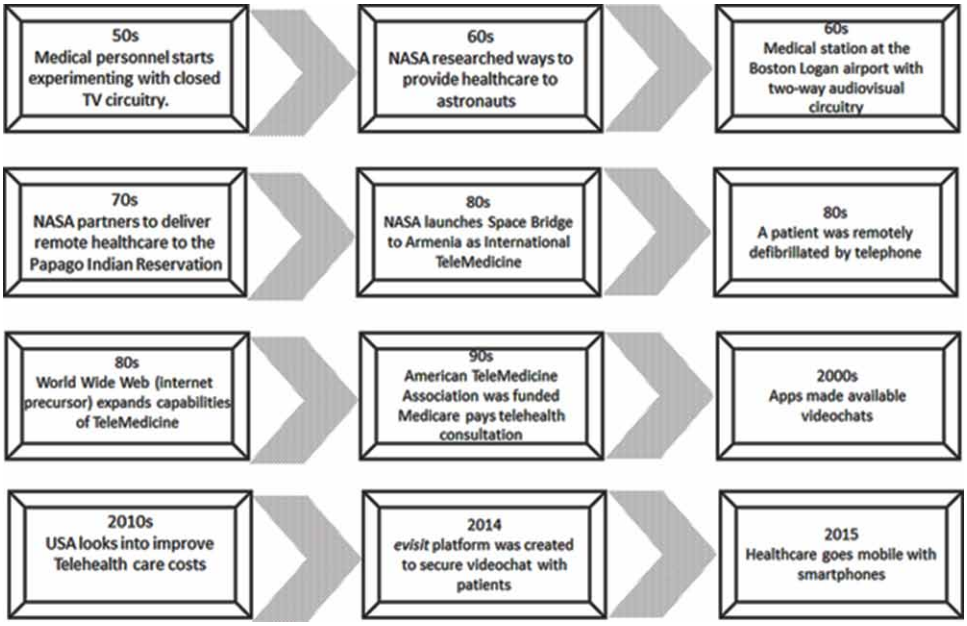
Patient Care

Telehealth has proven to be a resourceful tool for physicians when assessing their patients' health status. Since its main objectives are to improve the health of populations and reduce the cost of health services, a notorious improvement in patient care has been reported. Telemedicine can be composed of 3 main domains that represent its purpose. The first one is characterized by the knowledge exchange that happens between physicians who belong in similar or different fields. This communication provides an opportunity to share information with each other, which may be helpful for when they have trouble or doubts in reaching a diagnosis. The second domain involves the education of pre-grade medical students. The technological tools that compose telehealth can be used in any of the student's frequent environments, for example their university classrooms or their homes. These tools represent a very valuable resource for their preparations since they provide an easy and unlimited access to all the information they need according to their grade. Finally, the last domain involves the most important aspect of telehealth, which is patient care (Tuckson et al., 2017).

Patient care can be defined as an experience where anyone can access specialized consultation about their health and receive treatment according to their specific needs. Telemedicine provides an opportunity for improving this experience and strengthening the relationship between physicians and their patients. By increasing the flexibility and availability of health services, patients can find a solution when facing a situation that prevents them from attending office-based visits (Donelan et al., 2019).

Healthcare is a system that imposes **economic** limitations for patients since it demands many expenses from them. These vary from cost of transportation, office visits, pharmacological treatment, and complementary studies for diagnosis. All of those represent a high demand in a patient's budget and sometimes they are unable to fulfill the complete list of payments, due to their personal responsibilities

Figure 1. Diagram of advancements in the field of Telehealth
Source: (Iafolla, 2016)



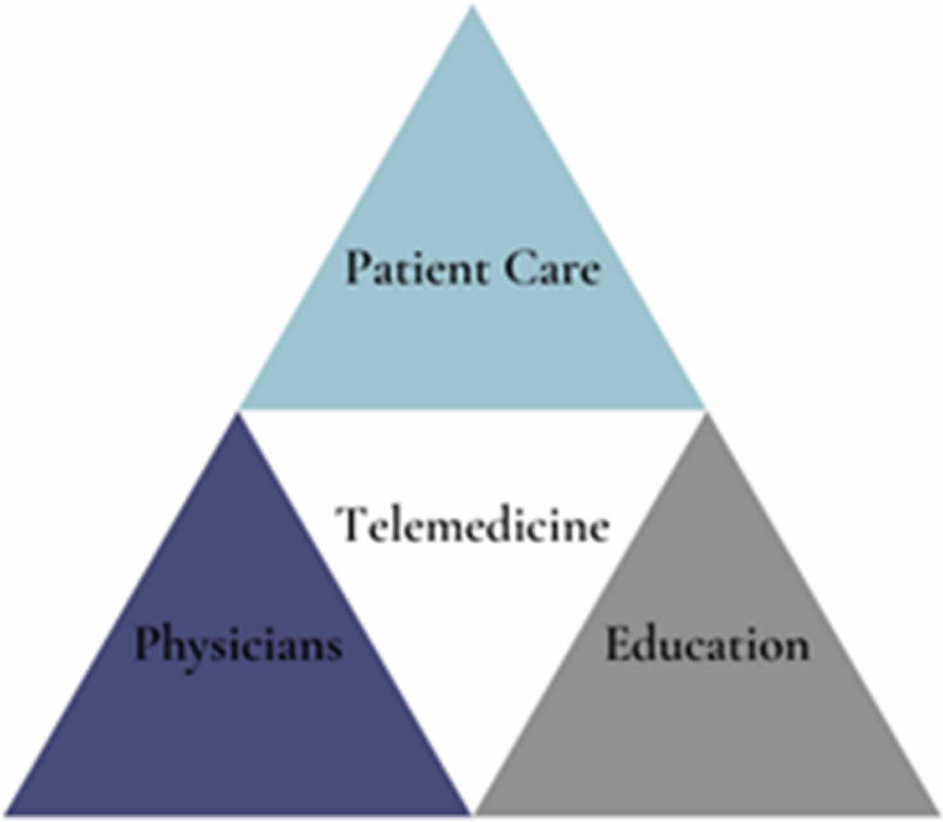
or a tight money resource. By implementing telehealth during primary care visits and follow-up care, patients can save up a huge amount of these expenses and still benefit from high quality medical attention.

Another significant limitation is the **transportation to a medical center**. Whether a patient resides in a metropolitan or rural area, transportation to a medical facility can represent a great expense in their budget. Cost of gas and parking tickets apply for patients who own an automobile. On the other hand, patients who live in faraway locations must pay for a round trip in transportation services, like a bus, taxi and even train. Moreover, patients can face a troubling situation which affects their arrival to their destination, making them late to their appointment. This can be due to traffic, a high number of people in need for transportation services and the lack of them in their district. A solution for this can be easily achieved since patients can receive specialized care in their home and work environments through telehealth tools and technologies.

Any medical field has a **high demand for service attention**. Since office visits depend on the availability of physicians, patients often must adjust to their schedules to book an appointment. This can create various limitations in a patient's daily life. For example, they will have to be absent from work and lose performing hours that will affect their salary. Also, if they have children, they must choose between taking them or leaving them at childcare, which represents another expense in their budget. Some communities face a shortage of specialized physicians, which means many people attend the same office to receive medical care. This will produce a tighter schedule and less available booking options. Technological tools, such as cellphones, tablets, and computers, provide physicians the opportunity to substitute the long hours inside their office and a full waiting room of patients.

Finally, patients who have any kind of **physical limitation** that prevents them from performing daily activities such as walking, climbing stairs, or being seated for long, experience a hard time attending office visits. Transportation to the medical facility represents a difficult task for them, and they often

Figure 2. Representation of the 3 domains of telehealth. Patient Care is located at the top of the pyramid, representing its significance and importance in telehealth.
Source: (Tuckson et al, 2017)



depend on their peers to help them. Even if they have no complications when arriving at their destination, they still must endure the possibility of a long list of patients waiting for their turn and a lack of available seats for them. By receiving medical attention in their home, patients will no longer have the need to face the challenge of transportation.

Considering the solutions provided by the application of telehealth services, several advantages and disadvantages can be identified according to the perspectives of physicians and patients.

After analyzing the relationship between telemedicine and patient care, it's important to now discuss the results that have been accomplished in a variety of medical reports all around the world. Certain chronic diseases and other disorders that originate from different types of organ systems, can be the perfect candidates to receive a therapeutic approach from telehealth services. Particularly, three medical fields have distinguished from others by reporting optimistic results obtained from their successful applications in patient care. These three are **Psychiatry, Dermatology and Surgery.**

Table 1. Common limitations faced by patients receiving medical care.

Limitation	Definition	Solution with Telemedicine
Monetary resource	● Patient's budget cannot fulfill all the expenses demanded by the healthcare system. ● Cost of transportation, office visits, pharmacological treatment, and complementary studies for diagnosis.	Not having the need of attending the physician's office, patients can save up these expenses and assign their budget to other economical responsibilities.
Transportation and location of the medical center	● Far away medical locations from rural communities ● High demand for transportation services ● Cost of parking ticket and gas for residents in metropolitan areas ● Troubling situations that make patients arrive late to their appointments	Staying at their home and work environments and still receive equal quality care as in office visits.
Availability and scheduling conflicts	● High demand for medical services ● Lack of available physicians ● Trouble in booking an appointment. ● Patient's responsibilities are sacrificed by spending hours in the waiting room	Virtual visits enable physicians to organize their schedule and make it more available for patients to choose the best option for them.
Physical limitation	● Physical health condition that prevents patients from performing daily activities such as walking, climbing stairs, and being seated for long.	Avoid the challenge that represents moving and transporting to a medical facility.

Source: (Powell et al., 2017)

Table 2. Advantages and Disadvantages according to physician and patient perspectives

Physician	Patient
Advantages	
● Better follow up of patient's health status and adherence to therapy ● Capable of addressing all the important aspects during online consult since there is no shortage of time. ● More availability and less scheduling conflicts ● More focused environment that enables them for an easier process for diagnosing and prescribing medication.	● Easy access to medical attention ● More time shared with physician. ● If located in faraway locations, transport expenses are avoided. ● Better understanding of the importance of monitoring their health and respecting their designated therapy ● Allows management of chronic diseases, faster revision of laboratory results and a more centered follow-up care. ● Patients have reported a preference for this method when receiving bad news, because they are in a comfortable and safe environment.
Disadvantages	
● Unable to perform physical examination. ● Considered to be a substitute for primary care that no longer seeks in-person interactions. ● Limited access to medical records ● May present technical issues during video visits	● May not identify the social behaviors and emotional interactions shared with office-based physicians (reassurance, empathy, humanity) ● May not possess electronic devices or good access to the internet, which are necessary for the practice of telemedicine (computers and cellphones) ● Patients have reported technical issues during their video visits, such as audio or video lag, and Wi-Fi complications. ● Older patients who do not know how to manipulate electronic devices.

Source: (Enderica Diaz et al., 2020; Powell e tal.,2017)

Psychiatry

According to the experts from the *Neuroscience Institute* in Guayaquil, Ecuador; the most common mental disorders are schizophrenia, dementia, generalized anxiety disorders, phobias, mood disorders and conditions derived from drug consumption. Telemedicine can represent an important ally when considering an improvement for patients' adherence to treatment. Virtual visits can exert a better control in pharmaceutical therapy, since physicians deliver prescriptions for patients to obtain the designated drugs for their condition. This way, specialists can evaluate the efficacy of treatment and the impact it has had on the evolution of the disorder. Additionally, technological tools can prove better follow-up care, since a patient's medical history and progression is available on more accessible platforms. Moreover, 70% of the relatives that were interviewed in the same investigation, demonstrated a positive stance regarding telepsychiatry. They stated that it would represent a functional tool for evading the harassment and mistreatment delivered from third parties to patients when they attend their scheduled office visits. Without a doubt, virtual visits can offer a secure and confidential experience for these types of patients, who would also benefit from a more economic but equally efficient healthcare (Lascano, 2018).

Dermatology

Experts from the Department of Dermatology located in Cleveland, shared the workflow chart that they use to evaluate a patient's condition and determine if they are suitable for teledermatology services. The first step from this "triage" involves patients since this is the moment where they must request consultation. Here they will provide the data and photographs needed to illustrate their actual condition. If they are appropriate candidates for virtual visits, then the next step is to schedule a live video, where experts will conduct the consultation. When the live video call finalizes, the physician in charge documents the data collected from the patient and sends them the prescriptions designated according to their results. An extra step can be added, and it is only applied for those whose condition needs to have an in-person evaluation due to its complexity, which will be conducted as normal office visits (Hammond et al., 2020).

Surgery

The Surgery Department from Thomas Jefferson University, located in Philadelphia, reported the results obtained from their implementation of telehealth in various surgical fields. A high rate of efficacy has been demonstrated in ambulatory surgery procedures, such as laparoscopic appendectomies and cholecystectomies. Patients who received follow-up virtual visits, reported a higher level of satisfaction since they belonged to uncomplicated cases. The members from this department performed 655 telesurgery visits, from which 152 corresponded to post-operative services. These reported only a 4% of readmission in patients after their 30 days of discharge. Another 424 patients received preoperative care and long-term follow up. These procedures require a longer term of care and attention due to their complexity. Surgical services such as oncology, bariatrics, vascular medicine, and thoracic surgery, have reported positive outcomes and experiences. For example, patients can receive their imaging and laboratory results through their online platforms and share them directly to their surgeon, to obtain an interpretation of their post-operative condition and future therapeutic approaches. Another situation can be seen in bariatric patients, who can benefit from virtual visits when discussing the dietary management needed

for their health status. Finally, vascular medicine can be effectively assessed through anticoagulation therapy delivered through virtual visits (Nandra et al., 2019).

Table 3. Application of Telehealth in the treatment of Chronic Diseases and other system disorders

Organ System	Patient Care	Application of Telehealth
Psychiatry	● Schizophrenia ● Dementia ● Generalized anxiety disorder. ● Phobias ● Mood disorders (bipolar disorder) ● Conditions derived from drug consumption.	Better adherence to therapy and easier access to a patient's information, which will enable physicians to evaluate their progress and determine the modifications needed for the improvement of their condition. It also offers a safer environment for them to receive healthcare.
Renal	● Chronic Kidney Disease	Education about CKD raised awareness of potential risk factors and recommended prevention behaviors to evade worse prognosis. Enhanced adherence to therapeutical management.
Endocrine	● Diabetes Mellitus	Adherence to therapy and enhanced glucose control. Education about risk factors and improvement of lifestyle.
Cardiovascular	● Hypertension	Better control of HT by the documentation of fluctuating rates, enabling a better communication between physician and patient, which can produce more adherence to therapy and a better control.
Dermatology	● Acne	Photographs and live video calls can provide the information needed to physicians to assess a patient's condition and determine their suitability for teledermatology.
Surgery	● Ambulatory procedures (appendectomy and cholecystectomy) ● Surgical oncology, bariatrics, vascular medicine, and thoracic surgery ● Wound care	Higher rate of patient's satisfaction and the substitution of follow-up care in-person conditions. Better approach to patients and adherence to their improvement.
Intensive Care Unit	● Nursing Care	Identification of trends in vital signs and unstable health statuses. Focused medical management and prioritization of a patient's improvement.

Source: (Powell et al., 2017; Castaño et al, 2016)

Diagnostics

Teleradiology

Telemedicine has become helpful to diagnostic technologies. Teleradiology uses peer review to improve work efficiency and distance limitations. The peer review is a method used to analyze cases for quality check. It represents a cycle of actions done by expertise's who try to discover unperceived findings, discrepancies in the interpretations or identify opportunities for improvement on diagnostic studies. This

method has been performed at radiology centers, used as telemedicine networks for quality improvement and implemented workflow (Morozov et al, 2018).

The use of telemedicine in developed countries has become a strategy for the management and the diagnosis of patients. Recently a survey of radiologists' perception of teleradiology was made in the United States. The results demonstrated the critical importance of teleradiology in modern radiology practice. They concluded that teleradiology provides a wide range of value practice including better multidisciplinary coverage (Rosenkrantz et al., 2019).

On the other hand, developing countries in Africa such as the Democratic Republic of Congo have recently implemented teleradiology to improve the diagnosis. With this implementation, more prescriptions were stopped, useless treatments were avoided in musculoskeletal injuries and unnecessary surgeries were averted avoiding high costs and patient risks interventions. Teleradiology significantly changed the diagnoses and improved the treatment, which had a significant economic value for avoiding unnecessary interventions and treatments (Crumley, 2020).

Even though teleradiology has improved, the need for experts has also increased. In some specialties, such as pediatric radiology, the lack of health providers has been a significant problem not just for developing countries but for developed countries too. As there are so few pediatric radiologists the World Federation of Pediatric Imaging has gathered with international societies of pediatric radiology from all over the world to improve radiology and provide training to health professionals. This interaction between countries showed the importance of patient's access to expert diagnoses and the importance of international cooperation (Kis, 2020).

Laboratory

Laboratories are responsible for the organization of the daily routine and workflow. The laboratory system should implement five core functionalities according to the phases of the data gathering process, where it includes the optimization of specimen collection, check, validation of the content and provide a medical report containing the main results. Telemedicine facilitates the distance limitations for the diagnosis with the information provided by laboratories. The exams are accessed by many specialists for them to visualize the results and search for clinical information. Finally, laboratories register the data so another expertise can analyze the results and contribute to the final diagnosis (Alves et al., 2016).

In Latin America telemedicine has helped in laboratory research for confirmatory testing. In Chile, patients with skeletal dysplasia's are diagnosed, followed up and treated by professionals in some institutions based on their expertise. Samples of laboratories are sent abroad when other disorders are suspected. The Laboratory of Molecular Biology and Cytogenetics at Pontificia Universidad Católica performs laboratory analyses for genetic disorders. This Chilean group has invested in improving genetics for diagnostic purposes in clinical management. Their experience with telemedicine has proved to be a good strategy to assist the diagnosis of skeletal dysplasia's and for problem-solving in many disorders (Cavalcanti et al., 2020).

Telepathology

Pathology is another specialty that utilizes telemedicine to perform diagnosis at a distance. In telepathology, to diagnose a patient a histopathological process must be performed. This process is based on the analysis of digital images that are projected on the screen, which are then contrasted with a conventional pathological study through a light microscope. There are two techniques for this process, static

telepathology and dynamic telepathology. Static telepathology is when these images are captured and transmitted. On the other hand, dynamic telepathology is a more modern technique, where the images are transmitted in real time, and can be controlled by a pathologist at a remote site. These methods can be combined as well (Biernat, 2017).

The way telepathology is used differs within countries, in developed countries like the United States and Canada, telepathology is widely used and implemented among public and private hospitals. In Canada, a telepathology network was implemented among 18 hospitals in the province of Ontario. The main purpose of this project is to provide IOCs to community hospitals that lack on-site pathologists. Surgeons who utilize telepathology during their procedures believe that this method helps them improve the quality of care they offer, because of how it reduces two-step surgeries and patient transfers (Pare et al., 2016).

The usage of telepathology in countries in development differs a lot from what was seen in the last example. At times, telepathology is used by developed countries to support countries in development to make diagnoses, this type of interaction between countries helps improve or augment the probabilities of survival for patients. In 2001, the *Instituto de Patología y Biología Molecular Arias-Stella* in Peru sent images of a 56-year-old patient's neoplasm to the *Istituto Nazionale per lo studio e la cura dei Tumore* in Milan, Italy. This case was categorized as "Latin America's first ever use of telepathology '' and its success in improving the patient's survival rate emphasized the effectiveness of this method for cases located in remote areas and it paved the way for implementation of telepathology in Peru's public healthcare system (Hernandez & Mosquera-Zamudio, 2019).

This type of supportive relationships is not limited to developing countries and developed countries and can also be seen among developed countries. Since 1999, the *University of Pittsburgh Medical Center* in the United States and the *Mediterranean Institute for Transplantation and High Specialization Therapies* in Italy have had an ongoing partnership in the telepathology department. This relationship mainly focuses on consultations of transplant-related biopsies that are preferred to be interpreted by experts. During this period, around three-thousand cases have been reviewed and about 86% of these cases have shown full agreement with the original diagnosis. The use of pathology teleconsultation as seen in this case encouraged the implementation of better technologies to improve the performance of telepathology. These advancements not only improved performance but also helped accumulate resources destined to equipment, IT infrastructure and staffing for telepathology-related procedures (Pantanowitz et al., 2012).

Expert Consult

Tertiary care centers offer specialized medical care, usually over an extended period and with the use of state-of-the-art facilities, procedures, and treatments. These centers are limited around the world, with most centers located in highly developed urban areas (Merriam-Webster, n.d.). This fact can become a challenge for a great number of patients of these centers, limitations in mobility and time can become barriers for these patients to fully cover their health needs. Telemedicine has become a potential solution for this problem. Recently, several studies have been able to show telemedicine as an effective way of delivering tertiary care in comparison to face-to-face encounters. In 2017 a retrospective cohort study was conducted at the ALS Centre in Cleveland, OH. Their objective was to evaluate the quality of care of patients through telemedicine and compare it to traditional care. Using video-conferencing technology, patients with ALS were able to receive quality healthcare with minimum complications,

setting telehealth as an alternative way for those with barriers against traditional care to receive expert consultation (Selkirk, 2017).

Telehealth users have been shown to be highly satisfied with its application, including those that are enrolled in tertiary care programs and specific pathology clinics. Specific pathology clinics offer specialized care around a single disease, the vast majority of which have chronic implications for which users must routinely revisit these clinics for a thorough management of their disease. Routine in-person visits to the clinic might be a challenge for many of these patients, especially those with mobility issues. Telehealth systems offer a cheap alternative for these routine visits, granting a comfortable way for these patients to link with their physicians when follow-up visits do not require extensive or complicated physical observations and examinations. It should be noted that while many patients, which include both users and non-users of telehealth systems, are interested in participating in these types of programs they rather prefer a hybrid system between in-person and remote consultations. Clinicians then should offer telehealth services as part of their services, mixed in with more traditional services, especially for those patients with long travel times, low socioeconomic standings, and mobility issues (Qiang & Marras, 2015).

There is a shortage of specialized providers across the globe, international cooperation through telehealth systems might prove an invaluable tool to fulfill the needs for most of the developed world. Telemedicine facilitates access to health networks by eliminating physical barriers such as borders and distance. More and more specialists from the developed world are joining efforts with healthcare providers from the rest of the international community to bridge these gaps for more people in need. The concept behind this cooperation is simple enough. While providers in the local community report serious or advanced cases, specialized teams in developed countries support the diagnostic and treatment considerations for these patients. Such is an example from Dominican Republic and the USA, where a partnership between pediatricians and geneticists has been able to provide complex genetic diagnosis to children who would never have access to these experts otherwise. The implementation of these kinds of partnerships, which go across borders, might be part of a key set of systems to bring health to everyone despite their origin, culture, or place of settlement (Mena et al., 2020).

Telemedicine to Attend Rural Areas

Telemedicine arouses mainly directed toward the implementation in rural areas since basic health assistance became a major goal to ensure global equality to health services. Also, urban and suburban areas were never left behind. Telemedicine has been a potential solution in the delivery of services to distant populations. Rural areas had received most of its advantages since it mainly helped reduce boundaries to reach for good patient care. Access to primary health and reduction of time-travel became the main reasons why e-health expanded to many areas. The opportunity to receive attention in less time became important to seek treatment earlier and prevent the progression of the disease (Lustig, 2012).

Although the urban population has more access to technological communication, today there are more programs related to rural telemedicine. Medical assets tend to be better in this area because of the higher personal income of the population, which leads to a better health acquisition. In urbanized areas telemedicine consultations are mainly between primary care doctors and specialists. Urban hospitals tend to use the services for specialties like cardiology, neonatal intensive care unit and neurology. Now, attention is focused on narrow applications of telemedicine directed to specific diseases, an example of this is tele-diabetes and telesurgery (Scott & Mars, 2015).

On the other hand, telemedicine in rural areas has some disadvantages such as lack of organizational effectiveness, limitation to technological infrastructure and low health staff motivation. Although it has been expressed those rural areas have difficulty with broadband connectivity, today there are several initiatives to promote the availability of technological devices and broadband. Online communication in telemedicine significantly reduced the time that took to reach primary care attention. Also, the cost of transportation can be reduced if this practice continues to grow. Although this is an emerging form of consultation that is more common every time, nowadays many people continue to prefer face-to-face consultation. In the case that there is an emergency, or the patient has a unique appointment, telemedicine could be more appropriate suggesting that this is a helpful tool to establish a triage (Zobair et al. 2020) (Russo et al. 2016).

One example of a project directed toward reducing the health gap between rural and urban access to health services. The name of the project is ENABLE, their objective is to deliver palliative care access to patients diagnosed with cancer and heart failure. Their objective is being resolved by online consultations provided by specialist and informative sessions to help patients understand their condition. Some results of this example of telehealth are the improvement in quality of life and decreasing rates of depression. Just like this particular use of telemedicine there are many programs directed especially to the most vulnerable areas of the world (Bakitas et al., 2009).

Among the United States there are several programs dedicated to telemedicine expansion into rural areas. The Federal office of rural health policy (FORHP) founded the Evidence-Based Tele-Emergency Network Grant Program (EB-TNGP). This was specially created to provide access to telehealth in rural areas and to collect data for evidence. During the investigation, telehealth services in rural emergency departments (teleED) were found to be useful to provide easy access to care. Telehealth aided in the evaluation of patients, arrangement of transportation to transfer patients and in the transfer to another facility in which the patient could receive better attention (Heppner et al., 2021).

Avera Health is an institution in which their mission is to provide access to medical attention to those who live in the Midwest part of the country. Inside small and critical access hospitals, primary ICU telemedicine reduced the number of patients that required a transfer. This ends-up with a reduction in costs and improvement in patient safety. The outcomes of the program show a decrease in ICU mortality due to the rapid telemedicine communication to rural areas. Also, reduction in cost due to the fast attention and reduced transfer to secondary and tertiary care centers (Zawada et al., 2009).

Patient Health Monitoring at Home

The increasing number of needed cares to elderly people is placing a strain on the healthcare services. A way to address this demand is by caring for patients in their own environments due that mainly they need therapeutic supervision of chronic diseases. The challenge is how healthcare professionals can accurately, reliably, and securely monitor the health status of their patients without physically visiting them (Abawajy et al., 2017).

Advances on the Internet of Things (IoT) and cloud computing (CC) have made it possible to transform the healthcare sector (Abawajy et al., 2017). Portable healthcare monitoring systems with emerging technologies are becoming of great concern to many countries (Islam et al., 2020).

Internet of Things (IoT) is nothing but linking computers to the internet utilizing sensors and networks (Islam et al., 2020). Keeping a patient at close observation and monitoring critical signs such as heart rate, blood pressure and body temperature etc. is significant in healthcare as to keep a record of the patient's

Table 4. Comparison between urban and rural telemedicine

	Urban	Rural
Communication	Better access to internet and health services.	Limitations still exists, but nowadays there are more programs of telemedicine for these areas.
Access to Health	More health providers available.	More prevalence of chronic conditions due to difficulty to reach primary attention.
Specialties	Child telepsychiatry, dermatology.	Adult telepsychiatry and dermatology.
Age Group of Users	Younger Patients.	Older patients, more common in >65 years old.

Source: (Scott & Mars, 2015)

health status. Doctors could ¿see multiple patients' data at a time and check the whole condition of an individual patient from anywhere using the internet (Ahmed et al., 2018).

Internet of Things (IoT) has abounded the digital healthcare system by providing remote monitoring of patients' health conditions and allowing doctors to have access to that information. The purpose of any health device is to have a low cost and compact design, be portable and user friendly. Still, the technology that combines all these features is not affordable and accessible by mass people in developing countries (Ahmed et al., 2018).

A Multidisciplinary Approach to Patient-Centered Care

Telehealth has been proven as a novel way to promote the work of multidisciplinary teams (MDTs). Multidisciplinary teams consist of specialists from different branches of the medical fields and distinct health professionals such as dieticians and pharmacologists (Aghdam et al., 2019). Together, these health professionals provide tailored patient care, especially on complex clinical cases.

MDTs are increasingly using new information communication technologies (ICT) to provide better and more effective care for their patients. One of the main ways in which ICTs are now used is to provide a fast and reliable method for MDTs meetings to occur, without the need of a physical space and or the physical availability of the attendees (Aghdam et al., 2019) However, the use of MDTs in a clinical setting is still underdeveloped outside of the meeting setting. Recent literature has concluded that the use of telehealth by MDTs is still lacking evidence of efficacy and regular use in the collection of real time

Figure 3. General scheme of Health Monitoring in home system
Source: (Ahmed et al., 2018)

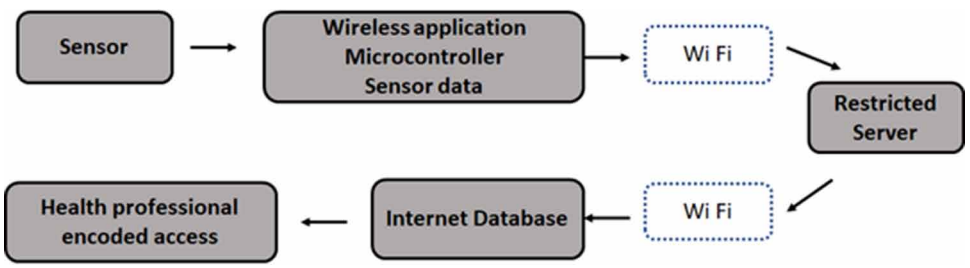


Table 5. Examples of IoT healthcare monitoring devices

Author	Sensor	Processing device
Tamilselvi et al. (2020)	Heartbeat, SpO2, Temperature, and Eye blink	Arduino-UNO
Acharya et al. (2020)	Pulse sensor, temperature sensor, BP sensor, ECG sensor.	Raspberry pi
Banerjee et al. (2016)	Pulse rate detection system	Pletysmography-like system
Gregoski et al. (2012)	Mobile smartphone camera for finger blood flow	Smartphone integrated device
Oresko et al. (2010)	Mobile smartphone tracked coronary rhythm in real-time,	Smartphone integrated device
Trivedi et al. (2017)	Mobile health parameter framework	Arduino-UNO
Kumar et al. (2017)	DS18B20 sensor for body temperature	Arduino into the cloud through the Wi-Fi module

Source: (Ahmed et al., 2018)

clinical data, which according to investigators is one of the most promising aspects of this innovative technology (Janssen et al., 2018).

Still, there are successful examples of its use in the clinical setting. Novel approaches combining telehealth and MDTs have resulted in the improvement of elderly care in Sicily. Researchers employed weekly vital parameter monitoring and nutritional counselling, biweekly psychological counseling, and a monthly consultation with a neurologist for the duration of a year to a group of 22 elders in the region of Sicily. Results of the study demonstrated improvements in the groups psychological and nutritional health, however its limitations such as a small sample size of patients and the lack of a control group makes the interpretation of these results difficult to prove a meaningful impact of the use of telehealth by MDTs (Maresca et al., 2019).

SOLUTIONS AND RECOMMENDATIONS

Besides the advantages telemedicine offers, challenges and risks must be considered. The solutions for access to the telemedicine system are promising as well as challenging. First, people in general are not aware of the system and how it works, so one of the main challenges is the unawareness of the system and the lack of initiative of the government. Secondly, the high cost of technology services in developing countries has always been an important issue. Expenditure on health care has increased and internet facilities nor data transfer are not available (Hasan, 2012).

Unawareness, uncooperative governments, or institutions represent one of the most significant obstacles in Telemedicine. In Denmark, where Telemedicine is at a higher progress rate, the project called Digital Welfare Strategy showed that Telemedicine is a multidimensional approach that needs the participation of people for a more successful implementation. With this project they developed a solution: they did a strong collaboration among surrounding regions to solve the unawareness of the population. Today this strategy has demonstrated to be the better solution for them. Despite the results, collaboration is still vital regarding supply and demand, yet in developing countries the collaboration with higher progressed developed countries could be the better solution for Telemedicine´s better implementation (Anwar & Prasad, 2018).

The success of telemedicine programs is limited in developing countries. One of the reasons is because the implementation of these technologies has been made too quickly and unplanned. In most of the developing countries, there are no strategies and policies established, which leads to confusion for designing the services related to this technology. It is thought that the standardization, implemented guidelines and program managers can be the solution to overcome the interoperability and security issues in these countries. Furthermore, the absence of structured organization is one of the biggest barriers in Telemedicine. In some other developing countries such as India, the collaboration and the presence of developed countries have been established but they have not been well structured, and they are still broken. One of the main solutions offered is a better structured national Telemedicine network done by the Department of Health and Family Welfare and the Department of Information Technology, where formal collaborations between developed and developing countries can be made (Lokken et al., 2019).

Developing countries such as Pakistan, have contributed to the development of telemedicine for many years but the studies assessing access to health are limited and haven't improved. Recently, with the COVID 19 social distancing and the fear of contagion, telemedicine has occurred to be a good way to face the multiple challenges in the healthcare field. The challenges include the lack of access to technology and the relationship with the professionals when diagnoses can be difficult to understand to the patient. The major challenge is the establishment of a system for adherence and monitoring, but also security related to the data involved. It is believed that with an appropriate creation of programs designed for the implementation of telemedicine developing countries can improve (Khan, 2020).

Despite the challenges found in both developed and developing countries, telemedicine has proven to be a tool with fast improvement and development when interacting with other systems. Also, the availability of technology has increased in rural and remote areas. Recently, the WHO launched an initiative to ophthalmology called VISION 2020, which demonstrated that telemedicine was a successful connection between specialists and people in remote locations. As smartphones and mobile devices are becoming an important part of our lives, they can become an easier way to communicate with healthcare providers, making it not only an easier way to receive a diagnosis, but also a better way to save money and time. In conclusion, "telemedicine is a connection between medicine and availability to technology" which can be improved if there is more interaction and support between developed and developing countries (Mohammadpour et al., 2017).

FUTURE REASEARCH DIRECTIONS

After reviewing the history and background of Telehealth and discussing the significance it has in various medical fields, it's important to analyze the future possibilities that can be accomplished with the continued application of this service. According to the experts of the American College of Cardiology and the Heartbeat Health platform, positive results have been reported from the clinical practices that surged as a response to the COVID-19 pandemic. The drastic reduction of office visits placed outpatient care into teleconsult services, resulting in the first step that directed the future of telemedicine. To continue leading this digital evolution in healthcare, physicians must encourage their patients to adapt to the virtual platforms responsible for remotely evaluating their health status. By guiding them through the process, physicians can effectively track the short- and long-term outcomes in each patient, which will provide the necessary data for decision-making between them (Poppas et al., 2020).

Health professionals from the Specialized Oncology Care and Research in the Elderly Clinic (UR SOCARE), located in the University of Rochester, modified their initial assessment tool through the implementation of telehealth methods. Usually, patients who were referred to the clinic were mailed a questionnaire, but because of the pandemic, this pre-visit evaluation was substituted for a phone-based survey. Operated by a professional, patients were introduced to this new method and assessed for about 20 to 30 minutes. Followed by this, came the virtual conducted through a Teleconference application that allowed the interaction between the multidisciplinary team in charge of discussing and evaluating the patient's management, and family members were able to participate (DiGiovanni et al., 2020).

Since the beginning of the COVID-19 crisis, government agencies around the world have implemented this tool in several health institutions for only a period, making it unclear whether they plan to continue using it **after the pandemic**. Considering the positive results that have been obtained and reported in many cases, would it make sense to just withdraw it from management strategies? This is an important question that must be answered by evaluating several aspects, such as:

- Physicians should carefully discuss with their patients about their **preference** regarding their therapeutic approach. Would they be willing to continue using a virtual platform or return to the traditional office-based visits? Depending on their personal experience, patients will determine what makes them feel more comfortable, hence providing physicians the necessary answer to continue their care according to their needs.
- **Payment parity** constitutes the equal financial reimbursement for virtual visits as in physical visits. This has generated a debate between institutions since telehealth is usually cheaper. In the state of Louisiana, the payment differed between services. Considering a 30-minute office visit that is worth $62, telehealth would only constitute almost half the price ($33). The justification for reducing this amount is that less procedures are performed during virtual visits, and that their duration is shorter than physical visits. Some health professionals argue that it would be an overpayment to equalize the price between both services. Nevertheless, it is important to mention that virtual visits increased from 10% to 90% during the pandemic, which is why experts should carefully consider the situation and determine a fair solution.
- **Health professionals** should be capable of **performing both services** with equal quality and compromise. To successfully implement telemedicine in future healthcare, it is important to design a system that combines physical and virtual visits, where trained professionals can educate and guide patients through the best option for them.

Telemedicine should not be treated as a tool that was only useful during the COVID-19 pandemic, but as an *opportunity* for healthcare to evolve and embrace the future technologies that will produce a huge benefit for many patients and physicians all around the world (Haque, 2021) (Shachar et al., 2020).

CONCLUSION

Telemedicine has proven itself as a valuable tool for active patient care. Due to the recent advancements in technology and new global situations such as the COVID-19 pandemic, research and use of it has seen a great boom. Its utility has grown from just providing an easy to access service for patients, we are now seeing more benefits for both patients and providers such as access to previously unable specialists and

easier logistics around multidisciplinary teams. International programs have provided invaluable aid for underdeveloped communities around the third world while improving the knowledge and experience in first-world health centers. Rural areas are being connected to the same services that once only urban areas could provide. The development in the use of telemedicine and related fields is limitless. Healthcare is always active evolving, and telemedicine is evolving with it.

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KEY TERMS AND DEFINITIONS

Diagnostics: Determination of a condition through the careful examination around it.

Expert Consult: Medical advice and services offered by specialist in an area.

Health Monitoring: The monitoring of specific parameters to determine changes in health and overall wellbeing in someone.

Internet of Things: Network of objects actively connected to each other and the internet.

Multidisciplinary Teams: Group of multiple specialists and other non-MD health providers who work together to meet the needs of patients, especially those with complex conditions.

Patient Care: Act of providing services around health practices to those who need it.

Rural Medicine: Study of the delivery of healthcare to rural areas.

Telehealth: Use of telecommunication technologies in health practices.

Chapter 2
Telenutrition: The Fine Line Between Nutritional Coaching and an Effective Professional Practice

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ABSTRACT

In the last 20 years, telenutrition has gained popularity and visibility. This term refers to the incorporation of tools and skills of telecommunication into nutritional management. Telenutrition already had many reported uses even before the COVID-19 pandemic. In the present chapter, Telenutrition will be addressed considering important aspects such as differences with traditional care, the most relevant findings in pathologies relevant to the area, some suggestions for tools and marketing, as well as some ethical aspects.

INTRODUCTION

The pandemic caused by Covid-19 generated a series of restrictions in countries (like the maintenance of health distance; avoid crowds; do not greet with a kiss and hand; etc.), the complete closure of any non-urgent work and commercial activity; besides to medical institutions at maximum limit forced them to modify their clinical practice in most health sciences. Telemedicine was a perfect alternative to treat the patients in the distance; in this sense, Telenutrition gained strength. Therefore, this chapter aims to analyze the practice of Telenutrition, its characteristics, its main uses, and recommendations for its proper employment, emphasizing the ethical approach in its practice. The present chapter is a good alternative

DOI: 10.4018/978-1-7998-8783-6.ch002

for consultation, which will be useful for students, teachers of undergraduate programs in Nutrition, and health professionals in the field of Nutrition.

BACKGROUND

In contrast with another health science practice, where the Covid-19 substantially increases remote consultation evidence, Telenutrition shows sustained growth practice from the late 90s. In those studies, (Cline & Wong 1999), they showed the impact of Telenutrition on weight loss, it was shown as a very promising alternative for the future, which gave the patient the comfort of being from home, with the possibility of improving openness in a reliable environment that promoted nutritional education, greater follow-up, and a closer accompaniment for those patients who required it. Since then, various studies on Telenutrition began to appear, but in 2015, the number of publications per year began to rise. This could be related to the increase in the prevalence of various metabolic diseases such as obesity, type 2 diabetes, hypertension, and metabolic syndrome (Saklayen, 2018). Most of the studies are focused on weight loss, however other contexts analyzed with Telenutrition are type 2 diabetes mellitus, hypertension, cardiovascular diseases, and also in chronic kidney disease. In most of these studies, the interventions range from the assessment completely online, to various digital media such as specialized platforms, e-mail, social networks, or smartphone apps. As already mentioned, there are various proposals where Telenutrition is used for the management of several diseases or the promotion of healthy lifestyles, however, the documents are isolated, very focused on each of the diseases, there is no review that makes a consensus of all the information. differences between telemedicine and face-to-face care. Throughout the chapter, these uses will be deepened and broken down for the reader to reach a better conclusion about the use of Telenutrition, and if he is determined to use it, he will be able to have a guide to its correct use.

MAIN FOCUS OF THE CHAPTER

Telenutrition has been growing in the last twenty years, being used more and more and even being something common; making it clear that Telenutrition did not come with the Covid-19 pandemic, but that it has been evolving in recent years. This increase may be related to the use of technology, constant improvements in telecommunications, without neglecting that we live in a globalized world. Telenutrition has already reached us, and for Nutrition professionals to become more competitive, adapt to new ways of communicating, and acquire tools that favor a better relationship with patients/clients, it is necessary to have a guide to how it works. This chapter will discuss the main uses, the differences in patient management, and the recommendations of some tools, marketing use, and the non-recommended aspects, which will be analyzed, ending with the ethical aspect for a better understanding and correct use of Telenutrition.

Table 1. Main differences between traditional nutrition care processes and those applied in Telenutrition

STEPS in Nutritional Care Process	Traditional method (face to face)	Tools employment	Telenutrition	Tools employment
Assessment & reassessment	1. Obtain/collect timely and apropiate data 2. Analized/interpreted with evidence based standard 3. Document	1. Complete antropometry 2. Interview	1. Self-assessment 2. Analized/interpreted with evidence based standard 3. Document	1. Basic measurements: weight, height, abdominal circumference, calf circumference 2. Interview in video calls, text messages
Diagnosis	1. Identify and label problem 2. Determine cause/crontibuting risk factors 3. Cluster sings and syntomps/ defining characteristics 4. Document	1. Interview 2. Assessment of nutritional state	1. Identify and label problem 2. Determine cause/crontibuting risk factors 3. Cluster sings and syntomps/ defining characteristics 4. Document	1. Interview 2. Online dietary questionnaires like: ASA24 and Oxford webQ
Intervention	1. Plan nutrition intervention. Formulate goals and determine a plan of action 2. Implement nutrition intervention. Care is delivered and actions are carried out 3. Document	1. Delivery of feeding plan printed or sent	1. Plan nutrition intervention. Formulate goals and determine a plan of action 2. Implement nutrition intervention. Care is delivered and actions are carried out 3. Document	1. Sending digital meal plan
Monitoring and evaluation	1. Monitor progress 2. Measure outcomes indicator 3. Evaluate outcomes 4. Document	1. Complete antropometry 2. Interview	1. Frecuency monitor progress, 24/7 2. Self-measure outcomes indicator 3. Evaluate outcomes 4. Document	1. use of software, monitoring applications, support groups, social networks

1. DIFFERENCES BETWEEN TELENUTRITION AND FACE-TO-FACE CARE, RESOURCES THAT CAN BE USED

In the first instance, it might seem that traditional nutritional care and Telenutrition are very different, it might even be thought that in the latter there is no scientific rigor, that it is impossible to apply the nutrition care process (NCP), that there is not full attention to patients or that the latter do not take it seriously; However, the Nutrition professional must apply the NCP regardless of the care system he is offering. The objective of this section of the chapter is to understand that there are differences in the management of patients through Telenutrition, however, we can highlight the benefits of this and make our intervention more efficient either in future extraordinary conditions, as happened with the Covid-19 pandemic (Brunton et al. 2021), or in traditional conditions where we normally use technology (Polak et al., 2018); To do this, we will analyze the differences based on the four principal steps considered in the NCP model: assessment and re-assessment, diagnosis, intervention and monitoring and evaluation (Skiper, 2008). In table 1, these differences are summarized.

1.1 Nutrition Assessment and Re-Assessment

The collection of data and Telenutrition depends entirely on the access to telecommunications by the service provider, as well as the patients. In such a way that Telenutrition consultations have endless possibilities, they can be through calls, video calls, text messages, use of specific applications and recently the use of social networks has been promoted (Farid, 2020). This diversification makes it possible that if the patient does not have an option, he can access another, as long as he has the minimum necessary equipment: telephone, smartphone, tablet, or computer. It should be noted that in addition to the aforementioned, due to the type of attention, the payment of services requires access to a credit or debit card,

making bank transfers, specific payment applications, among others; with which the target audience that can receive care through Telenutrition is reduced (Busay & Michel, 2008; Mehta et al, 2020). In addition, it is important to analyze that not all patients have the same tolerance to loss of connection, not all have technical skills to handle applications and/or software, and there are even patients who may not accept and take the consultation seriously (Eze et al., 2020).

In conventional nutritional practice, we have an important component that is difficult to compensate for in Telenutrition, a complete assessment of nutritional status that considers anthropometric, biochemical, clinical, and dietary components. As Nutritionists, using various indicators of anthropometry such as circumferences, perimeters, amplitudes, which generally allow them to determine the body composition of their patients, it's very important. This part is left aside in Telenutrition, making us dependent on the instruments that patients have, and on your expertise to use them. In this sense, some studies show that there is no difference between self-reported anthropometry and measurement by training personnel in epidemiology studies (Ortiz-Panozo et al, 2017; Villarini et al., 2019). However, its use individually for Telenutrition has not yet been evaluated. Regarding measurements, weight and height are two parameters that are easily measurable and accessible to patients, since most of them have a scale at home. Arm width can be used to estimate height in cases where it is impossible to obtain it traditionally. These indicators are useful for the majority of the population, and in pediatrics, it is highly relevant to assess growth and development (Viana-Bagni et al., 2021). To evaluate body composition, some studies suggest the use of waist circumference as an indicator (Ortiz-Panozo et al, 2017; Villarini et al., 2019), abdominal circumference is also suggested for its ease of measurement, only for assessing whether it increases over time; Similarly, it has been suggested that calf circumference be used to determine changes in muscle mass (Viana-Bagni et al., 2021). One of the important recommendations is that the professional previously investigate the technical characteristics of the materials to be used to foresee and make an estimate of their reliability. In addition to being carried out with the support of someone else and making the measurements in duplicate so that there is less error. "If the difference between the measurements is greater than expected (0.5 kg for weight, 0.5 cm for height, 1.0 cm for abdomen circumference, 0.2 cm for calf circumference), it is recommended that a third measurement should be performed and that the average of the two closest should result be used" (Viana-Bagni et al., 2021); similar to when you are training in anthropometry. In Telenutrition, the use of biochemical studies becomes a key element for a better diagnosis and follow-up, especially considering that the clinical aspects will only become subjective as they depend on the observations that the patients can indicate and their perceptions of symptoms. In the case of the dietary component, the traditional interview can continue to be used. However, to speed up the consultation and work on other nutritional guidance issues in the session, tools such as ASA24 (Kirkpatrick et al., 2014) and the Oxford Web-Q (Greenwood et al., 2019) can be used, which have been validated as 24-hour recall self-administered questionnaires, with results similar to the interview with an expert. In minors, tools such as StrongKids can be used to identify some nutritional problems and be able to intervene in time (Dos Santos et al. 2020).

1.2 Nutrition Diagnosis

To make a better diagnosis, it is advisable to use most of the possible indicators, as mentioned in the previous section. It may be convenient to collect such data in advance to make the consultation more efficient and generate a better disposition and care of patients in those cases in which real-time review is used (mainly video calls). In this sense, to have a better interpretation of the data obtained, it will be

relevant to evaluate the evolution over time rather than the beginning itself, considering only anthropometry (Viana-Bagni et al. 2021). In addition, it is suggested to request continuous measurements of the patients, as training so that the measurement error is reduced. In the case of Telenutrition, as in traditional care, all patient management must be based on scientific evidence.

1.3 Nutrition Intervention

It has been widely evidenced that, unlike traditional clinical practice, in Telenutrition, closer connections are established with patients, because they feel more accompanied, and self-care is favored so that the nutritionist leaves that authoritarian position and becomes a guide. This is a key point to achieve a more lasting nutritional education and that generates greater adherence to meal plans. There are different monitoring methods, it can be through specialized applications (for example Nutrimind, Avena, etc.), directly through video calls, text messages, or calls; Sending educational material such as infographics, videos, photographs, motivational phrases, among others. The intervention of Telenutrition involves any telecommunications device such as the internet, but it is not the only alternative, because as mentioned, text messages and calls are also part of Telenutrition. An example of this is the IDEATel project, carried out in different sectors of the United States, they followed a comprehensive telemedicine plan, considering the part of nutrition in diabetes, a self-monitoring was better because the participant was more active, which showed the efficacy of this type of approach (Shea, 2007). Similarly, there are several clinical trials where different proposals are given to pregnant women with overweight or obesity, in which the monitoring by telenutrition (Kenelly et al. 2016). Other pathologies have also been treated through Telenutrition, thus, during confinement for Covid-19, at The Johns Hopkins Adult Epilepsy Diet Center, they established protocols for the care of children with epilepsy for their treatment with a ketogenic diet, in which they made the consultation through video calling platforms, parents flocked for supplements, and monitoring was constant (Kossof et al. 2020). The response was good and the benefits of nutritional management were maintained. In such a way that the perception that patients have of Telenutrition is quite good (Eze et al., 2020), which could be an important point to consider as it positively predisposes patients and involves them even more in their treatment. In the intervention of Telenutrition, the patient is the central point of everything, since he is not only going to execute the recommendations but also actively participates in the data collection. The nutritionist participates by interpreting the data and further favoring nutritional guidance from the first consultation, which is generally worked in person when the patient has improved significantly.

1.4 Nutrition Monitoring and Evaluation

Monitoring in Telenutrition can be with the same frequency as if it were in person; However, in the case of remote care, constant monitoring is promoted, in some cases even 24/7, since patients can send messages with doubts about their meal plans, images in real-time of when they perform physical activities or of the diet, and they may even mention moods and emotions. This quality allows a greater closeness of the nutritionist with the patient, favoring trust and better retention of them. There are various monitoring methods, it can be only with the professional through text messages or calls, or in groups, where the nutritionist functions as a moderator, and where among the patients who share some pathology there is support, recommendations for example of recipes, and even tips on how to cope with the meal plan. These groups function similarly to self-help groups (Harvey-Berino et al., 2010). Regarding this point,

Table 2. Main uses of telenutrition. Abbreviatures: X weak evidence, XX moderately evidenced, XXX, strong evidence; N/A, not applicable in the study, N/E, not evaluated in the study

Disease	Weight loss	Biochemical control	Cost-effectiveness	Nutritional education	Suggestion for its use	References
Obesity	XXX	X	X	XXX	XXX	Hartmann-Boyce et al., 2015; Hutchesson et al., 2015; Sorgente et al., 2017; Alencar et al., 2019]; Ventura Marra et al., 2019
Diabetes type 1	XX	XXX	N/E	XXX	XXX	Joiner et al. 2017; Boscari et al. 2021; Viñals et al. 2021
Diabetes type 2	XXX	XXX	N/E	XXX	X	Wang et al. 2017; Izquierdo et al., 2003; Vadheim et al. 2017
Dyslipidemia	N/E	N/E	N/E	X	X	McMahon et al. 2021
Arterial hypertension	N/E	N/E	N/E	X	X	Omboni et al. 2016, Tucker et al. 2017, Omboni et al. 2020; McMahon et al. 2021
Celiac disease	N/A	N/E	N/E	N/E	X	Elli et al., 2020
Epilepsy	N/A	N/E	XX	XXX	XXX	Kossof et al. 2020
Chronic Kidney disease	N/E	N/E	N/E	N/E	X	Kalantar-Zadeh & Moore, 2020
Malnutrition	N/A	N/E	XX	XX	XX	Knotowicz et al., 2019

the efficacy of these groups have been evaluated through the internet and it has been found that they are effective, for example in weight control (Hartmann-Boyce et al., 2015) and diabetes control (Chen 2012). This possibility may allow greater interdisciplinary if, in addition to Telenutrition, the intervention of physical educators and psychologists is favored.

2. MAIN FINDINGS OF THE USE OF TELEMEDICINE IN SOME IMPORTANT PATHOLOGIES FOR THE NUTRITION AREA

As has already been mentioned, weight loss, as well as the management of type 2 diabetes, have been the most analyzed pathologies, however, there are several clinical trials with different approaches, some consider virtual consultation, other frequent personalized messages, others through videos; but they have shown important results. The importance of this section of the chapter lies in trying to take the most outstanding results and combine them in a proposal that could be more effective, due to the most common pathologies that we attend as Nutritionists: Obesity, diabetes, hypertension, and dyslipidemias. Besides, some proposals will be generated for some common digestive conditions such as colitis, gastritis, and gastroesophageal reflux. Table 2 summarizes the main findings of the use of Telenutrition for the management of pathologies, with this review it is clear that its use has been focused mainly on the hand of overweight and obesity. Therefore, the long use of Telenutrition in the last twenty years, mainly in obesity management, gives way to an emergent use in other diseases with relevance to Nutrition.

2.1 Obesity

Most of the studies focused on weight loss through Telenutrition are focused on self-monitoring, goal settings, support and motivation, and regulation/restrictions; In addition, it is observed that there is a greater reduction in weight concerning the control groups that use it (Hartmann-Boyce et al., 2015; Hutchesson et al., 2015). This weight loss is dependent on the time of the intervention and the population evaluated, however, which shows that obesity can be managed effectively through Telenutrition. In a study conducted in Virginia City, USA, a 12-week e-nutrition weight loss program was found to be effective in weight loss (Ventura Marra et al., 2019). In a weight loss program that included nutritional education (mindful/intuitive eating, fiber, hydration, calorie counting); fitness education, and behavior modification, a greater weight loss (7.3 kg $\pm$ 4.4) was observed in the Telenutrition group, while in the control group (1.5 $\pm$ 4.1), showing that the intervention favored the loss of> 5% of excess body weight in obese patients (Alencar et al., 2019). Similarly, in women with overweight or obesity, in which the monitoring by Telenutrition reduces the risk of gestational diabetes and preeclampsia (Kenelly et al. 2016); contrary to a meta-analysis where no differences are seen in the weight gain of women with traditional intervention and through Telenutrition (Halligan et al., 2021). As evidence, many studies show a positive and hopeful outlook on weight management (Sorgente et al., 2017), where Telenutrition is an excellent alternative, however, most of the studies have a short duration, at most 12 weeks, in this regard it is fine. It has been shown that most nutritional approaches have this same effect, however in the long term, even weight gain can occur. In this sense, only one Telenutrition studies has been evaluated in the long term. In overweight veterans, the effect of a video program called MOVE! Was evaluated, which consisted of 12 weeks of physical activity; in this work, maintenance of weight loss was observed in 1 year after the intervention (Ahrendt et al., 2014). All this information highlights the need for long-term studies evaluating the effect of Telenutrition on obesity.

2.2 Diabetes

Regarding the management of type 2 diabetes, various studies have been carried out focused on changes in diet, in these, it has been observed that there is a reduction of at least 1% in HbA1c (Wang et al. 2017); This effect is comparable to traditional intervention (Izquierdo et al., 2003; Vadheim et al. 2017). Thus, it has been seen that modifications in patients' lifestyles in conjunction with behavioral support have been more effective in managing and maintaining positive behaviors associated with eating (Joiner et al. 2017). In the case of diabetes 1, it was observed that a 4-week intervention through telephone calls reduced the high points of hyperglycemia and maintained the target glucose levels for a longer time (Boscari et al. 2021) without increasing the time of hypoglycemia. (Viñals et al. 2021). These results show Telenutrition as a promising tool for self-monitoring of patients with chronic disorders at an affordable cost, particularly in communities where access could be conflictive, however minimal access to technology is required to carry out such interventions (Zhai et al., 2014).

2.3 Cardiovascular Diseases

In the case of cardiovascular diseases, Telenutrition has not yet been widely used, most of the studies are focused solely on self-monitoring of values such as blood pressure or heart rate, and make some superficial mention of modifications of the styles of exercise. life, however, no mention is made of Telenutrition

(Omboni et al. 2016, Tucker et al. 2017, Omboni et al. 2020). Some studies analyze weight loss and reduction of waist circumference as a marker to reduce the risk of cardiovascular diseases, in these, it is observed that the intervention by Telenutrition is effective (McMahon et al. 2021). Considering what was previously reviewed, a hypothesis could be made that Telenutrition would probably be effective in the control of patients with CVD; however, due to their complexity, they could not replace traditional care.

2.4 Other Pathologies

A protocol for the care of children with epilepsy for their treatment with a ketogenic diet in The Johns Hopkins Adult Epilepsy Diet Center during Covid-19 showed improvement effects similar to those observed in face-to-face care (Kossof et al. 2020). In the case of nutritional management through Telenutrition, there are no studies regarding specific diseases, however, suggestions have been made on how the intervention could be in the face of the restrictions caused by Covid-19. In this sense, chronic kidney disease, the use of Telenutrition, the use of important tools such as the Subjective Global Assessment (SGA) of Nutrition and the Malnutrition-Inflammation Score (MIS), and the type of usual diet through reminders have been proposed. 24 h, food frequencies, and 3-day diaries; This recommendation goes in the direction of the need for constant self-monitoring of this type of patient (Kalantar-Zadeh & Moore, 2020). Similarly, in celiac patients, it has been proposed that nutritional management include nutritional education, verifies vitamin deficiency status, and monitors gluten-free diet, as well as celiac disease status. (Elli et al., 2020). In older adults with malnutrition, greater adherence to meal plans was observed through an intervention through telephone calls; With these results, the authors propose it as an alternative to treat malnutrition in pediatric patients (Knotowicz et al., 2019).

3. DIGITAL TOOLS AND STRATEGIES FOR REMOTE CARE

Digital tools and strategies for online care. For online care, different programs can be used to carry out the clinical history, the calculation of macronutrients, the elaboration of our nutritional proposal. Besides, there are different applications for smartphones that serve to make the diet more accessible, showing images and recipes. In this regard, in various effective Telenutrition strategies, they use complete recipes, showing videos and photographs in real-time to make the patient feel attracted to that food. Also, there are other monitoring tools where we can verify the physical activity of patients and that could give us more information for more comprehensive management. In such a way that various alternatives could enhance and improve the expectation of the consultation for patients, but mostly for the professional, ranging from the storage of the medical history, the monitoring, and the sending of the nutritional plan. In this sense, the nutritionist has to have a clear idea of his brand and the type of editors he can use to make his work more attractive. Of the tools that have gained relevance because it is a great alternative to attract potential clients are social networks such as Instagram, Facebook, tik tok, and Twitter (Helm & Jones, 2016). This generates that the patient feels confident because he sees his instructor in daily life, generating a greater openness and it could even favor the adherence (Mehta et al. 2020). It should be noted that sometimes the nutritionist becomes more of a health coach or is misunderstood as simply an “influencer”. However, it is important to emphasize that despite trying to use a “more accessible” language, using memes, jokes, or acting informal, you should take the position of a scientific disseminator, always respecting your role as a health professional. This point will be discussed later in the chapter.

4. MARKET STRATEGIES IN TELENUTRITION

Health marketing strategies have played a key role in Telenutrition and have enabled the efficient development of nutritional care. In this regard, health marketing is defined as the administrative orientation that seeks an exchange process between clients and professionals, to satisfy needs, desires, and expectations in terms of health, under an ethical and social approach. This is achieved through a plan, thus we find the inbound marketing that groups techniques and strategies of marketing and non-intrusive advertising, whose objective is to create quality content that contributes to customers and thus capture their attention. The benefits of inbound marketing are increases traffic to website and subscriptions, the customer does not feel harassed, increases brand presence and visibility, and builds brand trust and credibility. The following are some of the strategies used (Vega, 2017., Shum, 2019):

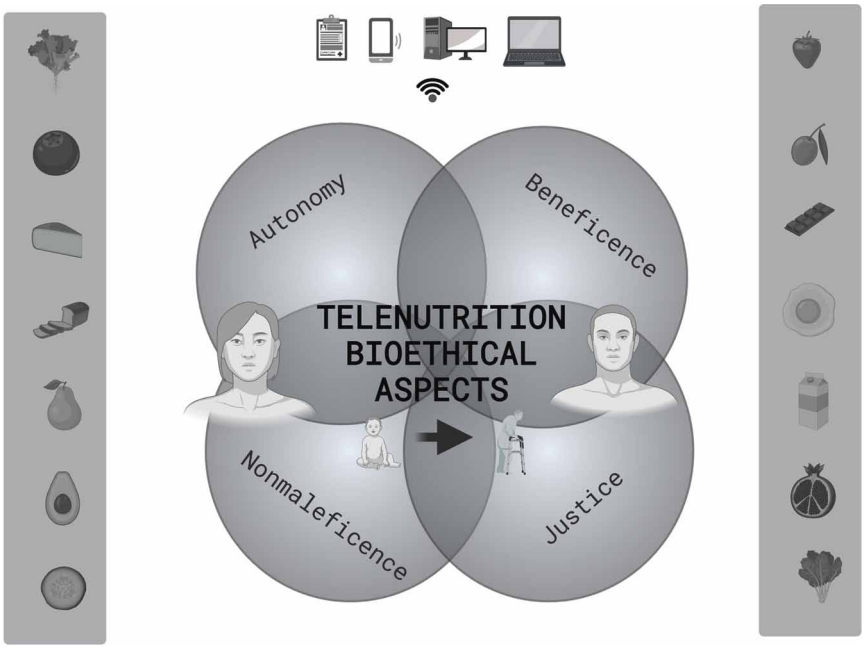
- Searching Engine Optimization (SEO) strategies for positioning health in major search engines such as Google, Yahoo!
- Engagement or emotional bonding with the target market focused on informing about the service or product and its innovative applications, placing it in an emotional context that engages and motivates the consumer to want to know more.
- Content marketing on websites and social networks, using a colloquial language using the main social networks such as Facebook, Instagram, Twitter.
- Use of E-mail marketing or newsletter to promote the health sector, which consists of sending advertising, newsletters, promotions, and consultation to customers who subscribe through digital channels such as the website.
- Use of testimonial videos of the nutrition practice that give credibility to the practice, indicating the health and technological services available in the clinics.
- Pay-per-click advertising on specialized health websites consists of paying for advertising on specialized pages.
- Health professionals search applications that allow direct and fast interaction between the health professional and the patient.

5. ETHICS AND PROFESSIONALISM WITHIN THE DIGITAL CONTEXT OF NUTRITION PRACTICE

The COVID-19 pandemic highlighted the importance of the use of telehealth as well as an opportunity to examine ethical issues. The ethical considerations may be different, greater, or more variable through Information Communication Technology (ICT) methods than through face-to-face care models. Traditional ethical and legal considerations such as consent, privacy, and confidentiality are complicated by concerns about patient autonomy, the altered nature of the professional-patient relationship, the lack of the human touch in care, and the medicalization of the home environment. Ignoring ethical impacts of ICT health service delivery creates unintended risk for patients and can lead to reduced effectiveness, non-compliance and harm, undermining the best intentions of governments and clinicians (Kaplan & Litewka, 2008., Perry et. al 2018).

We will conduct a clinical ethical analysis of telehealth from the four principles:1. Respect for patient autonomy; 2. Beneficence; 3. Nonmaleficence; 4. Justice, these principles are operative whether one is

Figure 1. Proposal of Bioethical aspects applied to Telenutrition. In Telenutrition skills, tools, and devices of telecommunications are fundamental to the development of Telenutrition, which can influence autonomy, beneficence, nonmaleficence, and justice of ethical behavior, for both the Nutritionist or patient; and must be applied in all stages of life



inclined toward a deontological or a consequentialist perspective. In figure 1, it was observed a proposal of ethical principles applied to Telenutrition.

5.1 Respect for Patient Autonomy

The word autonomy means "self-rule" individuals can decide on their purposes, as well as to act according to their own decisions, free from external restrictions or coercion. All individuals have the right to be treated as autonomous beings and can decide, those individuals who have impaired decision-making ability should be protected in making non-assertive decisions (Taylor, 2013). With telehealth, autonomy can both improve and diminish at the same time, on the one hand increasing the freedom of older adults to be cared for from their homes and on the other contributing to their isolation (Percibal & Hanson, 2016). From the perspective of autonomy in telehealth, it is paramount to assess the impact on patients and detect potential risks (Sorell & Draper, 2012). The methods used in telehealth for data collection, storage, and management can threaten patient autonomy if it is the main source of information, so a multi-pronged approach is recommended incorporating ethical principles in practice, rules, regulations, codes of conduct, and ethics (Layman, 2003).

5.2 Beneficence

This principle refers to the moral obligation to act for the benefit of others or what amounts to "doing good". This principle also encompasses curing harm and promoting good or welfare (Taylor, 2013). Telehealth has the potential to benefit individuals by providing security, self-management of individual health, reducing dependence on professional caregivers or family (Iserson, 2000., Eccles, 2010., Clark, 2010). It facilitates access to quality health services and allows for ongoing monitoring (Clark, 2010). In developing and implementing telehealth policies and guidelines then, it may enhance practice to be able to clearly articulate the benefits to both patients and providers in design and delivery, so that telehealth remains "a support system for well-defined needs and not be pushed as an engineering solution to health" (Gogia, et. al. 2016).

5.3 Nonmaleficence

Maleficence is harm or evil, so the principle of nonmaleficence refers to doing no harm and preventing harm. This includes not killing, not causing pain or suffering, as well as not causing disability, as expressed in the famous Hippocratic aphorism "First do no harm." (Taylor, 2013). In telehealth the potential for harm is more frequent, it has been reported that the use of videophones in the home has a stigmatizing or shaming effect on the person, as well as caregivers opting for remote communication in situations where the patient requires care in the traditional way (Perry et. al, 2021).

Confidentiality, nonmaleficence, and the professional responsibility of professionals are linked to ensure that patients are protected from "emotional, spiritual, social, or material" harm (Sarhan, 2009). The Code of Ethics for the Profession of Nutrition and Dietetics-updated in June 2018 and developed by the Academy and its accrediting agency, the Commission on Dietetic Registration-also emphasizes the importance of "safeguarding patient/client confidentiality following applicable regulations and laws" and "implementing appropriate measures to protect personal health information by using appropriate techniques (e.g., encryption)."(Peregrin, 2019).

5.4. Justice.

The principle of justice is generally considered to have two components: equity and distributive justice. Equity means that people in similar circumstances should be treated similarly. It also includes the rejection of discrimination and is a principle of a public and legislated nature. (Taylor, 2013). When considering justice concerning developing a telehealth practice, questions related to equal access and fair distribution of the technology, and whether a digital or information divide exists should be used to guide the implementation of telehealth services in practice (Palm et. al., 2013). In this respect, the COVID-19 pandemic has highlighted this digital divide (Ramsetty & Adams, 2020) and although the Federal Communications Commission has made some recent efforts at closing this gap, such as creating an interactive broadband map and increased financial support for the Rural Digital Opportunity Fund, lack of access to the technology needed for telehealth remains an ongoing barrier (Federal Communications Commission, 2021).

SOLUTIONS AND RECOMMENDATIONS

As has been widely mentioned in the book chapter, Telenutrition is shown as an alternative for daily use, far from being a temporary alternative, everything seems to indicate that it is functional in the long term. Particularly in chronic diseases where self-monitoring is of great relevance, such as obesity and diabetes. However, it is important to recognize that it has its limitations, particularly in ethics aspects depending on the complexity of the cases, and should be used with caution whenever possible. An alternative could be the use of a hybrid system that will combine a first face-to-face intervention and monitoring through Telenutrition, in such a way that diagnoses closer to reality can be established, as well as doing a brief training on how the measurements would be made. In addition to previously establishing and with the consent of the users, the employment of personal data, the dynamics of participation, and in general the operating rules in Telenutrition, to avoid or reduce the stigma.

FUTURE RESEARCH DIRECTIONS

Studies focused on the evaluation of the long-term efficacy of Telenutrition are required to determine its use and safety. Being a relatively accessible alternative could be proposed as a possible solution for large-scale nutritional intervention, preserving individuality. In addition to ethical and legal regulations, to promote the dignified treatment of patients.

CONCLUSION

Telenutrition is a powerful tool to carry out the nutrition care process in the face of particular situations such as that experienced by the Covid-19 pandemic, however, it can be used in the future as a safe and reliable alternative, as long as the steps in the nutrition care process and ethical aspects as nutrition professional.

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KEY TERMS AND DEFINITIONS

Anthropometry: A set of body measurements that serve us in nutrition to determine the body composition of patients.

Bioethics: A form of behavior based on moral values and qualities applied to biological and health sciences.

Diet: Total food is eaten throughout the day.

Digital Marketing: It is the application of marketing strategies and techniques carried out through digital media.

Food Plan: Nutritional treatment that is given to patients individually, according to the interpretation of anthropometry, biochemistry, clinical, and dietary as a diagnosis.

E-Nutrition: Refers to nutritional management exclusive by internet tools

Nutritional Care Process: It is a guide to the parameters that are required to work with patients, the most used model is made up of 4 aspects: assessment and reassessment, diagnosis, intervention, and monitoring.

Obesity: A disease characterized by excess weight due to adipose tissue, the most widely used indicator of which is a BMI greater than 25.

Stigma: Beliefs, attitudes, discourses, images, words, etc.; used to mark or signaling a person, for example, patients with obesity called “fat”.

Chapter 3
Design Specification for an M-Health Solution to Improve Antenatal Care:
Analytical and Technical Perspective

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ABSTRACT

Existing research on improving antenatal care—using information and communication technologies and related technology—has focused on mobile phones to support SMS alerts and the implementation of a tool for booking appointments. The SMS alert system is limited in many ways, especially in addressing the conflicts in schedule and time for appointment and visit. Even with the reported tool(s) implemented, activities in the software development process, especially the design specifications, were not correctly followed and documented to justify the solutions proposed. By means of a qualitative research approach, a face-to-face oral interview with both pregnant women and obstetricians and a brainstorming session with the obstetricians were achieved. The chapter approach harnesses course-plotting technology to determine the most suitable obstetrician based on proximity and route with Google Map's aid. The result is presented from both analytical and technical perspectives to prevent and reduce the high rate of maternal and neonatal loss.

DOI: 10.4018/978-1-7998-8783-6.ch003

INTRODUCTION

Over the years, the impact of information and communication technology (ICT) in the healthcare sector– particularly the internet, mobile, and web technologies– has revealed significant healthcare delivery improvement (Panir, 2011; Gambo and Soriyan, 2017). Notably, ICT diffusion and adoption in the healthcare sector generally take center stage in public health intervention programs, like Antenatal Care (ANC). For example, the improvement of maternal healthcare – as one crucial objective of the Millennium Development Objective (MDGs) – has been engendered through the use of ICTs (Ngabo et al., 2012; Mahapatra and Sahoo, 2015; Al Dahdah et al., 2015; Sondaal et al., 2016; Feroz et al., 2017; Uneke et al., 2017; Abejirinde et al., 2018; Thobias and Kiwanuka, 2018; Borsari et al., 2018). Specifically, significant mortality rates related to pregnancy and childbirth can be avoided if the women receive adequate and timely ANC using ICT as a facilitator.

At the center of ICTs development and application is the essential role of software engineering practices that provide essential support for thorough analysis and design specifications. The primary goal of analysis and design specification is to capture end-users concerns and represent them in a logically acceptable way. For example, designing mobile health (*m*Health) solutions for ANC requires that patients-expectant mothers' and other healthcare professionals' concerns are captured, analyzed, and represented adequately. Additionally, the design specifications are the necessary acceptable criteria developed from the end-users needs (Johnson and Gibson, 2014; Hsiao, 2019). Jack (2013) observed that the presence/absence of customers' precise needs could serve as the basis for accepting or rejecting a design solution.

The imperfection and negligence in design specification in most ICT-based solutions in the healthcare domain could endanger human lives and lead to death. Remarkably, when patients' needs are not adequately captured in the analysis and design process, the system's functionality will not be trusted and reliable (Samaras and Horst, 2005; Dabbs et al., 2009; Dennis et al., 2015). In this context, the design specification is a recognized activity in the software development lifecycle for determining the quality and success of software-based solutions (Gambo et al., 2014; Teixeira et al., 2014). The design specification serves as the blueprint for implementation. It could also be used as a communication vehicle among various stakeholders (Bass et al., 2003).

Therefore, the overarching goal of this chapter is to provide a design specification for implementing a *m*Health solution to improve ANC. The objective is to develop a system that would help expectant mothers access obstetricians close to their locations, schedule appointments for personal ANC and other related medical care at their own free time and most preferred location. The system's main idea is to provide ease and comfort to patients while getting a regular checkup based on the obstetricians' booked appointments.

Unlike the conventional ANC system that makes it difficult for pregnant women to book an appointment and receive prompt and timely care, the chapter proposed a *m*Health solution that patients can easily and directly use to reach out to obstetricians. They can also table out issues and get immediate attention and solutions to their problems. With this, appointments can be booked or scheduled outside obstetricians' and pregnant women's work or office hours. That way, it will not affect their productivity at their respective workplace, which will, in turn, sustain the economy of the nation. The *m*Health solution can also afford pregnant women to choose an obstetrician with ease.

The intended design specifications focused on the Nigerian case based on feasibility and need analysis. This chapter has four contributions:

1. Systematically, the chapter unveiled the concern for avoiding and reducing the mortality rate related to pregnancy and childbirth, especially for working-class and busy pregnant women and obstetricians in the Nigerian case. The chapter's systematic contribution extends to addressing the need for harmonization in the face of conflicting busy schedules of both pregnant women and obstetricians and the need to stay on the job for survivability.
2. Methodologically, this chapter provided extensive design specifications that describe the *m*Health ANC solution. The design specification can be used as a blueprint for implementation in other African countries to address ANC's challenges technically within the same context.
3. Practically, the chapter developed a web and mobile platform consisting of two segments that technically and empirically prove the design specifications. The first segment is the mobile and Android platforms for the patient and the doctor, with each having different interfaces. The authors focused on the Android platform because it is a Linux-based open-source operating system developed by Google to have broader coverage. The second segment would be the Admin part developed on the website; the appointments are managed on the website by the Admin. The Admin can view all the patients and doctors on the system (Ameta et al., 2015). He confirms and validates the obstetrician, their certifications, registration with the regulatory bodies such as the Medical and Dental Council of Nigeria, Nigerian Medical Association (NMA).
4. Analytically, the chapter provided evidence of users' responses, which could form the basis for acceptance or rejection of using the *m*Health ANC solution.

The chapter is organized as follows: In section 2, the motivation and problem statement are discussed. Next, in section 3, the chapter reviewed related works and established grey areas that require improvement. Section 4 discussed the methodological design approaches explaining the implementation's requirements and design specifications. Section 5 contains the system implementation that validates the design specification's accuracy. In section 6, the system testing procedures are discussed. Section 7 presents the results of the analysis and discussion. In Section 8, the limitations and threats to validity are discussed, and some ideas for future work are given in Section 9. Finally, the chapter identified the concluding remarks from the research in section 10.

MOTIVATION AND PROBLEM STATEMENT

Around the world, about two hundred and eighty-seven thousand (287,000) women die every year from preventable pregnancy and childbirth complications according to the World Health Organization (WHO) report (WHO, 2012a; Rochat et al., 1988; Ronsmans et al., 2006; Alkema et al., 2016). More than 95% of these deaths happen in sub-Saharan Africa and Southern Asia, which provoked the United Nations to list Improving Maternal Health as the fifth MDG. The aim was to reduce maternal deaths by three quarters in 2015, as reported by the WHO (WHO, 2012b; Requejo et al., 2012). Specifically, Africa bears one of the highest implications of maternal deaths in the world (WHO, 2012a). Nigeria has about 2% of the world's population while accounting for close to 10% to 14% of the world's maternal deaths.

In the literature, Nigeria is gradually displacing India and sitting at the top (Voorhoeve et al., 1984; FMOH, 2005; Babalola and Fatusi, 2009; Oladapo et al., 2009; Okaro and Iyoke, 2010, Omowaleola, 2013) in cases of maternal deaths due to poor quality of ANC (Aikpitanyi et al., 2019; Sageer et al., 2019; Olonade et al., 2019; Piane, 2019). In the authors' opinion, the major mortality rate related to

pregnancy and childbirth can be avoided if the women receive adequate and timely ANC at the expected times, without the fear of leaving their jobs or offices to visit the hospital frequently. Therefore, providing expectant mothers with adequate maternal care using ICT, birth supervision by skilled attendants, and access to emergency obstetric care in pregnancy and delivery can save lives (Starrs, 2007; Obaid, 2007; Freedman et al., 2007; UNFPA, 2009; Gebrehiwet, 2015).

Achieving those mentioned above can be facilitated with ICTs by providing a mobile platform for accessibility, effectiveness, and efficiency. By engaging the use of *m*Health, the occurrence of death through complications can be reduced within the range of 9-15% of pregnancies (Royston and Armstrong,1989; Clark and Hankins, 2012; Wang and Fung, 2015; Pierre et al., 2018).

In literature, 75% of maternal deaths are as a result of direct or indirect causes from severe haemorrhage (bleeding), maternal sepsis (infection), obstructed labor, hypertension disorders in pregnancy, including high blood pressure with fits in pregnancy (eclampsia), and unsafe abortion (WHO, 1985; Choudhari et al., 2014). Additionally, the delays in booking or looking for ANC centers, in arriving at a health facility, and in accepting care at an ANC facility are significant variables representing a great part of the maternal deaths in sub-Saharan Africa (FMOH, 2005; Hill et al., 2007; Krasovec, 2004; Maine and Rosenfield, 1999; Nimbalkar and Fadnavis, 2014). Notably, the delays result from myriads of limitations, including: financial, cultural, social, educational, geographical (Somé et al., 2013).

As an example, in Egypt, a report on the national maternal mortality revealed that delay in seeking medical care and non-compliance with medical advice by the patient contribute to 42% of the cause of maternal death (Campbell and Gipson, 1993; Campbell and Gipson, 2001). This homogeneity exists in Nigeria– delays and unbooked obstetric emergencies (that is, unregistered pregnancies coming in emergencies) accounted for about 70% of the maternal deaths discovered. Most of these women do not receive ANC or arrived at the health facility moribund or when life was already imperiled by difficult labor, advanced pregnancy complications, or simultaneous maladies.

The forms of delays contributing to maternal death or challenges at receiving proper medical care in pregnancy have been categorized as primary, secondary, and tertiary delays (Pacagnella et al., 2014). On the one hand, the primary delay is when the patient is undecided about going to the hospital. Other reasons could be that the patient is unaware of the need to visit the hospital for ANC due to ignorance or not attending ANC unbooked. On the other hand, the second delay is occasioned by the patient's inability to get to the hospital on time. Additionally, the patient may decide to go to the hospital. However, it might become problematic given the nature of bad roads, unavailability of vehicles, and financial constraints. The tertiary delay is encountered in the hospital, where there is a shortage of materials to use, shortage of medical personnel/specialists, financial challenges, and too many patients to attend to per time (work overload). In a rural Kenya study, 64% of pregnant women who wanted to deliver in the hospital were unable to due to the inability to reach the hospital in time and waiting time experienced at the hospital (Voorhoeve et al., 1984).

Generally, ANC is a significant public health intervention planned for guaranteeing safe pregnancy results. It is a specialized care pattern for pregnant women to enable them to attain and maintain a state of good health throughout pregnancy. The ANC aims to improve pregnant women's chances of having a healthy infant's safe delivery at term (WHO, 2016; Tunçalp et al., 2017; WHO, 2018). In Nigeria, for example, several reasons exist as to why ANC attendance is not fully utilized despite the stipulated recommendation (Adewuyi et al., 2018), some of which have already been stated above.

In the effort to promote optimum maternal health and reduce maternal and childhood mortality, the chapter seeks to design and implement a system that focuses on improving the relationship, interaction,

and privacy between obstetricians and expectant mothers, especially working-class pregnant women. On the one hand, the chapter observed that underutilizing ANC's significant concern by the working class and busy-oriented mothers is not unconnected to their busy schedules. Another reason would be that they want to remain in the job space. On the other hand, the obstetricians' busy schedule poses a significant concern, which eventually results in a conflict of time between the obstetricians and the patients. For example, the busy schedule and, sometimes, the thought of waiting in long queues to see a doctor seems untenable (Malik et al., 2017).

Against the background and motivation described above, this study answered the following research questions:

RQ1: Can the non-existence, imperfection in the previous designs specification with poor record keeping be improved using a better designed *m*Health ANC?
RQ2: Can the increasingly unacceptable maternal and perinatal mortality in Africa / Subahara Africa be reduced or prevented by *m*Health ANC?
RQ3: Is it possible to solve inaccessibility problems to the specialists / Obstetricians in Africa / Subahara Africa by *m*Health ANC?
RQ4: Is it possible to solve hospital delay problems, an unacceptably long wait or queue at ANC, using *m*Health ANC?

The RQ1 to R4 are answered technically and analytically in Sections 4, 5, 6, and 7. For example, to answer RQ1, the authors first established and justified the importance of ICT for improving ANC in Section 4. After that, the design specifications and other system functionalities of the *m*Health ANC are described. RQ2 was answered in Section 5, where the chapter shows the implementation of the *m*Health ANC solution proferred. With the *m*Health solution, the increasingly unacceptable maternal mortality rate can be reduced or overcame. In Sections 5 and 6, the authors answered RQ3 and RQ4 analytically by demonstrating the *m*Health solution and engaging potential users to provide feedback on the solution's validity.

RELATED WORKS

Existing research on improving ANC– using ICTs and related technology– have focused on the use of SMS (Cormick et al., 2012; Lau et al., 2014; Indira et al., 2017; Makunyi, 2018), provision of mobile phone support (Onashoga et al., 2011; Watterson et al., 2015; Feroz et al., 2017; Uddin et al., 2017; Borsari et al., 2018; Thobias and Kiwanuka, 2018; Tabatabaei et al., 2020), implementation of decision support system (Abejirinde et al., 2018), assessment of ICTs impact (Nyawawe and Seif, 2014; Abekah-Nkrumah et al., 2014; Coleman, 2014; Sondaal et al., 2016; Sahay, 2016; Namatovu et al., 2019), and the systematic or empirical review of the role of ICTs (Feroz et al., 2017). The emphasis has been tailored towards the peculiarities in different nations, especially the developing countries. Common in all of the research mentioned above is the need to improve maternal healthcare using ICT as a driving force and tool.

However, most of the research reported focused on qualitative analysis that involves administering questionnaires to elicit information on the impact of ICTs. Only a few focused on developing a tool that can be used for appointment booking and sending reminders through SMS. Even with the reported tool(s) implemented, activities in the software development process like requirements analysis and de-

sign specification were not correctly followed and documented to justify the solutions proposed. Also, existing work did not address the conflicts in schedule and time for appointments and visits.

Lund et al. (2015) developed the Wired Mothers system to address the declining nature of ANC attendance and improve care quality. Notably, Lund et al. (2015) harnessed the use of mobile phones to strengthen ANC services by increasing how frequently pregnant women use the antenatal and improving the content and timing of ANC services provided to individual women. Lund et al. (2015) used an automated short messaging service (SMS) system to provide pregnant women with unidirectional text messaging. Additionally, Lund et al. (2015) provided a mobile phone voucher system to facilitate two-way communication between wired mothers and their primary health care providers. The mobile phone intervention increases ANC attendance and eases communication between pregnant women and health agents. Even though the system significantly increases the proportion of women receiving ANC, it does not reduce the hospitals' waiting time but instead increases it.

In Oyeyemi and Wynn (2014), a project tagged Safe Motherhood was launched in Ifedore Local Government Area (LGA), Ondo State, Nigeria. The project addressed the high rate of maternal death in Ondo State and delays in seeking healthcare. The goal was to improve facility utilization for maternal health purposes through cell phones to reduce maternal deaths and neonatal mortality and improve healthcare services for pregnant women. Oyeyemi and Wynn (2014) collected sample retrospective data from hospital records and patients' case files to determine healthcare facility rates in different locations. After that, the authors gave closed users' group (CUG) phones to pregnant women and selected health workers. Through these phones, the women could communicate free of charge with healthcare services. Notably, there was increased access to health services, increased health facility utilization, and reduced missed medical appointments. Providing CUG cell phones to pregnant women led to express communication with the healthcare team in emergency times. However, it does not cater for delay at the primary health care level. Besides, it was impossible to give exclusive attention to pregnant women who have busy schedules outside the specified time frame for a visit.

In a comparative study, Menaka et al. (2017) explored the critical role of *m*Health in ANC. They developed a mobile and web-based application to track pregnancy and increase antenatal visits. The application assisted in timely referrals for high-risk pregnancies in remote areas. The application helped track pregnancy, increased antenatal visits, and helped in timely referrals. However, it does not cater to scheduling an appointment with the health agent.

Chib and Chen (2011) started a midwifery-centered experiential program in the remote Aceh of Indonesia to discover how mobile technologies could fill in to help midwives working in rustic territories after the 2004 tsunami. Unfortunately, midwives from this zone get restricted information and, as such, have poor access to factual information that would enlighten them. However, Chib and Chen (2011) introduced mobile phones to rural midwives to contact medical experts and communicate with patients. Chib and Chen (2011) supplemented the analytical frame of the ICT for healthcare development model to address the multidimensionality of benefits and barriers. It was discovered that midwives had access to clinical data and other critical health information and could share information to the community effectively with mobile Technologies (Chib et al., 2008). It encouraged communication among midwives and doctors and surveyed mobile information gathering's achievability. The project's best advantage was the feeling of strength delighted in the Aceh midwives. In subjective meetings, midwives expressed feelings increasingly skillful. In other words, they were sure about their practices, just as accepting more special regard from the network.

Bhuvaneswari et al. (2017) also developed a Doctor-Patient Interaction System (DPIS) for android; this provided fast and adequate medical services. The system improved the specialist's efficiency concerning the patient's service. It made patients more relaxed, as they do not have to stand in a long queue to fix their appointments. Appointments were booked according to the individual's choice more conveniently. Doctors did not have to worry about managing their appointments. This system does not exempt the fact that the clinic would be visited. Still, appointments get booked from anywhere, and how they want it. This helps to save the time of the patient. The patient can also get the doctor of their choice through various filters used in the application. The doctor can also view his day-to-day appointment list, making it easier to plan his schedule. This application successfully optimized the work of patients and doctors.

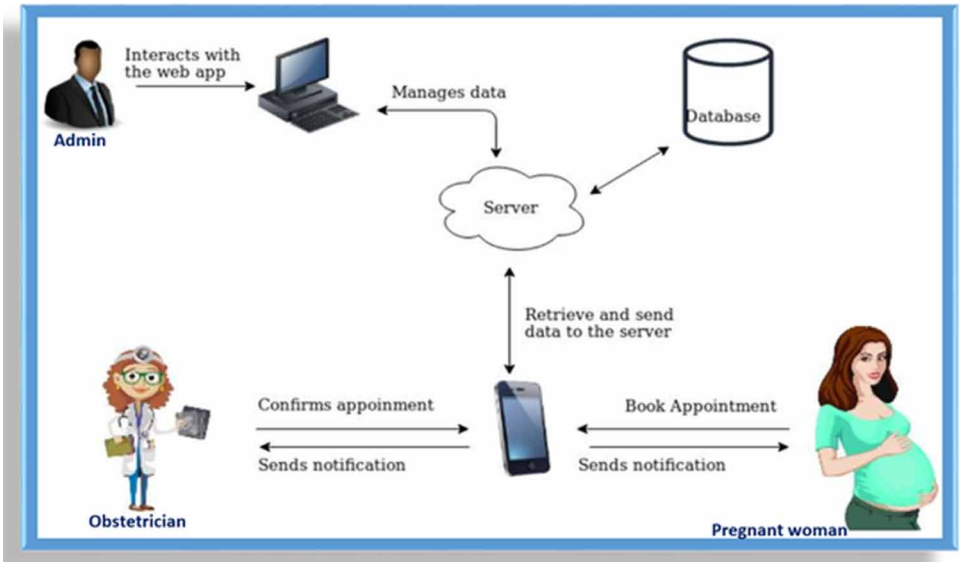
Ameta et al. (2015) developed an Android application with an automatic alarm ringing system to remind the patients of their dosage timings to stay fit and healthy. The alarm can be set for multiple medicines and timings, including date, time, and medicine description. A notification will be sent to the patients through email or message inside the system, preferably chosen. Searching for doctors and hospitals and navigation details is also available in the app so individuals can receive adequate required treatment on time. It centers on the relationship between doctors and patients. Patients do not always need to remember their medicine dosage timings. They can easily set the alarm for reminders on when to take the drugs. They can search for doctors disease-wise and get doctors' contact details as per their availability. Users can also see different medical fields and health care tips. The system focuses on straightforward navigation and an excellent user interface. Related medical reminder systems developed always required new hardware. However, it does not apply to this system, as it is economical, time-saving, and supports medication adherence.

Having reviewed many research works, the authors discovered that many of the current systems (Symey et al., 2013; Ameta et al., 2015; Bhuvaneswari et al., 2017) do not use internet-enabled solutions for their mobile systems. They instead utilize Unstructured Supplementary Service Data (USSD) or Global System for Mobile (GSM) communication technology for booking appointments and monitoring their antenatal visitations; these systems are advantageous in their way. They do not cater to the pregnant woman's preference and choice in a similar vein, making her access thousands of obstetricians within her reach. This would allow her to select the best option based on previous reviews and services rendered by the obstetrician. The previous methodology does not take the ANC as outpatient services, thereby causing delay and increasing waiting time in various primary health care centers and hospitals. The chapter's approach is pregnant woman-specific. It adopts the outpatient methodology for its operation, where pregnant women receive care at convenient places of their choice and time, not necessarily in the hospital. The authors harnessed course-plotting technology to determine the most suitable obstetrician based on proximity and route with Google Map's aid.

METHODOLOGY

In this chapter, the authors strictly followed the software engineering processes, practices, and principles outlined in Sommerville (2016) to design and implement a prototype tool. The tool addresses the problems identified in sections 2 and 3; and reduces neonatal loss and mortality rate during childbirth. Specifically, the change-driven software development process model (Breu, 2010; Bergmann et al., 2012) was adopted. This model includes gathering the targeted user's requirements (Pregnant women and

Figure 1. Context Diagram



obstetricians), analysis, design specification, and implementation. Figure 1 shows the context diagram upon which the approach in the chapter relied on.

As Figure 1 describes, the Admin interacts with the web app. The Admin validates the obstetrician's credentials and grants the obstetrician access into the system after registration. The pregnant woman books appointment with an obstetrician via the app. After this, a notification is sent to the obstetrician, then later sent back to the pregnant woman upon confirmation or appointment decline. The data are saved in a database hosted via an online web server. The app accesses it through an application programming interface.

In the chapter, two (2) qualitative research methods were used to gather the ANC system's requirements (data). These include a face-to-face oral interview with both pregnant women and obstetricians and a brainstorming session with only the obstetricians. The pregnant women and obstetricians were purposively selected for the study as the primary respondents. However, the authors inspected relevant literature and books to understand ANC's process as the secondary data source. A brainstorming session is a fantastic group working technique where the authors engage obstetricians to exchange ideas, generate new ideas, and form a new combination of ideas (Sommerville, 2016; Kendall and Kendall, 2011; Satzinger et al., 2011; Shelly and Rosenblatt, 2010) on how to make the design specification better. The second author (being a consultant obstetrician) facilitated the brainstorming session via Skype meeting with other obstetricians who are not in the study location. In all, twelve (12) obstetricians were involved in the brainstorming session. The brainstorming session's goal was to gather as many responses as possible from the experts (obstetricians).

Data Collection and Analysis

Data collected and analyzed for the chapter were drawn from the initially targeted users. They are in the Ile-Ife community, Nigeria. The users include pregnant women within the gestation period of 1-38

Table 1. The Summary of Participant Socio-demography

Variables	Numbers	Percent (%)
Age of women in Years		
16-20	5	7.3
21-25	24	35.3
26-30	23	33.8
31-35	10	14.7
36-40	6	8.8
Religion		
Christianity	43	63.2
Islam	23	33.8
Other	2	3
Highest Grade Completed		
Primary	15	22.1
Secondary	12	17.6
Medium level	3	4.4
University	38	56
Occupation		
Student	30	
Worker/Businesswoman	34	
Housewife	4	
Average Monthly Income		
10k - 50k	16	25
50k-200k	38	55.8
200k-500k	10	14.7

months and obstetricians with years of experience, two (2) years and above. The overall data were collected from sixty-eight (68) respondents with five (5) pregnant women between the ages of 16-20; nineteen (19) pregnant women between the ages of 21-25; eighteen (18) pregnant women between the ages of 26-30; seven (7) pregnant women between the ages of 31-35; six (6) pregnant women between the ages of 36-40; and thirteen (13) obstetricians, out of which five (5) of them had over five (5) years experience. The other eight (8) had between 2 to 5 years of experience. Table 1 shows the participants' socio-demographic summary.

During this course, the data were collected using face-to-face interview sessions with some pregnant women and obstetricians, getting their views on how beneficial the system would be as compared to the current method they adopt. In the interview conducted for the pregnant women, questions about their health status, cultural backgrounds, professional activities, economic status, and physical activities were asked. Moreover, as for the obstetricians, questions regarding their daily work schedule and the hospitals' status quo in addressing ANC and antenatal checklist were asked. The information gathered provided insight into respondents' viewpoints on how ICT can be used to improve ANC holistically.

Table 2. The outcome of the T-distribution test

T-test Analysis			
Sample (i)	X	$X_i - X'$	$(X_i - X')^2$
1	92.8	-3.23	10.4329
2	89.1	-6.93	48.0249
3	99.8	3.77	14.2129
4	92.5	-3.53	12.4609
5	98.7	2.67	7.1289
6	99.5	3.47	12.0409
7	98.9	2.87	8.2369
8	96.8	0.77	0.5929
9	97	0.97	0.9409
10	95.2	-0.83	0.6889
	960.3		**114.761**

To further establish the relevance of ICT towards improving the ANC, the following null hypothesis H_0 and alternative hypothesis H_1 were formulated. The hypothesis (H_0 and H_1) were subjected to a statistical test to verify their validity or otherwise. The hypotheses are stated as follow;

H_0: *ICT cannot be used to improve the ANC.*
H_1: *ICT can be used to improve the ANC, thereby reducing maternal and neonatal death cases.*

To test H_0, ten (10) selected users with significant ICT backgrounds among the participants in Table 1 were selected and asked a few questions. These questions were designed correctly to capture the individual's opinions on the possible use of any ICT-driven application towards ANC improvements. This is important to determine whether people will accept the proposed ICT-based solutions. The responses received were documented adequately for computation and analysis. The average percentages of each response were computed and applied appropriately to test H_0.

By adopting *t-distribution* test techniques at α=0.05 the t value was obtained to be 3.57. From the standard t-table for 10 degrees of freedom, it is straightforward to observe that the null hypothesis is rejected if the calculated t value is greater than the critical value of t that is, t>2.228.

Since the obtained *t* value is greater than the critical value of *t* the authors rejected the null hypothesis, which states *ICT cannot be used to improve the ANC*. The details of the *t-distribution* test carried out are shown in Table 2, where X is defined as the average rating from each respondent $i \in \{1 \ldots 10\}$. Similarly, mean X' was computed to be 96.03 while the postulated mean μX was selected to be 92.

Based on the outcome of the presented analysis, it is clear that ICT can be used to improve ANC. This forms the basis of the design presented in the remaining part of this chapter.

Design Specification

During this phase, proper analysis of the data was carried out and transformed into graphic designs to depict the users' expectations. The analysis was done to ensure users' needs and expectations are captured and reflected at every step in the design process. The design was achieved using Umbrello and Star Unified Modelling Language (StarUML) tools to describe the relationship between the users and the system operations. Tables 3 show the system's functional requirements, including a user authentication system before granting full access.

Table 3. Functional requirements

S/N	Specification
1.	For authentication purposes, a username and password should be used.
2.	An administrative site should be available to monitor all the system's operations. They would also present and have an agreement document in the form of MOU/legal consent involving the Obstetricians, pregnant women, and Admin.
3	The database should be designed and implemented to store data efficiently.
4.	There should be a search operation to support and enhance data indexing and course plot technology.
5.	Users of the system can register as either obstetricians or pregnant women. Pregnant women are given access to update their profiles. The obstetricians upload their credentials, certifications and wait to be validated by the Admin.
6.	Registered users are authenticated into the system and given access based on their registration.
7.	Users registered as pregnant women can decide to search and schedule appointments with obstetricians based on their choice. This could also be vice-versa. However, it is the choice of the pregnant woman to give consent.
8.	The system also imbibes a test checklist functionalities for a pregnant woman under treatment; after every necessary test, the obstetrician checks it, and the pregnant woman is carried along.
9.	The system administrator can validate an obstetrician before being granted access to the system. The system administrator can also add, update, and delete an obstetrician or a pregnant woman.

Figure 2 shows the use case diagram, which specifies the system's functional requirements and corrects them as they are reviewed. The use case diagram, in this context, describes the set of actions (use cases) that a system should or can perform in connection with one or more external users (actors) of the system. The three-tier architecture diagram in Figure 3 was used to specify the system architectural structure for the Admin dashboard. Notably, Figure 3 comprises a standard Graphical User Interface (GUI) that can be previewed on a web browser application to access the functionality of the system applications. The browser transmits the user's request to the web server, sending the request using the HTTP protocol. The MySQL database server is specified at the data tier layer to handle the database application. MySQL can be accessed through Django, a python framework used for server-side coding. Finally, the webserver with the possible returns from the database server is meant to generate the HTML pages returned to the user. The Model View View Model (MVVM) architecture was used for the mobile system architecture, as shown in Figure 4, to separate the model class's business logic and views. This would enable efficient code testability and maintainability. Figure 5 further depicts the block diagram showing all the system's principal parts represented by blocks– and connected with lines– to establish individual blocks' relationships.

Figure 2. Use Case Diagram of the mHealth System

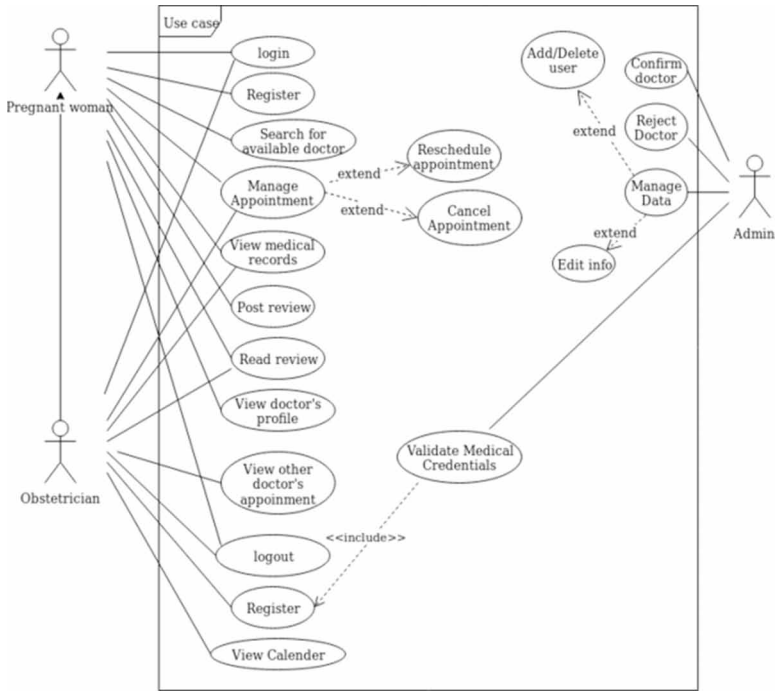


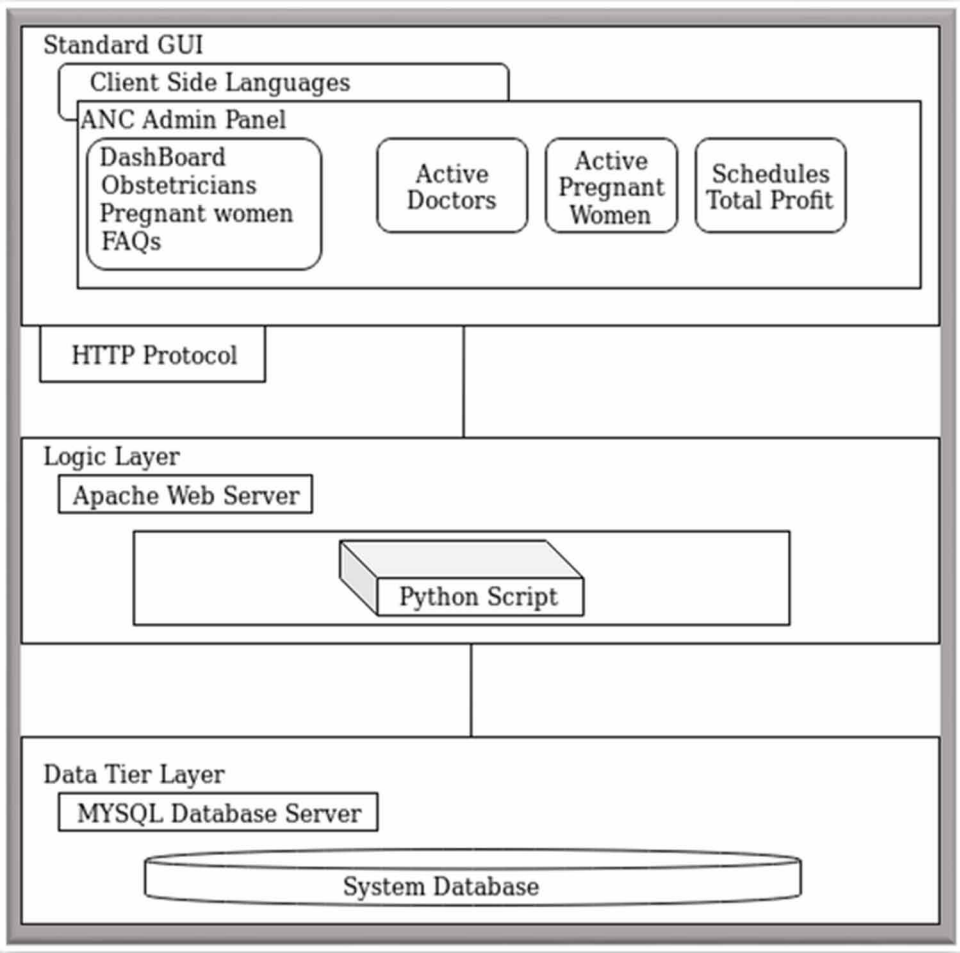
Figure 6 represents the class diagram. It identifies the different classes of the system activities wherewith their relationships are defined. The class names, methods, and attributes of the system's classes and their relationship are identified. Specifically, the system contains the user superclass, which has an obstetrician, an admin, and a pregnant woman as its child class. On the one hand, the pregnant woman class is associated with the review class by one-to-many relationships.

On the other hand, the obstetrician class is associated with the credential class (many-to-many relationships), withdrawal class (one-to-many relationships), and appointments class (many-to-many relationships). The Admin class is related to the credential class via a many-to-a-one relationship. Also, the notification class is an interface class of the parent-class user, so all the child classes of user– Admin, obstetrician, and pregnant woman class– can implement the methods in that class. Only the pregnant woman and obstetrician class is associated with the medical history class. The medical history class methods are private and protected because the information is not visible to any class within or outside the package. The medical history class can only be made public to the obstetrician class if granted access by the pregnant woman.

In Figure 7, the activity diagram was used to show the activity flows performed on the system. The diagram captures the system's dynamic behavior, using various forward and reverse engineering techniques. Upon user registration, the system requests to know if the user is a pregnant woman or an obstetrician. If the user is an obstetrician, it requests their medical credentials be sent to the Admin to validate. Moreover, after validating, the user is granted access.

On the contrary, if not validated, they end the registration process. The pregnant woman is granted access immediately after registering without any Admin confirmation. Hence, she searches for an obstetrician close to her. Suppose the pregnant woman finds an obstetrician and feels comfortable with the

Figure 3. Admin Dashboard System Architecture

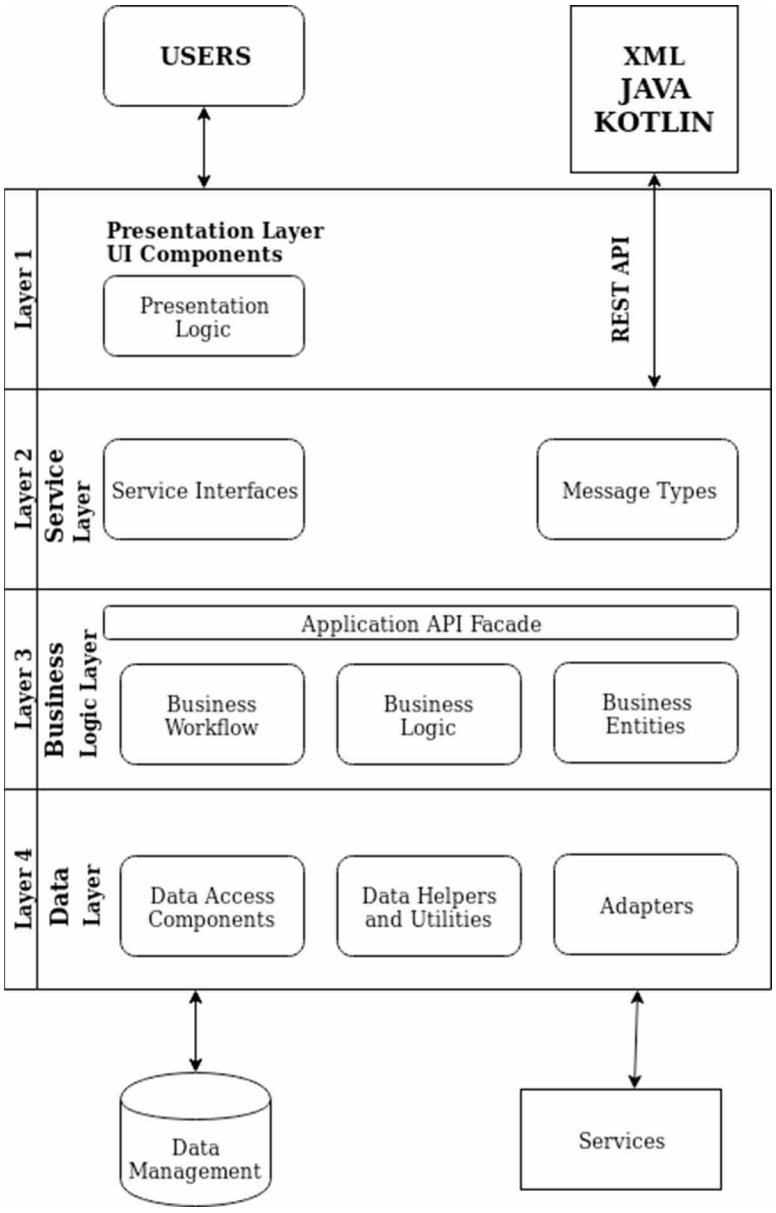


services and reviews. In that case, she books an appointment, then waits to be confirmed or declined by the obstetrician. However, suppose she does not find an obstetrician. In that case, she can report to the Admin, who would pair her up with an obstetrician available to see her. After confirmation by the obstetrician, the two users can receive reminder notifications regarding scheduled meetings not to forget. Visitation and checkups occur, after which the pregnant woman grants the obstetrician access to update her medical record. She writes reviews, confirms she is satisfied, and then makes payments that the system withholds and does not send to the obstetrician until the job is completed.

SYSTEM IMPLEMENTATION

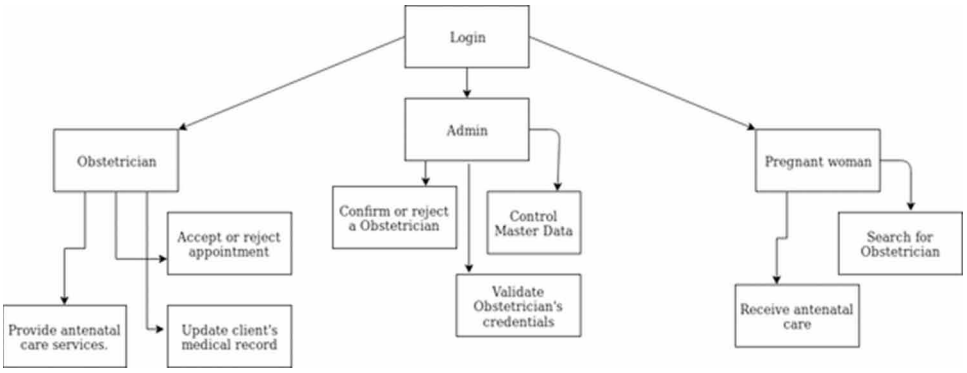
The implementation of the system was achieved using the necessary web technologies for the admin panel: Hypertext Markup Language (HTML), Cascaded Style Sheet (CSS), Javascript, and BootStrap. Django was used for the client-side. MySQL was used for the database. Java and Kotlin were used for the Android app. Alpha and Beta testing techniques were used to test the system involving the users in

Figure 4. Mobile System Architecture



the process. The Mobile application was implemented on a 64-bit Windows 10 Pro Operating System (OS) with an Intel(R) Core™ i7-2670QM CPU @ 2.20 GHz processor and 12GB RAM. The development took about six (6) months to complete, and the length of the pilot implementation was about three (3) months. The authors ensured a user-friendly interface that both the obstetrician and pregnant woman can use. Figures 8 to 18 show the various functionalities of the system, as explained below:

Figure 5. Block Diagram of the mHealth ANC System



- Figure 8 shows the login screen where either of the users can log in. The doctor can have access to their dashboard only if validated by the administrator. The pregnant woman can also login immediately after registration. The users can recover their passwords if forgotten by clicking the forgot password and then providing valid emails. The recovery password code is sent to their emails.
- Figure 9 shows the registration page, which is unique to the pregnant woman and the doctor. Both users must fill in their email, name, address, state, and password. In contrast, the doctor(s) must fill in their specialization and work details.
- Figure 10 shows the pregnant woman's dashboard, where she can search for doctors based on her location, and she can then see various doctors close to her.

Figure 6. Class Diagram of the mHealth ANC System

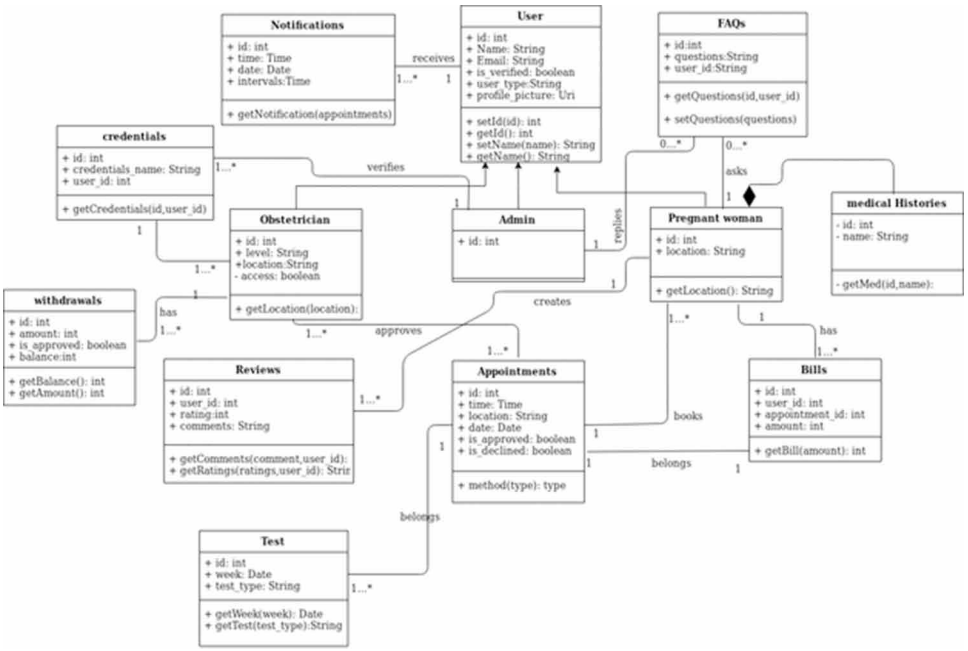
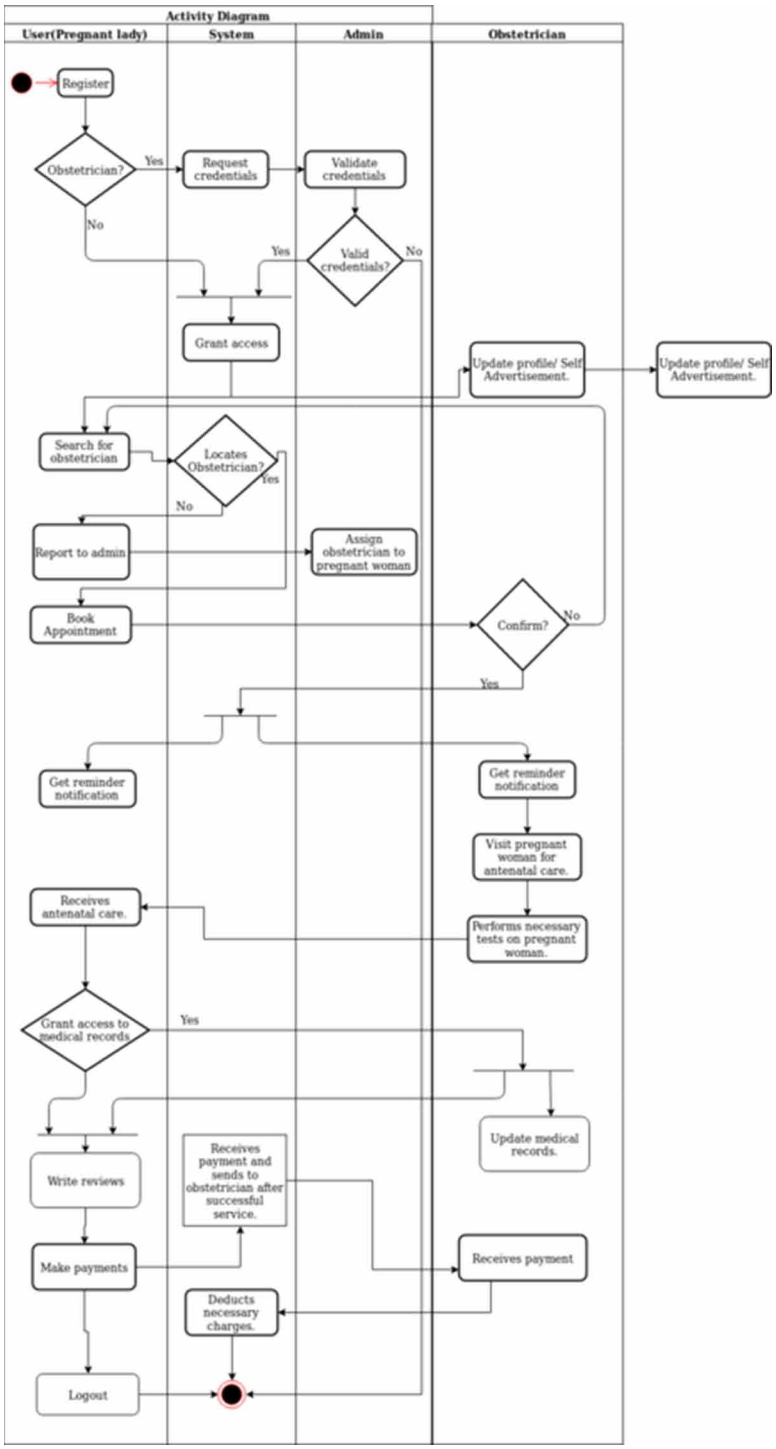


Figure 7. Activity Diagram of the mHealth System



- Figure 11 shows the search result list of obstetricians in a pregnant woman's particular location. The pregnant woman can filter the results as she wants; she might only want a female or male

obstetrician. Whatever filtering tag is used, the search list responds based on that.

- Figure 12 shows the obstetrician's profile page. The pregnant woman can see details about the obstetrician they want to schedule an appointment with on this page. They can read previous women's reviews on obstetrician-customer satisfaction.
- Figure 13 shows the scheduled appointment page after the pregnant woman decides on her choice of an obstetrician. She can then book an appointment with the obstetrician by selecting the desired date, which can be any of the available times of her choice. Again, she can enter the address she wants the obstetrician to visit her. She can also fix a reminder notification on this page. After scheduling an appointment, the system either shows that the appointment is schedule is successful or not. If the appointment is successful, the pregnant woman will then wait for a confirmation message from the obstetrician.
- Figure 14 shows the pregnant woman's profile page. On this page, appointment details are displayed here. The obstetricians can view reviews of pregnant women also to know whether to accept an appointment or not. Nevertheless, the pregnant woman can decide to grant the obstetrician access to view and update her medical records.
- Figure 15 shows the antenatal test checklist to be done at that particular week the pregnant woman is. The obstetrician checks a test if it is successfully carried out. The pregnant woman and the doctor can then keep track of the necessary tests and raise a flag if a test is not done.
- Figure 16 shows the obstetrician dashboard containing an educative post. Any obstetrician can post for other obstetricians to see. So, all obstetricians can view it and comment when any pregnant woman raises an issue.
- Figure 17 shows all the obstetrician appointments, and the appointments can be pending, active, canceled, or done.
- Figure 18 shows the admin dashboard. The Admin has total managerial control over the system; he monitors the system's outgoing and incoming transactions. He most importantly validates an obstetrician before granting him or her access to use the system.

SYSTEM TESTING

The type of test carried out on the system is the unit and beta test. On the one hand, the unit test involves separating different integrated system modules to isolate errors from the codes. The separated modules were integrated and tested as a whole. It was then tested on various devices to ensure its responsiveness is accurate. On the other hand, the beta test measures pregnant women's perception of the prototype tool (Fine, 2002) to understand their system's acceptance level.

The authors used the usability criteria to gather feedback on how well each pregnant woman can use the system regarding what it can do (Hamid and Sarmad, 2010). In particular, the pregnant women were given the prototype tool to interact with while observing their behaviors and reactions. The beta test's goal was to validate the tool, uncover issues with complex flows (if any), elicit further both the pregnant women's neutral and objective opinions, and gain insight into how to make the pregnant women enjoy using the tool. Table 4 shows the pregnant women's responses based on the usability criteria.

Furthermore, the authors recommended using a questionnaire after the beta test to evaluate the test's usability and design (Thomas, 2015). Thus, the questions in Table 5 were administered to preg-

nant women. Also, the system usability scale (SUS) (Thomas, 2015) was used to ask pregnant women whether they agree or disagree with the system. Table 5 reflects each question's percentage response by the sixty-eight (68) pregnant women used to measure the system's usability. With the SUS, the pregnant women selected the answers that best express how they feel about each statement after using the tool.

Figure 8. Login Page

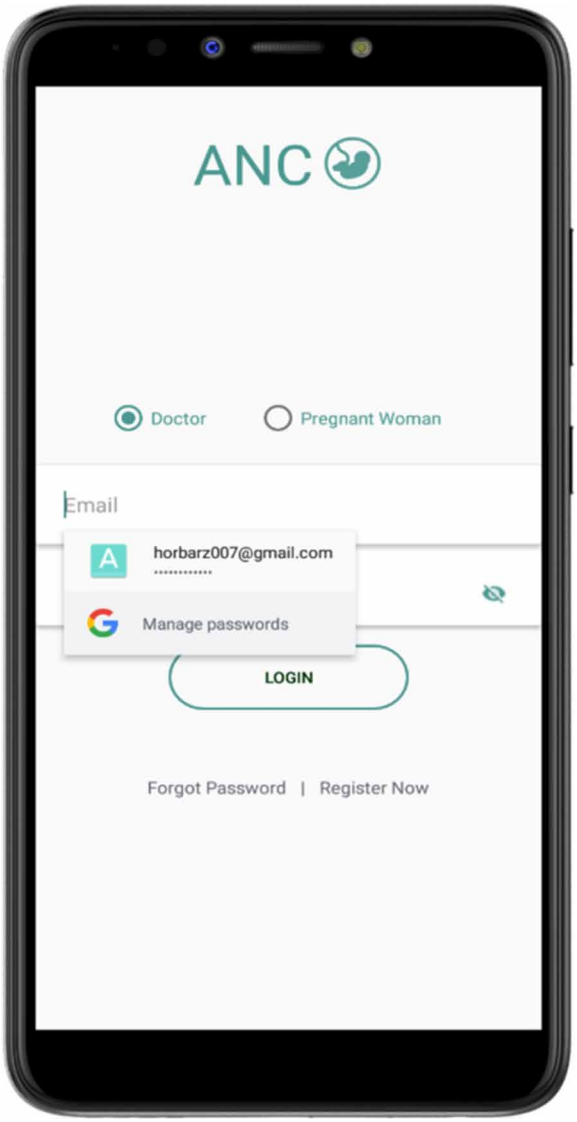
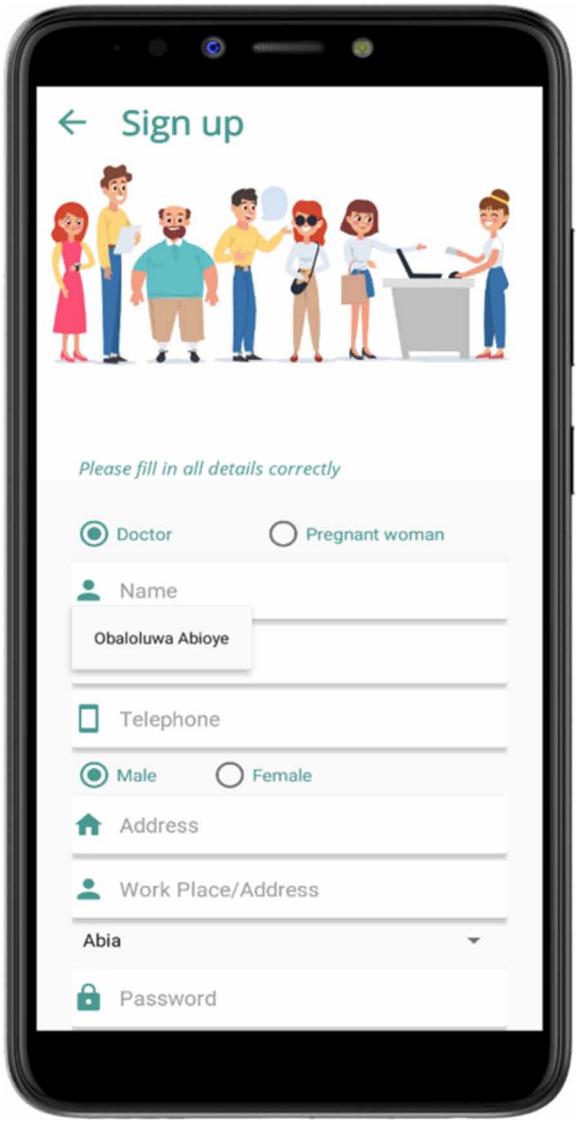


Figure 9. Registration Page

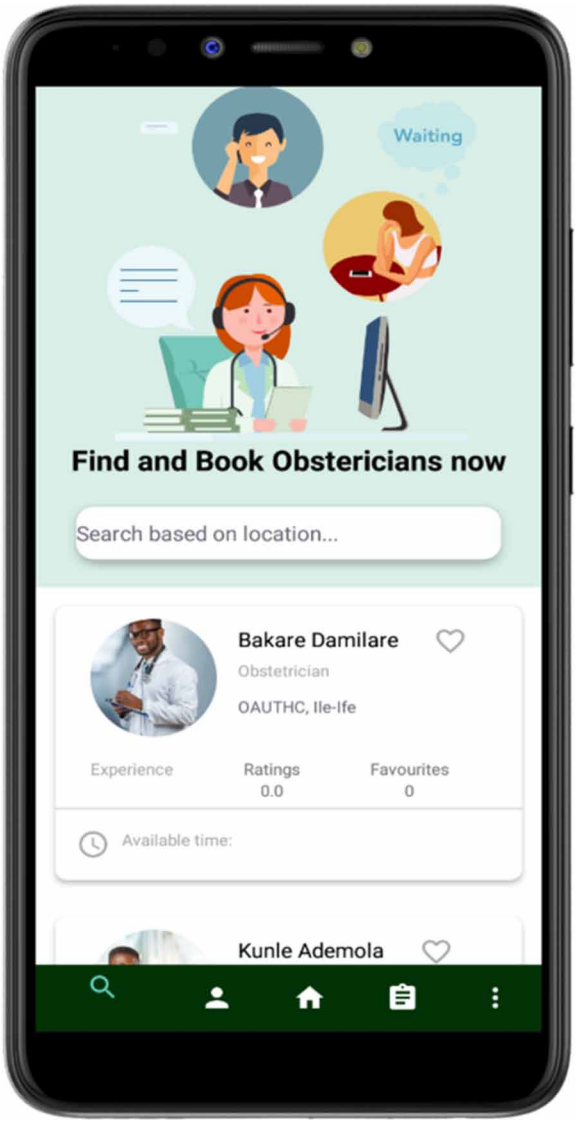


RESULTS AND DISCUSSION

Figures 2 to 7 reflect a robust design specification upon which the prototype tool was implemented. The design specifications gave a logical and functional description of the system, which serves as the basis for quality improvement in software engineering.

Figure 19 shows the system's acceptance, neutrality, and rejection levels as reflected in the sixty-eight (68) pregnant women (see Table 1 and Table 4). The acceptance levels for usability criteria, such as: efficiency, attractiveness, aesthetics, and installation, had the highest acceptance of 100% with 0% rejection and neutral rates. Next is the effectiveness (95.59%), operability (91.18%), satisfaction and

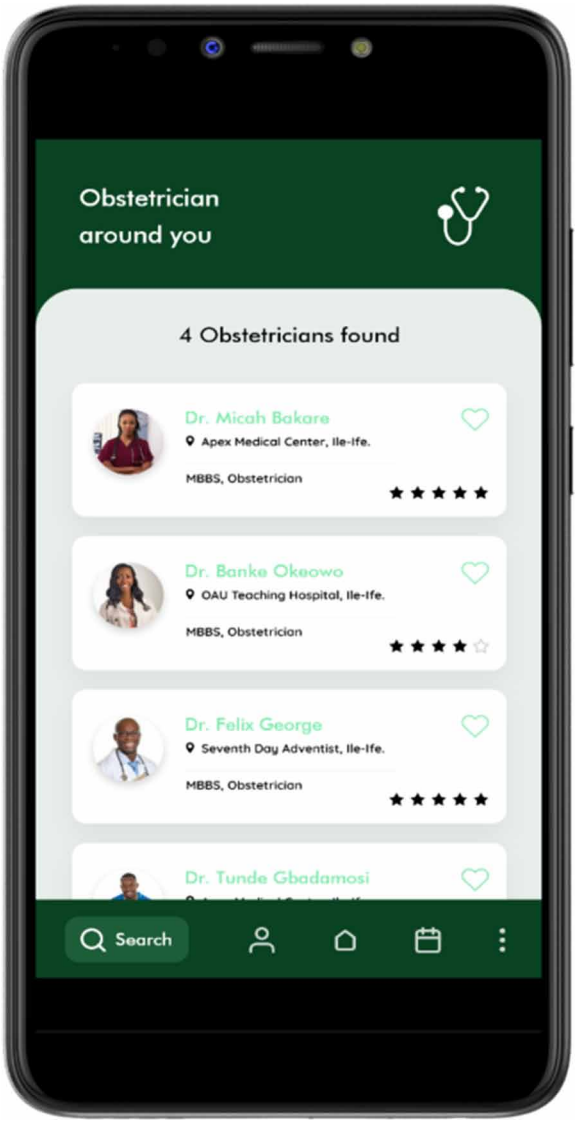
Figure 10. Pregnant Woman Dashboard



task accomplishment (94.12%); learnability and ease of use (88.24%), understandability (73.53%) and errors (17.65%).

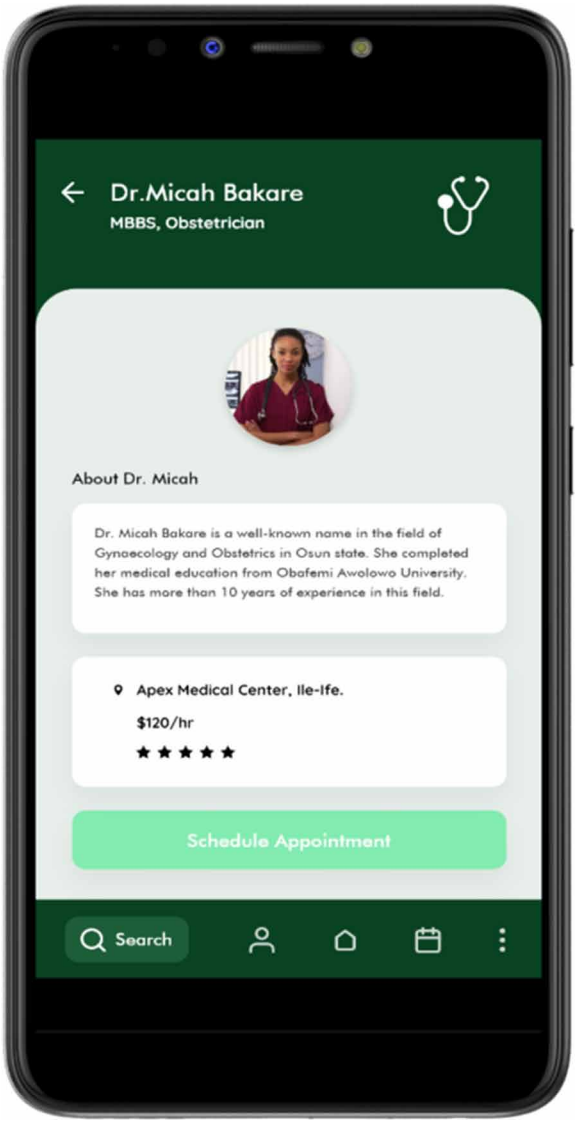
Figure 20 represents the average response percentage for all the usability criteria in a pie chart, indicating the system's evaluation. Overall, the authors discovered that 86.89% appreciated the system and claimed it would benefit them and ease the antenatal process. 9.19% were against it and preferred to visit an obstetrician themselves, claiming they have the time to do so. Noticeably, most of these 9.19% are full housewives, and they are not too busy to tolerate the hospital's waiting time. 3.92% of pregnant women were indifferent about it, claiming it is an excellent system. However, it does not validate that they would use it.

Figure 11. Search Result



After the beta test, the same sixty-eight (68) pregnant women, ages ranging from 16-40 years, were used for the study to evaluate the design's usability. The number 68 suggests an optimal size (Nielsen, 2006) for measuring the system's usability using the SUS (Thomas, 2015). Fortunately, all pregnant women experienced using mobile phones; not all can use personal computers (PC) without someone putting them through. Figure 21 presents each question's percentage response by the 68 pregnant women. 92% of the pregnant women strongly agreed to use the tool frequently, and 90% strongly agreed that they are very confident using the tool. 82% strongly disagree that they found the tool very cumbersome to use. This means that the tool is easy to use and justifies the 88.24% level of acceptance on the ease of use in Table 4 and Figure 19. More so, 88% disagree with the tool's existence of errors. Overall, pregnant women feel and agree that the system is timely addressing their antenatal needs.

Figure 12. Obstetrician Profile Page



Suffice it to say, the authors are optimistic that the proposed system will solve a significant health problem among pregnant women, especially those that are too busy to go through the stress of a regular appointment with an obstetrician in the hospital. Besides, it caters to their care directly and effectively. Previous methods have always been to get registered in the hospital and get appointments manually, which has resulted in delayed service. However, the approach in this chapter will save time and is less stressful for pregnant women. Compared with the conventional queuing method, the tool significantly increases user satisfaction. It reduces the total waiting time for ANC and medical checkups (Nazia and Ekta, 2014). In a similar vein, the tool serves as an intermediary between obstetricians close to pregnant women. Therefore, it can be used to conquer or reduce maternal and neonatal death cases almost wholly.

Figure 13. Schedule Appointment Page

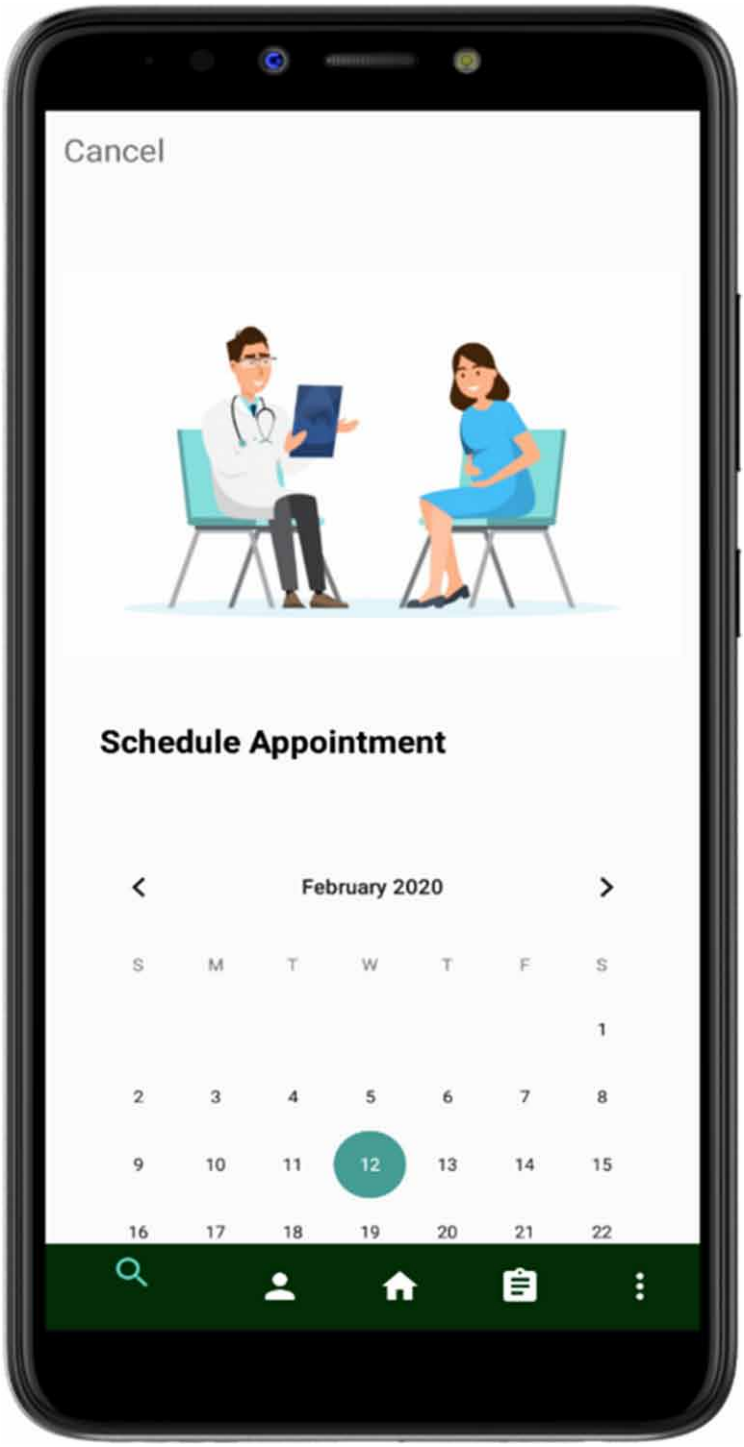


Figure 14. Pregnant Woman Profile Page

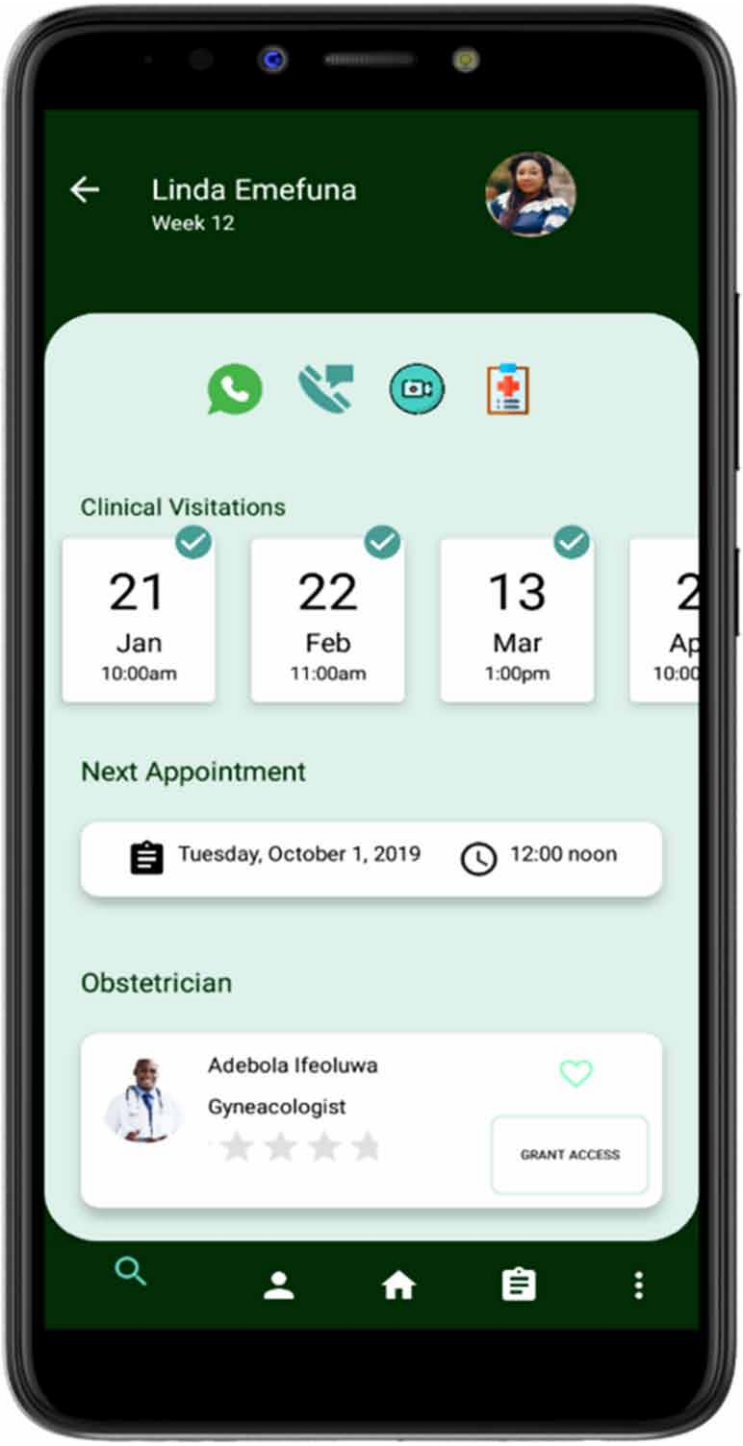


Figure 15. Antenatal Test Checklist Page

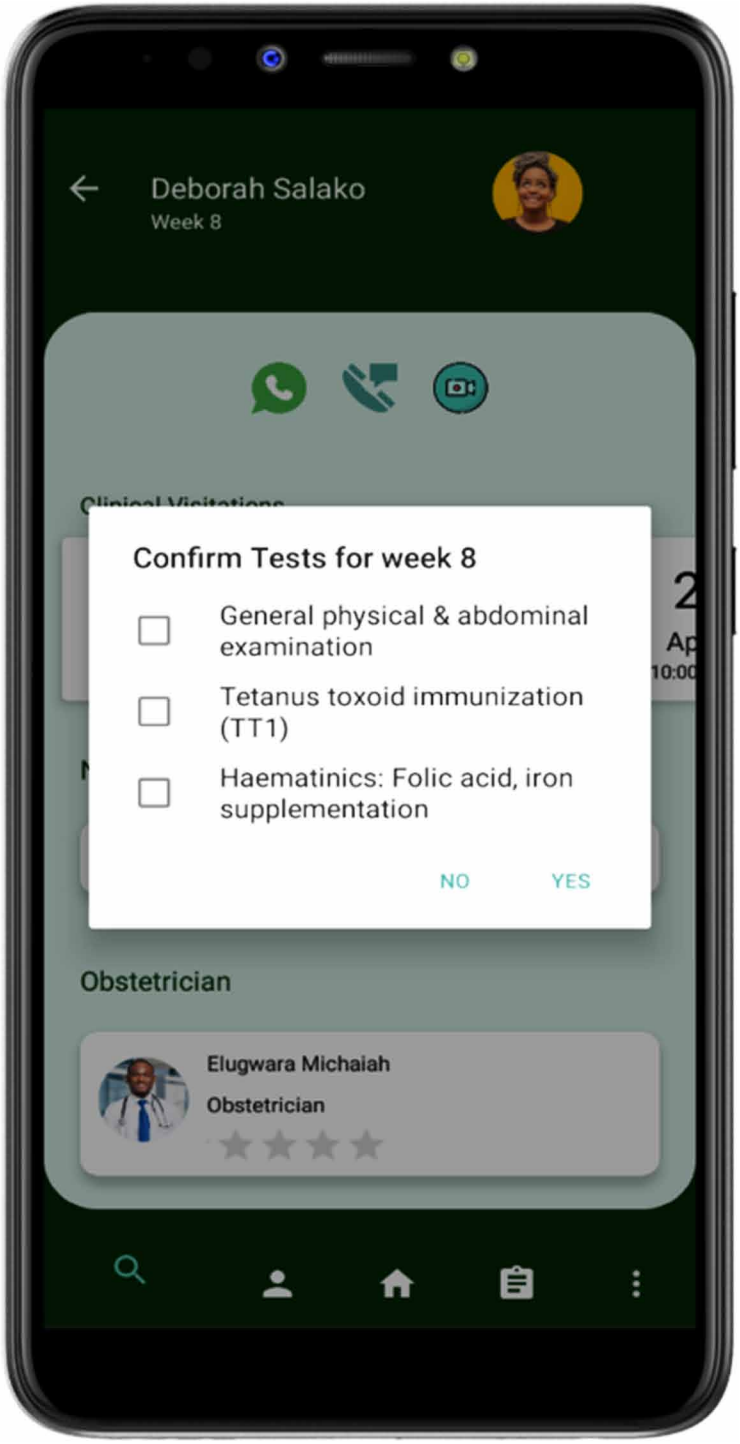


Figure 16. Obstetrician Dashboard

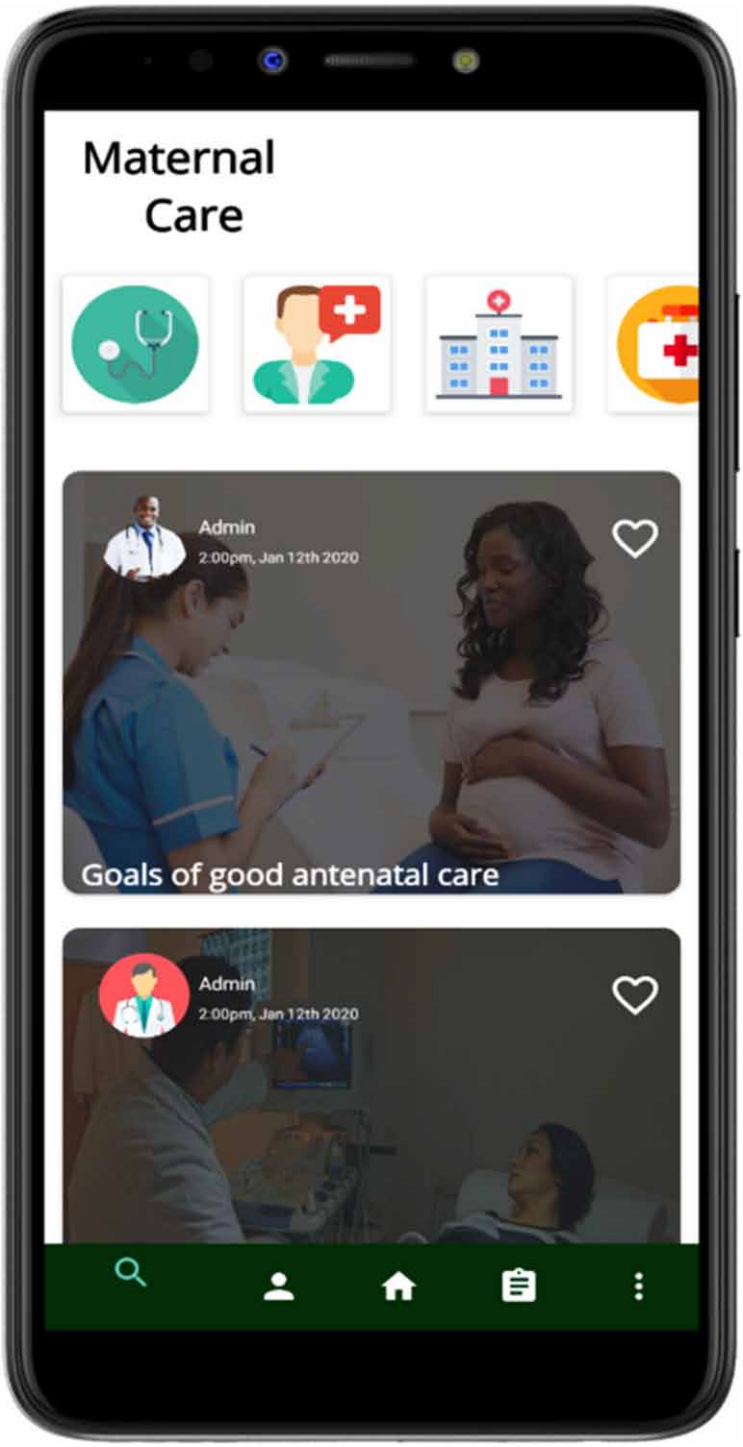
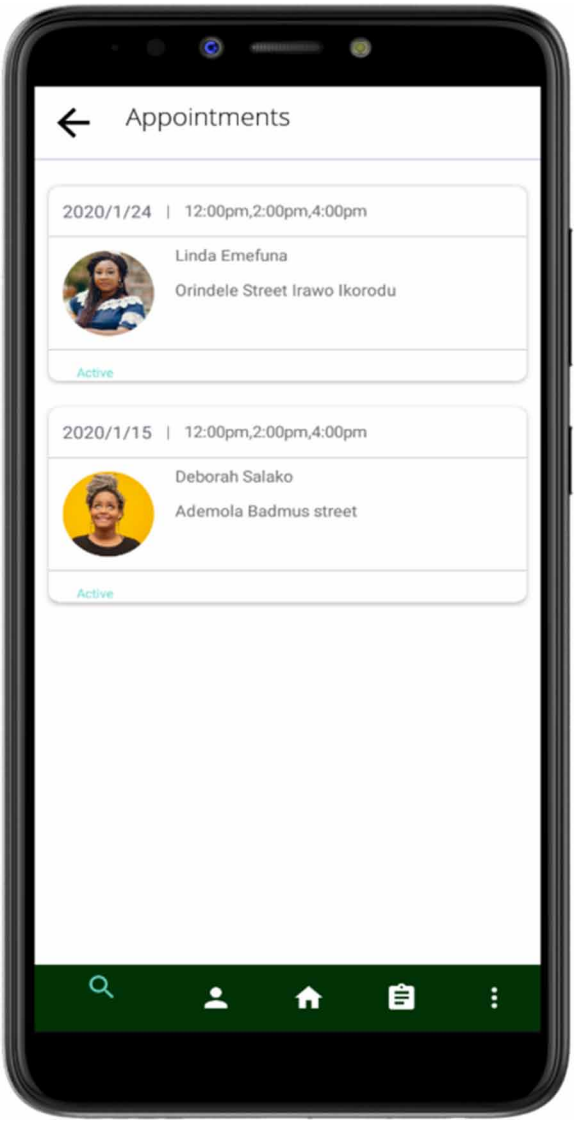


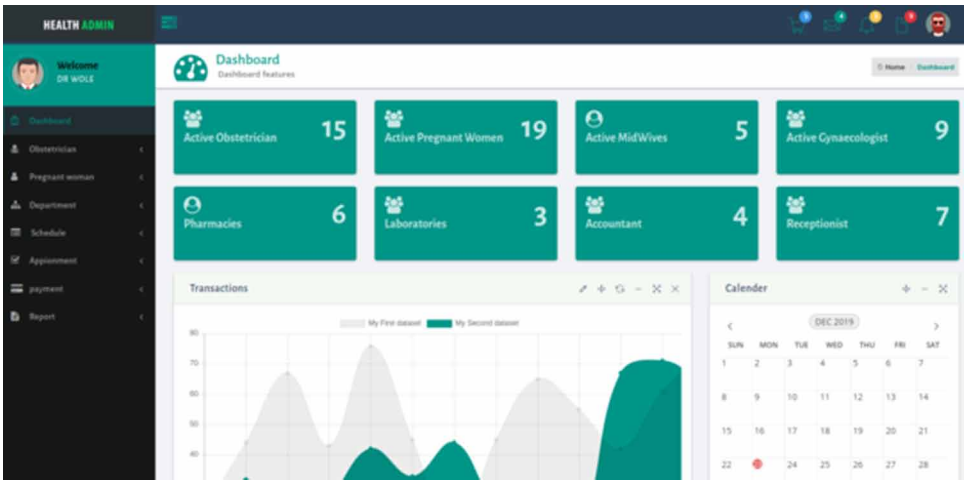
Figure 17. Obstetrician Appointments Page



LIMITATIONS AND THREATS TO VALIDITY

Several limitations exist for this study. Firstly, at the time of requirements elicitation, it was difficult to gain the full attention of the pregnant women at their place of work for the face-to-face interview. While some pregnant women saw it as a time waste, others showed not being interested due to personal reasons, lack of motivation to use technology, and need for training or guidance to use the tool. On the other hand, some pregnant women express feelings about the security and privacy of the information they were asked to give and that of the application. Remarkably, security and privacy issues are legal and regulatory barriers common to adopting new technology, especially in the healthcare domain (Garrett et al., 2006).

Figure 18. Admin Dashboard Page



Other barriers include the cost of implementation and acquiring infrastructure, time, fear, usefulness, and complexity (Lawton & Parker, 2002; Ash et al., 2004; Gans et al., 2005; Gleiss & Lewandowski, 2021). Furthermore, not all the pregnant women's experiences and expectations were captured in the design because some of their expectations are psychologically inclined, requiring the application of psychological theories and expertise for implementation. However, we left the psychological aspects for future work.

Table 4. Pregnant women response to the prototype tool

Usability criteria	Acceptance		Neutral		Rejection	
	Response	Percentage	Response	Percentage	Response	Percentage
Effectiveness	65	95.59	2	2.94	1	1.47
Learnability	60	88.24	4	5.88	4	5.88
Satisfaction	64	94.12	4	5.88	0	0.00
Efficiency	68	100.00	0	0.00	0	0.00
Understandability	50	73.53	10	14.71	8	11.76
Errors	12	17.65	2	2.94	54	79.41
Aesthetics	68	100.00	0	0.00	0	0.00
Attractiveness	68	100.00	0	0.00	0	0.00
Operability	62	91.18	6	8.82	0	0.00
Ease of use	60	88.24	4	5.88	4	5.88
Installation	68	100.00	0	0.00	0	0.00
Task accomplishment	64	94.12	0	0.00	4	5.88
Average percentage	**86.89%**		**3.92%**		**9.19%**	

Number of participants N = 68

Table 5. Questions and SUS for measuring the usability of the system

SN	Questions	Strongly Disagree	Neutral	Strongly Agree
1.	I think I would like to use this tool frequently.	2%	6%	92%
2.	I find the tool unnecessarily complicated.	80%	14%	6%
3.	I think the tool is easy to use.	5%	15%	80%
4.	I think that I would need the support of a technical person to use this system.	8%	13%	79%
5.	I find the various functions in this tool well-integrated.	2%	14%	84%
6.	I think there is too much inconsistency in this tool.	82	11%	7%
7.	I imagine that most people would learn to use this tool very quickly.	5%	8%	87%
8.	I find the tool very cumbersome to use.	82%	10%	8%
9.	I feel very confident using the tool.	3%	7%	90%
10.	I need to learn many things before I can get going with this tool.	8%	12%	80%
11.	I find many errors in this tool.	88%	8%	4%

Secondly, at the brainstorming session via Skype with the obstetrician, it was challenging to get them motivated because there was no incentive for them, and they are required to use their internet subscription and access. Consequently, it was impossible to have them stay until the end to deliberate further on making the application more robust than the current implementation. However, we envisage that adequate funding is required to mitigate the lack of motivation. Additionally, the obstetrician expressed the need to have a chaperon to attend to the pregnant women promptly. With the current implementation, it takes time to get a chaperon to examine the pregnant women at their convenience. Again, this became an archived idea that should be considered for future improvement.

As for the threats to validity, the presentation and acceptance of the prototype tool is an internal threat to validity. The prototype tool was demonstrated to both pregnant women and obstetricians to mitigate this threat. We showcased the tool's ease of use and flexibility to justify the importance of us-

Figure 19. Analysis of Beta Test Showing Levels of Acceptance, Neutral and Rejection

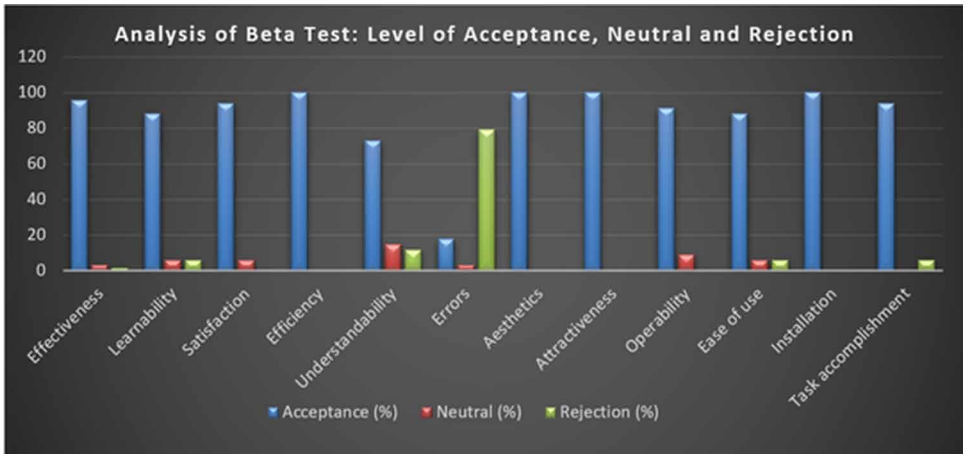


Figure 20. Pie Chart Showing the Evaluation of the System

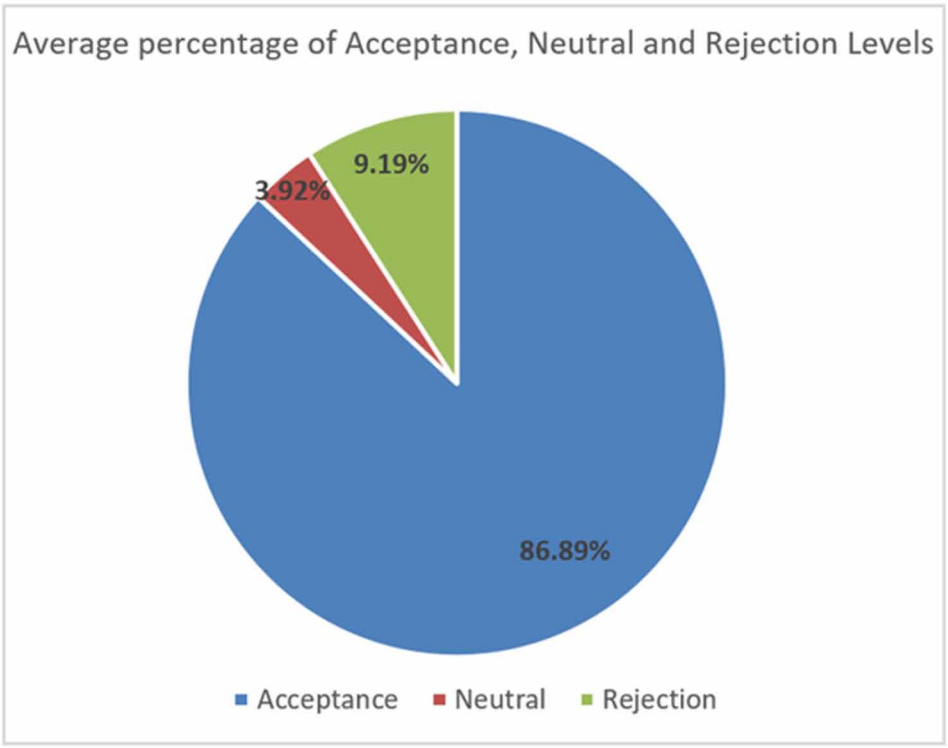
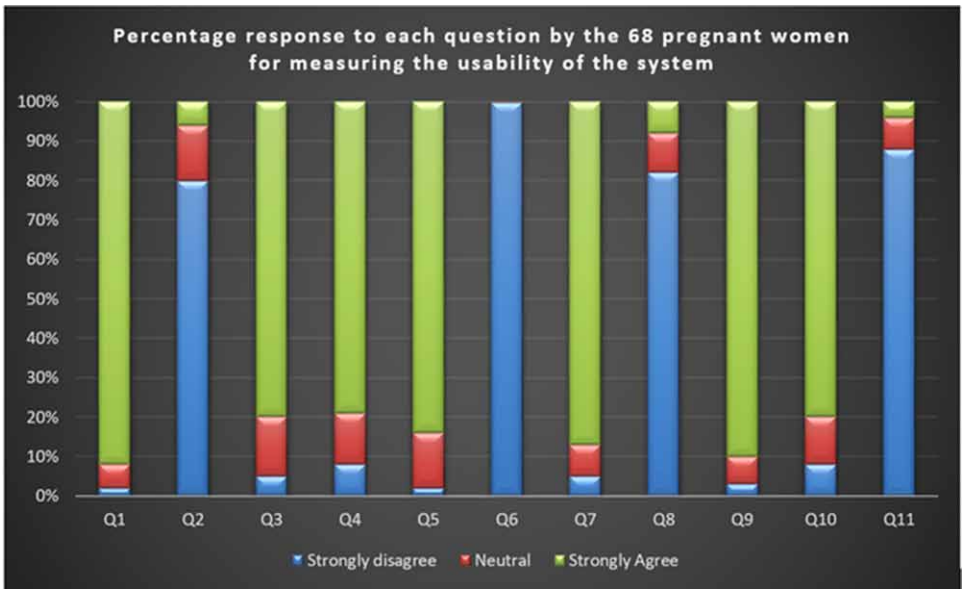


Figure 21. Percentage Response of Pregnant Women Feel About Each Question After Using the Tool



ing *m*health solutions for improving ANC. Since both pregnant women and obstetricians are receptive to using technology to enhance the quality of service and delivery in ANC, they expressed confidence in accepting to use the tool.

Despite the limitations, however, it is worth mentioning that the COVID 19 pandemic outbreak made more pregnant women embrace the mobile app due to fear of coming to the hospital, which stands out as a significant strength of this work.

FUTURE WORK

The research is still open for further studies and modifications to increase its robustness and improve the quality of care given to pregnant women. Therefore, the authors suggest the need: (i) to predict possible pregnancy risks from health records, and (ii) for health data analytics on pregnant women's health records. Additionally, a model that supports pregnant women not using smartphones to access this technology is essential. Nonetheless, building a supporting diagnostic system for obstetricians is inevitable.

In the immediate, we plan to set up a technical team and secure funding as a future step to scale up the project implementation. The goal is to improve the stability of the present solution to engender an excellent user experience for both pregnant women and obstetricians in the use of *m*health solutions for ANC. With the emergence of technical teams and adequate funds, new training and communication alternatives can be identified and organized. Also, new deployment strategies can be ensured for a more effective and successful appropriation of the *m*health solution for ANC. Overall, the technical team will ensure that the *m*health solution positively transforms the process of ANC, thereby reducing maternal and neonatal death cases.

CONCLUSION

The chapter proposed an optimized method where pregnant women can access obstetricians from any hospital or health-related organizations close to them for a personal checkup. There is no need to revisit the hospital until when necessary or if recommended. Detail history, examinations, and investigations will be made without necessarily visiting the hospital. In this wise, the authors developed a system that links pregnant women and obstetricians and does not include other patients with health-related issues. Also, an Android application was developed to affording expectant mothers easy access to obstetricians near them or based on choice with the functionality of scheduling appointments alongside health personnel ready to attend to them based on preset availability and acknowledged location. There is no need to visit the hospital throughout the gestation period unless strictly needed or during delivery or surgery (caesarian section). The mobile application keeps track of the necessary tests and checkups to be carried out throughout ANC. This reminds the expectant mother and the health personnel when a test has not been carried out. Medical records of the woman's health are collected and stored on the app.

Furthermore, the system enables pregnant women to schedule appointments with obstetricians close to them. Also, the authors provided a flexible system that equates pregnant women to outpatients and provides an avenue for them to get medical attention outside the hospital facilities. By this, the obstetricians can see a pregnant woman either at home or in the office.

The strategy in this chapter also harnesses course-plotting technology to determine the most suitable obstetrician based on proximity and route with Google Map's aid. It also provides a community of obstetricians with enough information to aid and enhance the service they offer. Therefore, they can share thoughts on situations and jointly resolve patients' issues.

Disclosure Statement

The authors reported no potential conflict of interest.

Funding

Any organization or institution did not support this research. The research was self-sponsored.

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Chapter 4
Going Online!
A New Model for Telepsychology Considering Adjustments for Online Clinical Interventions

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ABSTRACT

The use of technology in healthcare became a prevailing necessity during the COVID-19 pandemic. The sanitary services oriented in mental health broadened their way of interaction due to the increase in the need for these services. Healthcare professionals had to develop different learning skills and adapt their abilities to the virtual clinical practice through a digital interface, where communication represented the biggest challenge. The objective of the study was to identify the different adjustments, especially in the communication skills, made by those who provide psychological services by the Virtual Clinic in Psychology and others and clinical psychologists. The authors considered adequate qualitative methodology for the study with an exploratory, descriptive design. The data gathering tool was a semi-structured interview and the word analysis method. The participants are professors that provide psychological care in the Virtual Clinic in Psychology of a nonprofit institution of higher education in Mexico and professionals providing mental health attention.

DOI: 10.4018/978-1-7998-8783-6.ch004

INTRODUCTION

Technology-mediated psychological care was one of the mental health services that increased significantly during the COVID-19 pandemic, two fundamental elements generated this increase, on the one hand, the restriction of face-to-face encounters indicated that using telepsychology was the only way to access this care and on the other hand the increase of adverse reactions to mental health as an effect of the feelings of uncertainty and fear generated by the news of the pandemic. It is important to differentiate social distancing, proposed by health authorities as a protection strategy, with social isolation, which is the separation of a human being from a social reference group. For Argüero-Fonseca and collaborators (2021) the lack of interaction of the person with the environment (social and physical) prevents psychological restoration, i.e. recovery from the cognitive and emotional wear of daily stresses is not generated.

Mental health professionals who maintained their clinical practice had to migrate to online care, with or without previous training, making the necessary technical and methodological adjustments to offer psychological care mediated by technology or telepsychology. In this sense, it is relevant to identify the adaptation that mental health professionals made in their clinical practice to provide virtual care and which communication and interaction strategies with their patients they consider the most efficient.

The model of interaction in telepsychology proposed in this chapter was developed with the work experience of the authors in the Virtual Psychology Clinic and with the analysis of the experiences of the mental health professionals who participated in this study, which were expressed in the questionnaire and in the interviews conducted, which are presented in the results section.

BACKGROUND

Pre-pandemic Online Psychotherapy

Telepsychology is defined as the provision of psychological services using telecommunications technologies for patient-therapist interaction (Committee on National Security Systems, 2010; American Psychological Association, 2013). This interaction and transmission of information can be oral and written, accompanied by images, sounds, or other types of data. It is also indicated that communication can be synchronous (interactive videoconference, telephone call) or asynchronous (email or text message). Since its beginnings, it has been evolving considering three fundamental factors: ease and speed of communication, reduction of transmission costs, and acceptance of the Internet as a social communication tool (De la Torre & Pardo, 2018).

In 2015 more than 40% of the world's population had access to the internet (De la Torre & Pardo, 2018; UCLA Internet report, 2018), with the arrival of the internet to homes a new way of interpersonal communication was integrated and given this scenario also increased the potential to offer new modalities of psychotherapy (Marcías & Valero, 2018). According to Godleski et al. (2008) in 2007, there were more than 40,000 visits to services related to mental health online.

Internet-mediated psychotherapy is recognized by the terms e-therapy, cybertherapy, e-health, online therapy, telehealth, and telepsychology (Barak, Klein & Proudfoot, 2009). It is a type of telehealth that can be offered to patients or clients, there is no doubt that it is currently a necessary therapeutic modality and that more and more professionals in the health field are using new technologies to offer

Table 1. Differences between face-to-face psychotherapy care and telepsychology

	Face-to-face psychotherapy care	Telepsychology
Personal data interaction	During the first appointment	Before the first appointment
Setting	Physical space	Virtual space (videoconferencing platforms)
Social environment	Neutral, the consultation setting is considered neutral for the patient.	The patient is in a public space or family space.
Confidentiality framework	Implicit in the use of an office isolated from interruptions.	The patient must be provided with the space without interruptions. The patient is in a public space or family space.
Use of technology	Sporadic only on a supplemental basis	Integrated all the time as a means of interaction The patient is in a public space, or family space.

their services through e-mail messages, telephone calls or video calls to provide a complementary or additional service to the face-to-face one.

De la Torre and Pardo (2018) identify telepsychology as complementary to face-to-face psychological care in psychotherapy; however, the increase in the incidence of mental health diagnoses, mainly anxiety disorders and depression, coupled with a growing interest in considering treatments based on new technologies have led to see telepsychology as an option in itself. It is pertinent to highlight some differences as shown in Table 1.

Treatments based on new technologies and telehealth have proven to be useful in improving the efficiency and accessibility of psychotherapy, thereby decreasing costs in mental health care and moving psychological care to different geographic areas (Shafran, et al., 2009). However, the challenges now facing psychotherapists are still in the process of discovery, for example, what types of interventions are most appropriate for this new medium, as well as the delineation of advantages and limitations inherent in this new communication format (Marcías & Valero, 2018).

Telepsychology: A New Approach to Psychotherapy

At the beginning of the COVID-19 pandemic, health authorities indicated that face-to-face interactions should be replaced by online interactions; this adaptation required a substantial economic investment by governments and private initiatives. Likewise, health spending to expand the response capacity was concentrated on medical emergencies; however, several authors stress that investments in psychological assistance should also be implemented in order to contribute to an improvement in the health of the population (Wang et al., 2020; Argüero-Fonseca, et al, 2021).

In the field of clinical psychology, there was a drastic change in the opinion with which mental health professionals evaluated online psychological care, from considering it a complementary method (De la Torre & Pardo, 2018) to being the necessary and sometimes the only method. Evaluating the effectiveness of psychological interventions of different psychotherapeutic modalities and posing the indispensable elements of a technology-mediated psychotherapeutic intervention became a target of analysis in several countries.

In Egypt, a study was conducted on the care of people with a diagnosis of Obsessive-Compulsive Disorder (OCD) applying Online Cognitive Behavioral therapy whose results were positive and showed that technology-mediated communication is an effective means to alleviate symptoms and improve the quality of life of the consultants (Aly, 2017). On the other hand, in Canada, in addition to finding similar results to that of Aly's (2017) study regarding the significant reduction of symptoms in patients, their findings focused on improving the system of care by decreasing the waiting list of patients, increasing the level of compliance of patients in psychotherapy, and increasing the number of people seen (Omrani, et. al., 2017).

Evidence provided by Godzik et al. (2020) underscores the effectiveness of telepsychology in improving sleep quality and decreasing insomnia in older adults in the process of bereavement. Argüero-Fonseca and collaborators (2021) found that among the diversity of studies in telepsychology during the pandemic, those considered as psychotherapy or psychological support were: 1) those aimed at serving health professionals to reduce mental disorders in front-line workers against COVID-19, 2) those offered to the general public, health and government personnel, 3) the use of weekly cognitive behavioral therapy via video call, for the treatment of post-traumatic stress for children and adolescents, and 4) psychological support for the treatment against depression and anxiety of patients hospitalized in a hospital.

There is an agreement that the main changes of conducting psychotherapy in a virtual setting are the technical aspects of the interaction medium (Carlino, 2011; Sfoggia et al., 2014; Siegmund & Lisboa, 2015). Therapists can go the extra mile and use a wider range of interventions to express and communicate with patients (Siegmund & Lisboa, 2015).

Focusing communication on verbal expressions and foregrounding facial interaction, especially facial expressions, paraverbal and kinesthetic elements may be more difficult to interpret. Also, the communication channel can become a disruptive factor, i.e. a difficulty rather than a means of access, as interruptions are frequent due to internet connection or with the quality of the equipment.

Although there is no doubt that telepsychology is a relevant modality of therapeutic care today, it is still pertinent to review what are the factors in distance communication that make it effective together with the analysis of the ethical, legal, and clinical elements associated with this interaction where the scarcity of nonverbal signals becomes evident (De la Torre & Pardo, 2018). The increase in telepsychology interventions makes it necessary to regulate this practice, the American Psychological Association (APA, 2010) indicates some guidelines for its correct use and proper functioning, as shown in Table 2.

Telepsychology implies complying with the legal, ethical and academic training requirements that are present in face-to-face psychotherapy, together with those specific to this model, such as training in new technologies, intra- and inter-institutional policies regarding data management, as well as the demands of the particular context. It is the responsibility of mental health professionals to balance them adequately to successfully carry out online therapeutic treatment.

PROPOSAL OF A TELEPSYCHOLOGY MODEL

The review and analysis of the proposals in psychological interventions mediated by technology together with the results of the present research (presented in detail in the results section) are the basis of the present Telepsychology Care Model in which has the following components grouped into two blocks: Framing and Flexibility in the use of technology together with Therapeutic Alliance and Therapist Self-care.

Table 2. APA Guidelines for the Practice of Telepsychology (APA, 2010)

Criteria	Description
1. Competence of the psychologist	Psychologists offering services should ensure their competence with both the technologies used and the potential impact of the technologies on their clients/patients, supervisees, or other professionals.
2. Comply with protection standards in the provision of telepsychology services	Psychologists must ensure that ethical and professional standards of care are guaranteed and met throughout the process and duration of the telepsychology services offered.
3. Informed consent	Psychologists are to provide and document informed consent that specifically addresses the unique concerns related to the telepsychology services they provide. In doing so, psychologists are aware of applicable laws and regulations.
4. Confidentiality of data and information	Psychologists who provide telepsychology services must protect and maintain the confidentiality of data and information related to their clients / patients and inform them of the risks of confidentiality inherent in the use of technologies, if any.
5. Security and transmission of data and information	Psychologists providing telepsychology services must take steps to ensure that security measures are in place to protect the data and assess what risks exist in each case before entering into such relationships to avoid disclosure of confidential data.
6. Security and transmission of data and information	Psychologists are required to dispose of data and information used. According to the APA Record Keeping Guidelines (2007), psychologists are encouraged to create policies and procedures for the secure destruction of data.
7. Testing and evaluation	Psychologists should adapt the instruments to the on-line modality without losing psychometric properties (reliability and validity). They must also be aware of the specific problems that may affect the assessment.
8. Interjurisdictional practice	Psychologists must be familiar with and comply with all relevant laws and regulations when providing telepsychology services. Laws and regulations vary by state, province, territory and country, so they must provide services within the jurisdictions in which they are located.

Psychotherapy processes in general are based on three central elements: therapeutic contract (frame), therapeutic situation (frame) and therapeutic alliance. All of them were taken into account in the present model and are integrated in two of the elements, the therapeutic setting and the therapeutic alliance, with the pertinent adjustments with respect to the virtual or technology-mediated communication medium. The other two elements of the present model are therapist self-care and flexibility in the use of technology.

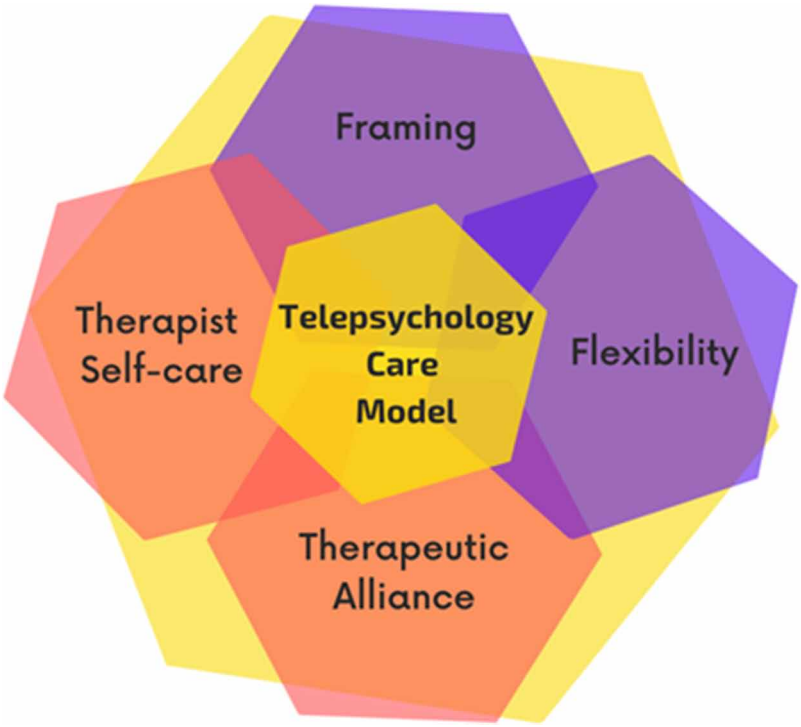
Framework and Flexibility in the use of technology

The therapeutic contract is defined as an explicit agreement between the mental health professional and the patient or client. Maintaining a clear and structured environment is the constant recommendation in online psychological interventions, through explicit rules or framing from the first meeting (Cook & Doyle, 2002; Carlino, 2011; De la Torre & Pardo, 2018).

In this the psychotherapist defines terms of cost, duration and frequency of the sessions, for his part the patient or consultant raises the reason for consultation and his availability to maintain the treatment; both parties define or configure the objectives of the treatment, the work plan and the therapeutic space. Unlike face-to-face psychotherapy, where the space was provided by the therapist, in teletherapy it is the patient's or client's responsibility to maintain an appropriate space to carry out the treatment.

The contributions of the patients or consultants to the therapeutic scenario are greater in telepsychology than in face-to-face care, since if this element is not taken care of, patients often report difficulties

Figure 1. Therapeutic Care Model (TCM).



in finding a private space where they can feel protected without being invaded by their family or environmental noises. It is important for the therapist to make this issue explicit and, if necessary, to make specific indications about the characteristics of the therapeutic space, in terms of privacy, comfort, lighting and sound efficiency.

Another of the radical changes in the Telepsychology Care Model is to clearly and explicitly address the means of communication, both the psychotherapist and the client must reach a mutual agreement on the means to be used for telecommunication. In the model presented here, it is suggested that the therapist maintain a flexible posture regarding the means to be used and establish clear contingency plans in case of connectivity failure.

In the literature it is found that the interventions from telepsychology range from an e-mail message to a video call, in the present study it has been found that the video call is privileged to maintain visual contact between therapists and patients, however, not only this aspect but all the preverbal and kinesthetic elements of communication such as tone of voice, facial gestures and incorporating gestures with the upper trunk in order to express an open posture in synchrony with verbal communication must be taken care of. In the case of working with children, it is suggested to maintain a wide angle with the camera in order to encourage play.

In face-to-face psychotherapy, traditionally a frame was made with cash payments, incorporating electronic payments was one of the first inclusions of technology in this field. The important adaptation in this model is to make explicit the amount of the payment, the method or means of payment as well as the payment for cancellation of the service. Some of the therapists interviewed recommend payment

in advance, since they consider that carrying out psychotherapy at a distance favors the cancellation of appointments or non-payment.

One of the elements that becomes relevant in telepsychology is the use of data, so it should be an aspect to work on explicitly from the setting. The psychotherapist must offer the client the guarantee and the right that the therapeutic session will not be videotaped or reproduced without his/her consent. In case it is required, the reasons for doing so must be expressed in a justified manner, and their refusal must be respected as part of the ethical commitment to the treatment of humans.

All the aspects mentioned in framing and flexibility in the use of technology have a direct impact on the communication between therapist and patient, as well as a medium impact on the interaction, so they should be handled in parallel to the therapeutic alliance and thus ensure the success of the treatment avoiding emotions of mistrust that often accompany the beginning of a therapy.

Therapeutic Alliance and Therapist Self-Care

This element groups together both the therapeutic alliance and the self-care that the therapist must maintain in order to carry out a treatment under this Telepsychology Care Model. The therapeutic alliance is known as the collaborative aspect of the therapist-patient relationship, it is characterized by developing a bond of mutual trust and attunement or agreement on treatment goals (Bordin, 1979; Norcross & Lambert, 2018).

After approximately half a century of psychotherapeutic research one of the most systematic findings is that the quality of the therapeutic alliance is the most robust predictor of success in psychotherapeutic treatment (Safran & Muran, 2005).

Safran and Muran (2005) advocate a concept of therapeutic alliance that reconciles the view of the therapeutic relationship as a co-constructed experience between the two participants, which is both the essential component and driver of the change processes observed in and as a consequence of therapy, with the broader conception proposed by Bordin (1979), the more fundamental role played by the patient's capability to trust the therapist's ability to promote change, and that the different types of alliance contribute to change.

In studies without a comparison group, researchers concluded that users were generally satisfied when psychotherapy is conducted online (Frueh, Henderson, & Myrick, 2005) and studies comparing teletherapy with face-to-face psychotherapy obtained similar levels of satisfaction between the two conditions (King et al., 2009). However, there are limitations to these results that will be addressed in depth in the discussions.

Regarding the analysis of the therapeutic alliance, one of the issues of greatest concern among professionals, fourteen studies concluded that patients and therapists perceive a strong therapeutic relationship comparable to face-to-face sessions (Germain, et.al, 2010). However, in a group therapy group (Greene, et al., 2010), they found a poorer therapeutic relationship when using videoconferencing compared to those who received face-to-face treatment.

In any therapeutic modality, it is emphasized that the therapeutic alliance is a central element in it, Norcross and Lambert (2018) indicate that the relationship between the patient or consultant and the therapist is a fundamental factor in meeting treatment goals in psychotherapy in various theoretical models of therapy.

For example, in online care can the psychotherapist give feedback through his or her own cameras, mostly turned on if there is no technical problem with the internet, the therapist may be limited to only

observing a part of his or her body without knowing if his or her leg is possibly shaking as a clinical sign of anxiety or may pay too much attention to how he or she is seen from his or her own camera and this may be perceived as a lack of attention, without considering that face-to-face psychotherapy uses a physical space that implies immediacy of sensory experience and therefore an undoubtedly qualitatively different exchange.

The most obvious difference between face-to-face and online psychotherapy are the technical difficulties that can arise in the psychotherapy session, an unstable connection, a frozen screen, poor lighting, choppy audio are some of the difficulties that can affect the conversation in psychotherapy (Markowitz, 2020).

METHOD

The present study considered a quality approach, with a descriptive design. The data exploration was through two instruments: an interview and an open questionnaire, both of them developed in this study to identify the different adjustments made by mental health professionals to provide psychological services online.

The data was collected during the first quarter of 2021, even during the COVID-19 pandemic. The sample of the present study is made up of 61 mental health professionals, specifically clinical psychologists with online psychotherapy practice in different cities of Mexico (8 participants from the semi-structured interview and 53 from the open online questionnaire). Their age between 26 and 71 years, average 45 years and a SD of 9.5, regarding the gender distribution of 54 female (89%), 6 male (10%) and 1 non-binary gender (1%).

About clinical practice, the present study participants reported having 1 to 40 years of practice, on average 16 years with a SD of 9.9. The current frequency in which they offer their clinical psychological care services online is presented in Table 3.

The participation was voluntary, which was expressed verbally and through the signing of the informed consent after the verbal (interview) or written description (questionnaire) of the research.

RESULTS

Regarding the different adjustments that were made by the participants in this study, it was found that the most widely used method of communication was videoconference and in the event of a failure in the internet connection it was changed to a phone call with the means of interaction. The softwares (programas, apps and platforms) that were reported as those used for the means of videoconferences were: Zoom, Whatsapp (Facebook), Skype (Microsoft), Meet (Google), Teams (Microsoft), Facetime (Apple). The frequency of use is shown in table 3.

Some of the participants indicated that it was important for them to show flexibility in the use of interaction tools, that is, they adjusted to the choice of the patient or consultant in order to facilitate the relationship and not generate greater tension due to adaptation to the communication medium: “I give them (patients) a choice of which platform to use, whatsapp, facetime, skype or zoom, so they use what they already know”

Table 3.Tools for interaction

	f	%
Zoom	35	57
WhatsApp	14	23
Meet	5	8
Skype	3	5
Teams	1	2
Phonecall	2	3
Facetime	1	2

The changes in the frequency of the online attention from the health care professionals that were part of this study are shown in table 4. 66% reported a substantial change in the use of telepsychology before and after this pandemic.

The participants in this study indicated that they had to make some adjustments so they can offer their services on-line, which were analyzed and classified into the ones that implied a change in framing, methodology of treatment and use of technology, such as shown in table 5.

During the interviews some of the participants expressed, regarding the framing, that the level of autonomy of the patient is very relevant, that's why some of them indicated that attending children and adolescents con be complicated, specifically with children, some emphasize that to attend them in an online format a level of symbolization is required so that the child understands that it is a means of interaction and not that the therapist is integrated into the interaction device, as mentioned by a participant "*one of my patients, I had to stop attending him because seeing me through the computer generated a lot of anguish and he began to wonder if I was real or a character* ". In the case of adolescents, having privacy or a personal space is complicated by the interference of some parents during their therapeutic session.

One aspect of the framing that stands out in the adjustments is the form of payment, even for some therapists they indicate that "*it is more uncomfortable online than in person, because in person the*

Table 4. Changes in the use of telepsychology before and after COVID-19 pandemic.

	Almost never uses telepsychology, before or after the COVID-19 pandemic f= 3 5%	**There was a change in the use of telepsychology, however its main clinical activity remains in person. f= 15 24.6%**	**Substantial change from almost never using it to almost always or all online attention. f= 40 65.6%**	**Keep your full attention online, before and after COVID-19 pandemic. f= 3 5%**
0 - 5		2	8	1
6 - 10	1	4	7	1
11 - 15		2	4	
16 - 20		4	10	1
21 - 25		1	3	
26 - 30			4	
More than 31	2	2	4	

Table 5. Adjustments made to offer on-line psychotherapy.

Framing	Recibe the payment by bank transfer
	Integracion of instant messages as means of interaction
	Sending connection politics previous to the session.
	Payment previous to consult
	Directions so the patient can find a safe space
	Make the data use explicit
	Provide indicaciones in case of technical difficulties
Methodology	Mindfulness dynamics
	Music therapy
	Digitalization of materials
Use of technology	Improvements in connectivity (faster internet)
	Equipment upgrade (computers, cameras and microphones)
	Contracting new services

receptionist performs the role of organizing payments", as well as unpleasant experiences such as the failure to pay for their services for this reason more than one began with the modification of payment in advance or prior to the appointment.

Parallel to the COVID-19 pandemic, an economic crisis occurred, so as support, free services were opened to help the population and adjustments were made to provide telepsychology services in a more accessible way, as indicated by one of the participants "*with some patients I had to handle a smaller quota since they experienced financial complications due to the pandemic but they did require treatment*." Likewise, another element in the field of patient economics is that the billing request became more frequent; It is worth mentioning that in Mexico the psychotherapy services that are provided in a private way are considered as medical services at the time of reporting the annual tax return.

Participants indicate that investment in their professional activity had to be increased, especially in the following aspects: Improvements in computer equipment, camera and microphone, contracting services (more powerful internet, zoom use licenses), improvements in lighting and adequate furniture as well as adjustments in the physical space to provide care with greater comfort:"*I made an investment in better internet signal and Zoom licence*".

Regarding the adjustments Respecto a los ajustes derived from the therapeutic method, it focuses in the objectives of treatment and the means of interaction por example, "*In Neuropsychology through facetime i have had to make some changes, like making some of the exercises in paper because i can't share screen*". Making time adjustments of the sessions per patient or between patients has resulted convenient for avoiding fatigue for the constant use of screen, as said by some of the participants: "*I adjusted the times in which i had my sessions, before I could immediately attend to patients now I have set aside 15 minutes between each consultati*on to clear myself", "I adjusted the times of each session, before i saw patients each hour and now i change it to 50 minutes to havo time to change platforms or move between patients".

The age group was an important aspect to take into account, in the case of older adults, the participants reported that the most flexible means of communication for them was a phone call or video call through

Table 6. Contraindications of attention in telepsychology

Methodological and technological characteristics.	Bad internet reception
	Lack of privacy in the patient's environment
	Use of specific technique that are meant to be use face-to-face
	Psychological evaluation, face-to-face application of psychometric tests
Patients characteristics	Depending on the severity of the patients pathology or presence of: suicide thoughts, borderline personality desorder, anxiety, menthal inestability cause by a psychotic episode, etc.
	The patient requires special attention
	Play therapy in children below 10 years.
	When the patient doesn't feel comfortable
	Lack of formality and patient commitment
	Patients in fear of being recorded or exposed

WhatsApp, with the first sessions being attended: "*With the elderly having the possibility of someone in the family supporting them for the management of the technologies, what is easier for them if whatsapp or facetime"*. In the case of children, it was important to have training for interaction by videoconferences with children, since when the therapeutic objectives are framed in learning psychotherapies, the exercises are very similar to those used in educational intervention models: "with kids, it will be difficult, i took a course to make it happen but i don't see it very easy ".

Reviewing the characteristics of the participants such as the psychopathological clinical picture and the developmental age becomes particularly relevant and even the participants in this study specify some limitations to work from telepsychology as shown in Table 6.

The types of diagnosis not recommended to work in telepsychology are: severe eating disorders, borderline personality disorder, suicidal thoughts or risk, difficulties with impulse control, among others (table 6).

The privacy element becomes very relevant to approach from the framing, as recommended in the Telepsychology Care Model, how the participants mention the experience of their patients: *"it's not easy for the patients to find a moment of silence or without interruptions, the patients sometimes take their sessions from the car"* and *"with adolescentes it's not easy for them to find a safe space, some time they have to resort on chats to not be heard"*.

The experiences in telepsychology have been cataloged with more pleasant elements than unpleasant, as shown in table 7.

One of the findings of the present study is that the experience of migrating from face to face psychotherapy to online was found to be very pleasant. Another important finding was that even when therapists have many years of experience in face to face interaction, that didn't prevent them from having online sessions (as seen in Table 8), enjoying them, and also reporting some benefits, like the experience and feeling of one of the participant therapist: "*I feel very satisfied and happy due to the results. It has benefits like preventing contagion, it optimizes time, money, and effort for the patient. It is a secure option in face of psychosocial risks, and in home comfort*".

Table 7. Pleasant and unpleasant experiences.

Pleasant	In conducting a visualization exercise, it was very rewarding to see how the person relaxed.
	In general, my experience has been really pleasant
	Interesting
	It gives the person the opportunity to make their appointment even if they are out of town
	Efficient care in case of suicidal thoughts.
	Peculiar, I have given therapy at the seashore and work with very enriching sessions.
	At the beginning I had my concerns about online sessions (before COVID) and seeing the positive results, sometimes equal as the face-to-face sessions, I convinced myself it works, now with COVID was very easy.
	Treating patients in other countries with significant time differences and that the treatments are successful.
Unpleasant	Cases of domestic violence where the aggressor was present.
	Being interrupted by third parties at the places the patients decide to take the sessions.
	Instability of the connection (internet).
	In phone call interventions it feels weird not seeing the person.
	Light going off in the middle of catharsis.
	Minors with difficulties in managing session limits.
	Identify children and adolescents that most of the time are alone, because their parents worked all day or were absent.

Table 8. Clinical experience (years of clinical practice) and actual frequency of the use of telepsychology to offer their services.

	Almost never	**1 - 2 times to month**	**1 - 2 times to week**	**More than 5 times to week**	**Always**
	f=2 3%	f=6 10%	f=18 30%	f=12 20%	f=23 38%
1 - 5			2	3	6
6 - 10	1	3	4	2	3
11 - 15			3	1	2
16 - 20		2	4	3	6
21 - 25			1	1	2
26 - 30				2	2
More than 31	1	1	4		2

SOLUTIONS AND RECOMMENDATIONS

Communication is still a great challenge, technology can cover only a certain level of proximity, empathy, and warmth with the patient. This is why health care professionals must use their creativity, and have at hand resources like: specific screens, soothing colors, specific camera location, microphone, virtual backgrounds, etc. in order to maintain a comfortable level of engagement during sessions.

While working with kids, it is important to have some materials and games to use during the session, so keep in touch with parents or guardians beforehand, and make sure the patient will have the materials needed. It is easy to engage kids with different online stimuli like apps, games or small videos that can help maintain their attention and have a successful session.

Online family therapies have been greatly benefited by shortening distances, there is greater participation and collaboration of family members, compared to face-to-face psychotherapy where the location to hold the meeting could be a limitation (Shafran, et al., 2009).

FUTURE RESEARCH DIRECTIONS

Although this new way of working in psychotherapy has had more positive than negative results as millions of people have benefited from online psychological care in many treatment modalities, there are still several unanswered questions; in this chapter, we point to the challenges in this form of remote communication that is here to stay.

It is pertinent to analyze the effectiveness of technology-mediated mental health services and to identify how technology is helping mental health according to the diagnoses identified as found in the literature regarding the limitations of telepsychology (De la Torre & Pardo, 2018) and how they make mention by the participants in this study.

Flexibility "online care allowed me to observe some elements of the patient's day-to-day life and family dynamics" "care for families where people live in different areas, more easily they can meet."

Scientific evidence on the applicability and transferability of telepsychology in different scenarios is still scarce (Argüero-Fonseca, et. al., 2021), so it is suggested to maintain lines of research that show reliable evidence of telepsychology interventions as a means of therapeutic interaction in different population groups and risk level. As was found in the participants of the present study, there is a variability of experiences regarding the susceptible population to be attended, as well as the characteristics of the interventions themselves, such as the theoretical basis of the intervention in psychotherapy, the frequency, and duration of the sessions as well as the results obtained according to the patient's diagnosis.

CONCLUSION

What was found in the sample of this study agrees with the literature regarding the flexibility offered by mental health professionals in maintaining a wide variety of means of interaction with their patients or consultants implies an additional effort on the part of therapists but helps interventions to express and communicate with patients. In this way, the use of remote human communication in psychotherapy can be used to decrease mental health costs and move psychological care to different geographic areas.

Remote human communication will continue to increase in the following years, the pandemic COVID-19 accelerated the use of online psychotherapy, therefore, it is crucial to standardize the criteria to operate the therapeutic alliance as a factor in successful psychological treatment.

ACKNOWLEDGMENT

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

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KEY TERMS AND DEFINITIONS

Communication Skills: Skills that allow individuals to give and receive information, some communication skills are active listening, friendliness, confidence, sharing feedback, etc.

Digital Interphase: It is known as the medium of communication between a human being and a computer. In this chapter it is used to describe the application used to establish communication with the patient.

Mental Health Professionals: Is an individual that provides a service to improve the mental health condition of another individual. In this case it can be a psychologist or neuropsychologist.

Social Distancing: Is the space between people, it is to avoid gatherings, or to interact with people that do not live with you. It is an intervention used around the globe to prevent health issues like COVID-19.

Telepsychology: A method used to provide psychological services using technology, like computers, apps, internet, etc.

Therapeutic Framework: It is the contract or boundaries used during the therapeutic process. It usually covers appointments, limits of confidentiality, costs, logistics, etc.

Therapeutic Relationship: Is an interactive relationship between patient and mental health professional. It has boundaries, and it is positive for both parties.

Virtual Clinic: An online service provided for individuals who want to get mental health attention, it has a well-established process in order to keep it formal and efficient.

APPENDIX

Semistructured Interview Guide

We appreciate your participation in the study, the objective of which is to identify the adjustments in communicative competences that are made to carry out psychological treatment by virtual means compared to face-to-face sessions.

1. General data:
    a. Gender
    b. Age
    c. Clinical practice time
    d. Population group with which you work in your clinical practice
    e. How frequent do you work online? (before and after COVID)
    f. What tools do you use for online attention?
2. Questions
    a. What was your experience in psychological care using virtual media like before the COVID-19 pandemic?
    b. What do you consider are the main differences between a face-to-face treatment and an online one when establishing rapport with your patients or consultants?
    c. What adaptations have you made in your methodology of work to attend your patients online?
    d. What are the benefits in the communication with your patients or consultants that you have experienced with online attention?
    e. What are the difficulties in the communication with your patients or consultants that you have experienced with online attention?
    f. What element have you modified or incorporated to improve the experiences of online attention?
    g. Have you had any cases where you don't recommend the experiences of online treatment?
    h. Have you had any unique experience or anecdote with online attention (would you classify it as pleasant or unpleasant and how you work it out)
    i. As a psychotherapeutic, how do you feel giving online attention?

Chapter 5
The Challenges of Training in Psychology: Lessons Learned During COVID-19 With a View to the Future of Psychology Education

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ABSTRACT

The training of the clinical psychologist requires the development of competencies in the fields of mental health prevention, health promotion, diagnosis, and treatment of mental illness. This training has undergone many changes due to the pandemic, evolution of education, and the translation of clinical practices to an online format. The present proposal focuses on making a review and reflection on the best practices derived from the adaptation of the training of these professionals with a future-oriented look. This chapter seeks to address two critical questions: What practices are necessary for the acquisition of the disciplinary competencies of clinical psychologists? and What didactic strategies were integrated during the COVID-19 pandemic? In the light of the lessons learned from the pandemic, the main tasks to be faced by the clinical psychologist in the face of the new demands of practice that require the creation of programs of psychological intervention and psychosocial support to the community are pointed out.

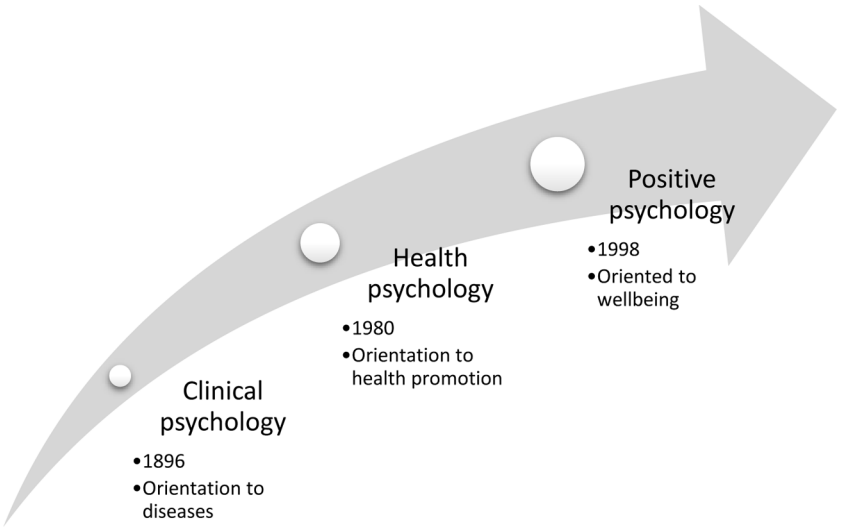
INTRODUCTION

There are many contributions that psychology offers in the field of health. Its conceptualization of the health process as biological, psychological, and social well-being and its perception of health as something to create and develop, and no longer to preserve, allows the person to play a more dynamic and active role.

In this new model of health, the psychology of health considers the psychosocial factors that can lead the individual to become ill. It has made inroads through study and research in all medical specialties interested in subjectivity in the process of health and falling ill. Martín (2003).

DOI: 10.4018/978-1-7998-8783-6.ch005

Figure 1. Evolution of the concept of clinical psychology



Health psychology accounts for the weight of behavior in life habits and explains the importance of healthy behaviors in slowing down aging.

In recent years, the field of action of the clinical and health psychologist has been changing, playing an increasingly prominent role in the field of prevention and health promotion and no longer only in the diagnosis and treatment of mental illnesses. His contributions are oriented to the creation of programs for promoting healthy lifestyles and to the attention of the emotional and social factors that predispose to the appearance of chronic diseases, to the understanding of the role that negative emotions play in cardiovascular diseases.

On the other hand, the clinical psychologist is also a companion in the different stages of diseases through specific advice on adherence to treatment in chronic degenerative diseases, interventions in oncology for the management of anxiety, fear, and depression expected in chemotherapy and hemodialysis treatments and acquired immunodeficiency syndrome (HIV), psychosomatic diseases, pain management, fibromyalgia, and terminal patient. At the same time, in his professional field, a psychologist is a key figure in the conformation of interdisciplinary and interprofessional work teams due to his knowledge of group psychology and communication.

BACKGROUND

Two essential developments within clinical psychology are clinical and health psychology and positive psychology (figure 1).

In the words of Matarazzo (1980), health psychology takes its efforts to the educational contribution to promote and maintain health and to direct its contributions to the prevention and therapy of disease in general. Another contribution is that it aims at improving the health system and health policies.

This direction of psychology emphasizes the different behaviors, attitudes, and the effect of the social environment that account for the maintenance of physical health or illness. This new look at the

individual's physical health makes possible a variety of approaches to address it from the perspective of behavioral and attitudinal behavior. Clinical and health psychology is a further step after medical psychology, which began by pointing out a way to understand the patient beyond his or her physical illness and the psychological causality in some illnesses. This advance in psychology points out the necessary vision of understanding not only the disease but also the keys to prevention, that is, how not to get sick.

On the other hand, in the 20th century, positive psychology emerged, initiated by Seligman (1998). The author points out that psychology is not only to offer therapy to "damaged" people but that the perspective of psychology should be oriented to prevention through the study and research of human strengths and virtues.

For Seligman (1998), human beings can use their virtues and strengths as buffers against mental illness, such as the vision of the future, optimism, interpersonal skills, faith, work ethic, hope, perseverance, ability to flow, among others. He also points out how depressive disorders have been explained based exclusively on negative emotions without considering the absence of positive emotions. Therefore, progress in prevention and health promotion requires building personal competencies and resilience (Seligman & Csikszentmihalyi, 2000).

Positive psychology is the branch of psychology that seeks to improve the quality of life and well-being from another perspective of the human psyche; positive emotions; experiencing them lead to mental and behavioral states that prepare the individual to face future adversities (Fredrickson, 2001).

Scheier and Carver (1993) point to the effects of optimism, humor, and laughter in reducing stress, which is the basis of positive psychology research. Other key research concepts of this approach are resilience and post-traumatic growth, the ability of the individual to resist and rebuild in the face of adversity, as these extreme experiences or experiences are a vital moment to rebuild their way of seeing the world and make the necessary adjustments to make personal growth (Vera Poseck, 2006).

The emphasis of these latest advances in psychology is placed on the prevention and promotion of mental health; the training of health professionals contemplates the acquisition of competencies in this line,

Important milestones for psychology are the first laboratory of experimental psychology by Wilhelm Wundt in 1879, the first clinic founded for the care of the mentally ill by Lighner Witmer in 1896, the first classification of mental illnesses by Kraepelin in 1896, and the discovery of the unconscious, the first theory of the psyche by Sigmund Freud in 1900, as shown in Figure 1, which describes the evolution of the field of psychology.

MAIN FOCUS OF THE CHAPTER

Psychology demonstrates how behaviors and attitudes play a significant role in maintaining health in many diseases, and the health emergency is no exception. For example, at the onset of the SARS VOC-2 pandemic, the global collapse of the health contingency at the political, economic, and educational levels quickly became apparent.

The little knowledge that was known about the virus, the inexistence of vaccines and isolation measures showed the crucial need to consider the behaviors and attitudes of people. Therefore, the knowledge that comes from psychology can contribute through its explanations on behavior and attitudes the necessary efficient programs of prevention and health promotion in times of pandemic.

In the 1990s, regarding the human immunodeficiency virus (HIV) or Acquired Immune Deficiency Syndrome (AIDS), Bayes and Ribes (1992) pointed out that beyond the origin of the virus and its poten-

tial medical treatment or the generation of a vaccine, the disease is viewed from its acquisition, process, and treatment as a psychological process.

In the face of the Middle East Respiratory Syndrome (MERS) respiratory infection in South Korea, Yang & Cho's (2017) research mentions how knowledge of the disease improves compliance with medical instructions on quarantine follow-up. These authors emphasize the importance of information about the disease with scientific and accurate data, consequently building public confidence in health systems.

The previously described experiences have pointed out the changes that should be implemented in the different psychological interventions in the currently required conditions with COVID-19, creating models for working urgent psychological problems with online psychological crisis intervention (Zhang, Wu, Zhao & Zhang, 2020).

This care must be dynamic and adaptable to the different stages of the epidemic. Zhang, Wu, Zhao, and Zhang (2020) proposed the model that was implemented in the West China Hospital, which emerged during the crisis at the epicenter of the pandemic. It integrates doctors, psychologists, social workers, and psychiatrists oriented to the care of patients, their families, and the medical staff itself. It focused on the first stage of care with psychological first aid to the stress response and fear of disease. In a second stage after the contingency, the model offers psychological support for the difficulties in adapting during the different stages of the epidemic, as well as making improvements to the health system.

The World Health Organization (WHO, 2020) report notes the importance of incorporating health and psychosocial support services into the response plan of most countries to COVID-19 using approaches such as telepsychology and hotline care targeting all populations, especially those in vulnerable situations.

The high levels of stress and its effects left by the health emergency are the risk factor that increases the appearance, aggravation, relapse of mental and neurological disorders and consumption of psychoactive substances; that is to say, they bring an effect of greater prevalence of anxiety and depression. For example, in Mexico, Cortés-Álvarez et al. (2020) agree that home confinement effects are associated with more significant stress, anxiety, and depression; while following precautionary measures, self-care such as hand washing, and social distancing brought lower levels of distress.

Therefore, this chapter emphasizes that the choice of care in COVID-19 times should be oriented to promoting health and self-care. The contributions of clinical and health psychology and positive psychology were included in the different modalities of psychological care, counseling, psychoeducational programs, and crisis interventions through the Virtual Clinic.

Issues, Controversies, Problems

The actions undertaken and described in this chapter fall within the framework of the guidelines set out in the action plan for the health contingency in the article I am preparing to help protect for the academic community, remote academic continuity with the use of digital media and simulation, support for the academic community and social responsibility response contributing with prevention and support to people impacted by the pandemic (Valdez García et al., 2020). Several initiatives were undertaken from this call to help, among others:

- In undergraduate programs, Eraña and Lopez (2021) created synchronous and asynchronous initiatives of accompaniment in challenging times by creating a safe space for listening to concerns and finding solutions for students at different stages of the curriculum.

Table 1. Innovations for the training of psychologists

	Virtual Lab	Virtual Clinic	Mental Health Promotion Campaign
Target	Strengthening of clinical competencies through structured practice with specific topics.	Develop clinical rotations for students, in which they performed patient care.	Promotion of mental health with reliable information through psychoeducational infographics.
Duration	1 quarter	1 quarter	1 quarter
Focused on participants	Final year students	Final year students	Final year students
Teacher role	Supervisor and Competency Development Evaluator	Accompanying teacher	Supervisor and evaluator of the material produced with quality.
Materials	Simulated cases with specific objectives.	Real patients.	Infographics. Social networks.

- In Segura-Azuara's initiative (2020), the use of clinical simulation to achieve critical judgment competency was evaluated using the individual generic competency questionnaire in the medical program with 51 students.
- Nieto and Lopez (2020) address the frustration experienced in the early stages of medical training and the inability to work on the front line of patient care with Covid 19.
- Mendez-Reguera, A., Lopez, M. (2020) generated the initiative of educational innovation aimed at students of generation Z to encourage participation and understanding of the contents of the immunology class from the creation of memes on the internet.
- Valdez-García, J.E., Lopez, M. (2021). The creation of the Virtual Chair to complement continuous professional training with emerging and updated topics, which allows to eliminate borders to achieve a greater approach and understanding of the needs of society. Strengthening in this way the active role that universities should have in the well-being of the community

Since the pandemic, significant challenges were imposed. On the one hand, in the teachers as trainers of a new generation of psychologists, ensuring spaces for clinical rotations and sufficient clinical experiences, but now in the virtual modality. On the other hand, the professor is an expert in mental health, adapting and implementing modifications in the psychological technique and being flexible in the new modality of patient care.

Some good practices that could be incorporated into undergraduate programs are based on the lessons learned from the implementations during the last year of the clinical psychologist's training.

These educational innovations emerged during the 2020-2021 health contingency. Therefore, the need to solve was to offer internships within the clinical year for psychology students. Illustratively, the three initiatives are presented: the creation of the Virtual Laboratory, The Virtual Clinic, and the Mental Health Promotion Campaign through psychoeducational infographics. These implementations brought changes in the usual conduct of clinical practices before the pandemic, each with different approaches, as presented in Table 1.

Each of the innovations are described in more detail in the following sections.

Table 2. Virtual laboratory practice (Cavazos-Montemayor et al., 2021)

Lab practice	Objective of practice
Psychological first aid	Perform containment in crisis interventions through the application of psychological first aid.
Evaluation of ego functions	Assess mental status and ego functions by asking pertinent questions and observing the patient's nonverbal behavior.
Communicating bad news	Apply communication skills, knowledge, and information management in such a way as to reduce and manage the emotional impact on the patient.
Symptom screening	Identify the onset, evolution, intensity, and frequency of the symptoms that occur.
Interview in a hospital environment	Participate as a member of the interdisciplinary team, helping the treating team, the patient, and his/her relatives to understand and manage the patient's reactions to his/her condition in the hospital context, knowing his/her psychosocial history and the presence of other stressful life processes.
Interview with adolescents	Identify the areas of conflict to be treated and the resources of the young person, with the establishment of framing, rapport, and confidentiality about the information of the sessions.
Establishing rapport	Making the patient feel comfortable in the presence of the interviewer, as well as willing to talk—empathic connection with the patient.
Interview and application of a psychological test	Apply the conditions of the psychological interview in the context of the application of psychometric tests. In a climate of trust and collaboration, the participants need to demonstrate the knowledge required for its application and the handling of the material.
Results feedback interview	To offer in accessible language to the consultants the explanation about the objective of the applied tests and the obtained results linked to the reason for consultation, the observations, recommendations, and prognosis according to the interest that motivated to make the evaluation.

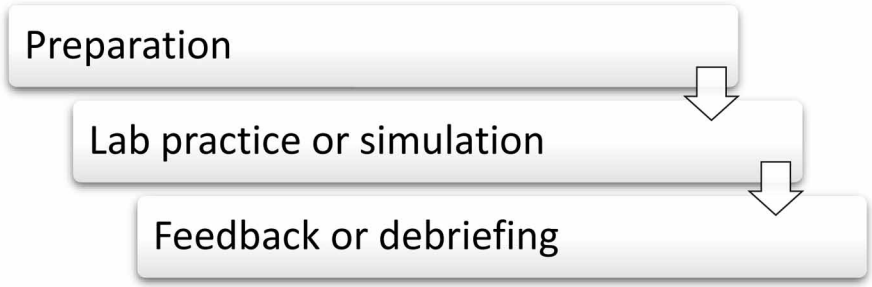
Virtual Laboratory

Before the pandemic, the acquisition of competencies was on the different subjects of the program and the teacher in charge conducted the use of simulation and role-playing. At the beginning of the pandemic, the Virtual Clinical Laboratory was created so that students could systematically, week by week, strengthen their critical thinking skills, communication with the patient, and clinical judgment (Cavazos-Montemayor et al., 2021).

Nine practices were designed using simulation and role-playing. The themes were active listening to the patient, the empathic attitude in all interventions, the establishment of rapport as a technique to encourage the patient's attachment to the intervention to recover their state of health, attention to detail through the monitoring of verbal and nonverbal behavior, the identification of the ego functions in the patient's discourse, the technical differences in the purposes of the psychological interview used, such as the application of psychological tests and the interview to return results, the management of the interview with adolescents, the appropriate referral to care centers and the characteristics of the interview in hospital centers (See Table 2).

With this transfer of the assessment of competencies online, similar to what was exposed by Valencia, Vallejo, and Olivares (2016), Segura-Azuara et al. (2018) on the use of the strategy of clinical simulation for the development of critical thinking in health sciences careers, found the base structure of the Virtual Clinical Laboratory, where three phases were considered: the preparation (specific theoretical review, introduction to the case, previous briefing); the simulation itself (2 psychology students represent the therapeutic scene: patient and therapist) and the feedback or debriefing with peers and teacher (it is the moment of analysis and reflection on feelings and attitudes and their mental route implemented for decision making in working with the patient; it is provided in a climate of trust, empathy, and respect).

Figure 2. Stages for conducting the Virtual Lab (Cavazos-Montemayor et al., 2021)



Finally, after the theoretical review and before the simulation phase, the student has the opportunity to resolve doubts.

This intervention model is similar to the clinical supervision that psychology students traditionally receive; however, it differs. Clinical supervision has been defined as a process in which a qualified expert guides the supervisee to help the helping experts rethink their actions and feelings about their daily professional work and uncover possible emotional and cognitive undercurrents Daskai (2008).

For Daskal (2008), the purpose of clinical supervision is to promote professional identity, seeking reflection on their practice to achieve transformations in know-how and know-how to be. Both interactions point to the importance of feedback or debriefing as the fundamental step that must be carried out in a climate of trust, empathy, and respect; however, in supervision, there is no simulation, an actual patient is already being attended.

For Maestre and Rudolph (2014), debriefing is a conversation where participants analyze their actions and reflect on their thoughts and emotional states to improve their future performance, including examining values and assumptions that guide the actions of professionals. The authors point out the importance of instructors being able to express their critical judgments without hurting feelings or provoking defensive attitudes to consider it a debriefing with good judgment. The authors reviewed emphasize that the superiority of this style of debriefing is that, in the judgmental style, it is assumed that there is an essential flaw in the participant and the instructor is always right; the cost of this style is the humiliation and demotivation of the participant as he or she feels devalued. Conducting the style without judgment risks confusing the learner and can lead to mistakes not being discussed, thus deviating from the essence of debriefing. In using good judgment, there is a fundamental difference; in this, the instructors use their own clinical experiences and are willing to validate their mental models when interpreting the observed clinical simulation (Maestre & Rudolph, 2014).

By using good judgment, to get to know the participant's mental maps, he must describe his actions and the result of these actions. The conversational style proposed for the trainer combines persuasion, I observe, I think, and inquiry through questions of genuine curiosity to provoke the participant's reflection on their mental pathways, *I wonder, I am curious to know what led you to...*

In the survey of students participating in the virtual laboratory, the following comments on the benefits obtained in the debriefing of their teachers/supervisors stand out (Cavazos-Montemayor et al., 2021). Some of the students' textual comments are the following:

- It helped me develop some skills and be in constant monitoring to be more aware of my mistakes and work on them.
- I think, as for the Virtual Lab, they found the best way to implement the practice with little preparation time in the middle of the pandemic.

Students highlight the depth of content that can be covered:

- Very positively. Many of these things we are not taught in class, or if we see them, it is not in a profound way, and here, we were able to delve into all these topics and explore them more broadly.
- It is used to practice intervention from a distance, bringing unique challenges and considerations to those carried out in person.

On the anxiety before clinical encounters with an actual patient, the student's highlight:

- I was very nervous the day I was going to see my first Virtual Clinic patient for the first time, I felt I had no idea what I was going to do, but I realized that the basics I had were enough to start the treatment well with the patient, besides my supervisors were a great help to me.
- It contributes a lot to the truth, having real patients.

These practices contribute to their reflective activity on their professional practice:

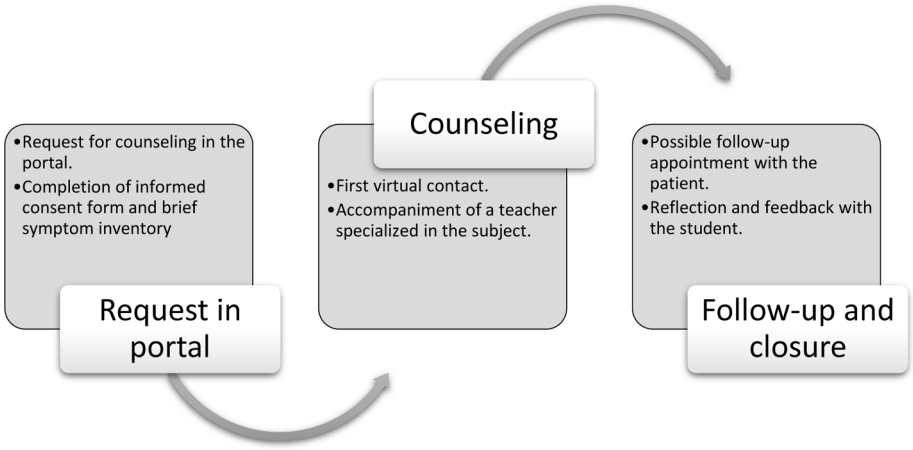
- All the internships we had helped me learn from my mistakes and listening to how my classmates do it also helps me have another perspective to do things.
- Through the experience of being able to apply what I have learned. As well as helping me to show myself what is easy and what is not.
- I think that the virtual lab is an excellent practice to structure the theory and apply it in simulation, as well as to prepare for a possible scenario, it helps to lose the fear of the different issues that one can face as a psychologist, but you can organize in a better way the necessary ideas to cover depending on the case. Of course, I say this speaking for myself and my experience, as I think it has helped me identify the basics and the details that are important to cover in various situations.

The documentation of this experience of acquiring competencies in critical thinking and communicative competencies allows for the creation of new environments to strengthen the mastery of these competencies and to reformulate those that do not contribute to their formation, in addition to the construction of competencies requires evaluation over time. This initiative will be essential to maintain after the health contingency and can be face-to-face or virtual. It requires new practices to be designed for the competencies required by the program.

Virtual Clinic

Mental illness and emotional destabilization are the other pandemic resulting from COVID-19, so mental health needs to be addressed, maintained, and restored for those who have lost it. Therefore, in response to the call of the World Health Organization (WHO), the updated guideline on Clinical Management of COVID-19 (WHO, 2021) indicates as a priority to provide psychological support to people with suspected

Figure 3. Virtual clinic model during the pandemic



or confirmed acquisition of COVID-19, as well as early detection of symptoms of anxiety and depression with preventive psychological interventions for possible subsequent mental health complications.

The WHO emphasizes that this care must be coordinated, multidisciplinary and continuous, contemplating physical and mental health. It is necessary to research and prepare strategies with systematized guidelines for intervention through telepsychology. In this context, the Virtual Clinic was created during the health contingency of the COVID-19 outbreak so that students could attend to the community and reestablish their practices, now online, after the suspension of face-to-face classes.

The easy and rapid spread of the virus made telepsychology the safest option for psychological interventions. This modality of care is a variant of telehealth, which has been defined as the use of technology and communication to provide diagnosis, consultation, intervention, education and treatment at a distance (Landa-Durán, 2009; Nickelson, 1998; Peñate, 2012) and has been defined by the American Psychological Association as the provision of psychological services using telecommunication technologies including telephone, email, text, videoconferencing, mobile applications, and web-based structured programs (APA, 2013); including psychoeducation, assessment, training programs, and psychological treatment (Peñate et al. 2014).

The Virtual Clinic provides its services to students in their last year of the Clinical and Health Psychology career. An average of 33 to 38 students rotates in these professional practices that correspond to the subjects Clinic I, II and III, including 20 hours per week during their training.

The duration of this first experience of online psychological care was in the clinical quarter from April to June 2020. At the beginning of the quarter, before the students participated in the platform, a virtual training was conducted on psychological first aid and topics related to the effects of confinement. In this session, the model that would be used in the counseling platform was explained to them, which is presented in Figure 3.

The virtual clinic model as a clinical-school model required the invention of the role of the accompanying teacher during each of the sessions of attention in the virtual clinic, accompanying the student and the patient.

The request for psychological care contained, as a first step, the completion of an informed consent form for the authorization to receive care by students in their final year of the course, following the ethical

guidelines for health professionals; likewise, a questionnaire was included: BSI18- BRIEF SYMPTOM INVENTORY by Derogatis (2001), which the student reviewed before the first virtual contact. During the interaction on the platform, from the first visual contact with the user and throughout the counseling and orientation process, the student was accompanied by a teacher specialized in the subject. During the session, the expert supported the student with comments through an instant messaging service, and at the express request of the student, could intervene in the session if an extreme case arose where the well-being of the patient required it.

In this pilot experience, 12 teachers/supervisors participated and accompanied the students to elaborate infographics and in the virtual counseling experience. At the end of the quarter, a total of 40 infographics were produced as part of the activities aimed at the competencies for health promotion and psychoeducation, so necessary during the pandemic.

Students participated in various experiences through the Virtual Clinic platform, initially completing between 1 and 5 sessions with users who made the support request; as the pandemic progressed, the reasons for consultation changed to pre-existing difficulties or difficulties not necessarily linked to the health emergency.

This experience, which was well-received by students and faculty, arose out of the pressing need to fulfill the two commitments of training in clinical settings: caring for the community's health and providing formative experiences for students. The pandemic provided an exceptional, unique, and significant experience in which students could experience the responsibility of professionals in health promotion in a very tangible way. In the face of the pandemic, the context of fear, uncertainty, boredom, and irritability gives rise to multiple depressive disorders, substance and alcohol abuse, or post-traumatic stress, making support through an online platform very relevant and necessary. In addition to the possibility of taking care of their health and not exposing them to unnecessary trips out of their home, it enabled quick and timely access to care for psychological crises.

The accompanying teacher covered several tasks because, from the formative point of view, it allowed the student to be more confident in these first encounters of psychological attention that the curriculum contemplates in face-to-face scenarios and that due to the pandemic. Special care was taken for this accompaniment not to be intrusive for the users; although present and attentive to the monitoring of the psychological intervention, the teacher did not have the camera on unless it was required to participate. This participation was only at the request of the student or because the teacher considered it was in the best interest of the patient. In addition, another technological tool could be used, for example, WhatsApp to exchange messages with the student who was attending the consultation. Some relevant successes from the formative point of view are that this enables teachers' accompaniment while still being the student who conducted the psychological interview. In addition, it reconciles the commitment to care for the community and continuity of education to the student in a scenario of health urgency as the current one.

The psychological guidance platform developed at the educational institution where the study was conducted the exercise in which students provided psychological guidance and counseling, with psychoanalytic, cognitive-behavioral, and systemic psychological approaches. This service offers free care in Mexico nationwide. The students attended the telephone line according to a schedule with two shifts of participation, although the students were only involved in the morning shift between 8 and 12 hours.

The virtual clinic offered attention to these types of problems such as anxiety crises, mild depression, family conflicts, a hospitalized family member with COVID-19, death of family member by COVID-19, feelings of guilt in youth populations for going out to have fun, fear of infecting family members, grief, unemployment, migraine, love breakup, family problems, loneliness due to hospitalization with COVID-19,

alcoholism, work stress and excessive jealousy. In the beginning, it closely linked to the pandemic, and as time progressed, it referred to pre-existing conflicts of each patient.

Mental Health Promotion Campaign

In the context of widespread fear and uncertainty in the population, due to the alarming news coming from China in March 2020 and the outbreak of the epidemic in New York in April 2020 (Inchausti, 2020), the third initiative of the program, the mental health promotion campaign, arose. This activity, developed by the students under the supervision of teachers, consisted of documenting and designing psychoeducational material appropriate for social networks such as infographics, according to the World Health Organization (WHO) recommendations.

These infographics aimed to provide crucial and truthful communication on various mental health issues to a community affected by the infodemic and alarmist or false communications. Also, to promote the continuity of healthy habits during the pandemic, important themes were breathing and relaxation techniques for stress management and multiple topics according to the situation, such as the maintenance and modifications in family relationships. The latter was relevant as most family members were living together, working or studying from home. The students demonstrated their competence in information management through the development of this campaign.

Some of the topics covered in the infographics were: 5 reasons to take care of yourself through video calls, healthy coexistence at home, healthy couple relationships, positive psychology applied to family relationships, how to explain the pandemic to children, resilience, a telephone guide to a crisis-suicide, grief in times of COVID-19 and 10 tips for self-care.

As the pandemic progresses, new faculty initiatives have emerged to implement rotation programs face-to-face and online. The *Close to You* rotation is oriented to the care of the COVID-19 patient to provide psychological support, emotional accompaniment during their hospital stay, crisis intervention for them or their family members, and assessment of them through scales. Currently, the number of patients with COVID-19 has decreased, so psychological care is mixed, both to patients hospitalized for other diagnoses and to patients with COVID-19. Crisis intervention is also directed to the nursing team; this hospital has more than 500 nurses in its 3 shifts and the intervention is given either by express request of the nurse when the patient is in a state of agitation or by the affectation experienced by the death of the patient.

SOLUTIONS AND RECOMMENDATIONS

In this society increasingly globalized and involved in technology, the training of clinical psychologist must increasingly cultivate their critical thinking, orienting it to the unprecedented new demands in the field of mental health in the modality of telepsychology. Furthermore, the health contingency highlighted the importance of the role of the clinical and health psychologist in the promotion of a healthy lifestyle amid the adverse and abnormal circumstances that had to be faced.

The clinical and health psychologist, as an expert, has two fundamental tasks for the change and maintenance of a healthy lifestyle; on the one hand, the knowledge of the psyche relevant to attend mental health and on the other hand, motivational processes involved in the change of the appropriate lifestyle in the promotion of health (Matarazzo, 1980). Specifically, it directs its efforts so that the patient takes

an active role in facing the disease, promoting health through multidisciplinary work. The innovation in the three implemented initiatives presented in this paper contributed to the continuity of clinical training using telepsychology for community care.

The immediate transformation to telepsychology has proven to be a viable and safe option for the care of patients during the health contingency; some resistance to its use by the preference of face-to-face work could be dissipated, to see the acceptance of users with this technological tool of communication.

One of the lessons learned after COVID-19 was to support the acquisition of professional competencies in a standardized and controlled environment, with the new digital platforms and the creation of the Virtual Laboratory, simulation, and role-playing practices could help achieve the learning objectives. Students could now repeat the practice until they reach mastery of competence, for example, in critical thinking and communication, which constitute essential support for telepsychology. Moreover, the creation of the Virtual Clinic for community care was the only option for care in the face of the closure of community and hospital centers. These educational innovations allowed students to receive a quality education despite the distance. Finally, the lesson learned is that teachers, students, and directors' collaborative work and motivation made possible the continuity of academic training.

Implementations such as the Virtual Clinic, which at the beginning of the pandemic its primary objective was to provide psychological first aid derived from the health contingency, quickly migrated to brief psychological interventions on the reason for the requested consultation. Additionally, this model of care led to innovations in the role of trainers, creating the figure of an accompanying professor during the online psychological consultation. Thus, a triad of care was formulated where the student, an accompanying professor, and a supervisor cared for the communities.

In addition to the challenge of getting to know the technological tools and changing the program's face-to-face classes to an online format from one week to the next, meetings arose among the professors to face the challenge with teamwork. For the programs, this involved a series of collegial decision-making.

Another learning that the health contingency leaves behind and that is imposed on health science teachers is to analyze and reflect on the different experiences and innovations developed in their "work" as supervisors/teachers in these times of pandemic and to create the necessary strategies to return to the new normality.

CONCLUSION

The challenge is that all this learning path is not forgotten in the face of going back to presence-based education. The challenge is to rescue, reformulate and strengthen the good practices of distance care, so that the advancement of telepsychology is another option for the community.

Working in telepsychology requires continuing to strengthen communication and critical thinking skills, through the Virtual Clinical Laboratory generating new practices and performing debriefing with good judgment (Maestre & Rudolph, 2014), which allows the development of the student, and the instructor achieves this change from I tell you how to do it, to build meaningful learning together.

The contribution of positive psychology and health psychology was fundamental during the pandemic; they constituted the base material of the health promotion campaign and the interventions in the Virtual Clinic. Psychological care per excellence is a human act of accompaniment and empathy in that suffering experienced by the patient who requires the psychologist. This crisis made it possible to create

many ways to bring the contributions of scientific psychology into the care of the community when it needs it most during COVID-19.

ACKNOWLEDGMENT

To Dr. Xóchitl Garza Olivares, for her time and collaboration in the organization of this paper.

To the supervisors and students of the Clinical Psychology Program, class of 2020 and 2021 who participated with enthusiasm and professionalism in caring for the community during the pandemic.

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KEY TERMS AND DEFINITIONS

Accompanying Teacher: Role assigned to the supervisor to act as a co-therapist with the student in conducting the online psychological intervention of the Virtual Clinic.

Clinical Supervision: Learning space for students in clinical environments where an expert supervisor gives feedback on the conduct of the cases attended, in a climate of collaboration, supporting the emotional and cognitive well-being of the supervised and their professional growth.

Debriefing: A stage of reflection on the findings of the learning experience obtained in the simulation or role-play. In which the teacher acts as a facilitator of learning, supporting the student in the identification of their successes and mistakes, considering the emotions involved.

Telepsychology: Provision of psychological care services such as psychoeducational orientation, counseling and psychotherapy by using telecommunication technologies: telephone, interactive video conferencing, email, chat, websites and social media in synchronous or asynchronous mode.

Virtual Clinic: Online psychological care clinic conducted by accompanying professors/supervisors and students in rotation of the Clinical Psychology program.

Virtual Laboratory: Clinical Psychological Practices for the acquisition of clinical and communicative skills with the patient.

Chapter 6
Disease Awareness Campaigns: Education for Citizenship in Medical Schools

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ABSTRACT

Currently, professional training goes beyond the discipline itself and focuses also on being able to improve our society. Professionals have a great responsibility as active participants in the local, regional, national, or global community they belong to. In the healthcare area, all disciplines must contribute to a deep transformation of the quality of life of all the people in the society, not limited to the patients themselves, but embracing their context, with relatives, friends, etc. The healthcare professional, and professionals of all other areas must, therefore, be competent in their discipline and other transversal components to become an effective change agent. Transversal competencies or soft skills, including citizenship, can also be seen as power skills for all professionals, as they empower them to have a greater impact in their community. Activities focused on the development and self-awareness of these contribute to the training of better professionals in our universities.

INTRODUCTION

Universities around the world are evolving towards facilitating learners' abilities in identifying specific

DOI: 10.4018/978-1-7998-8783-6.ch006

areas in need of change to improve our society. This involves all areas of study and are especially true in health sciences. Nonetheless, patients are commonly not aware that they can drive their disease in different directions with simple changes in their every-day life activities. We have realized that the healthcare workers are not alone in fighting disease, and that the patients must be included in decision-making related to their own diseases. Some of the most important drivers of improved patient care are related to diet and exercise modifications. Although changes in lifestyle are commonly difficult to achieve, the more patients are aware of the way their lives can change as their disease evolves, the more likely they will act in achieving these goals. In the end, everyone hopes for a longer life expectancy in hand with a good quality of life.

The constant innovation in medical education is taking the lead in such proposals, with pioneer universities integrating major changes in their programs towards the development of competencies. On the other hand, the incorporation of multidisciplinary teams in patient care is a trend nowadays, to provide the best patient care in all settings. Many higher education programs are evolving towards a student-centered approach with a competency-oriented curriculum. The objectives of this chapter are to describe the transversal competences and state their importance in the programs' training, identify the relevance of the citizenship competence and provide an example of a project aimed to its application in the professional context of healthcare programs.

BACKGROUND

The complex teaching-learning process requires faculty engagement and ongoing training in the discipline and in educational skills. Health Sciences schools worldwide develop strategies to improve individual and collective self-management skills. The educational programs, aside from the disciplinary competencies, require the students to engage in activities related to patient care. This is a first step in collaborating for a better environment and society. Nonetheless, this is not enough if we seek to live in a world in which individuals take an active role in society and conceive themselves as responsible for the decisions the group makes. Self-governance is such a competency. But not only towards oneself, but, as healthcare providers, towards the patient and the environment and community he or she is involved in. It is within our hands to aid in improving the understanding patients have of their health issues, and how these have an influence on their diseases, as well as taking responsibility for their actions in relation to risk factors, preventing complications and prognosis. Working hand-in-hand with healthcare professionals, patients and family members, we can advance towards the best outcome for our patients.

MAIN FOCUS OF THE CHAPTER

Health Sciences' Programs

Health sciences programs are approached from different strategies in universities around the world. According to Abu-Rish, et al (2012), some of the avant-garde strategies are focused on Small group discussion, Patient case analysis, Large group lecture, Clinical teaching/direct patient interaction, Reflective exercises, and Simulation, while Workshops and E-learning aren't as common. As seen, face-to-face

activities are privileged, seeking close feedback from the facilitators according to the student's level of academic development.

Community-oriented activities allow a close bond between the professionals in training and their environment, so that they may recognize the health situations in which their patient is involved. This understanding triggers curiosity and motivates students to learn more, since this will be applied to concrete problems in the community. Also,

De Hei et al (2015) point out that collaborative activities promote the learning of both, disciplinary and soft skills.

Involving students in activities related to a real environment allows them to develop competencies of the utmost importance for their graduation profile.

Competences in Health Sciences' Programs

Universities provide an environment for learning competencies students will apply in their professional life. As a whole, these are classified as disciplinary and transversal; that is, related to a specific area of knowledge, and those related to the general practice of professionals in the society he or she belongs to. Usually, higher education programs have high standards to ensure their graduates acquire disciplinary competencies, as they perform well in external ranking assessments, which strengthens institutions' reputation. Even more, institutions are focusing beyond discipline but on soft skills which enable professionals to engage in active and positive actions in their daily life.

Competencies are described as the desired knowledge, skills, behaviors, and attitudes of the program's graduates (Olivares, 2018; Olivares Olivares & Valdez-García, 2017). Citizenship competencies include cognitive, emotional, and communication skills, all routed towards enabling all members of the society to act in a constructive manner. This includes the generation of opportunities which empower the citizens in their sense of belonging and decision-making focused on a common goal of improvement of the society they live in. Schools can transform students' and faculty understanding of their pivotal role in building a shared commitment society. As mentioned in Figure 1, there is a close correlation among disciplinary and transversal competences.

Disciplinary Competences

Disciplinary competencies promote that each medical graduate may be competent in the specific context of their area of knowledge. Competence can be seen through different lenses: the graduate must be a medical expert in their role, that is, capable of applying medical knowledge, having clinical skills, and professional values; being a medical expert in their role; a communicator and collaborator, given that the medical field requires teamwork from different individuals; must be a scholar, that is, willing to learn and relearn constantly and share new knowledge with the rest of the field; and must be a health advocate, that is, as facilitators of information that may improve the health of others (Sanfilipo, 2011; Potle, 2019). These "enabling skills" are that make a medical professional competent in their respective field. Nevertheless, the biggest component of curricular space is the knowledge needed in order to be an expert.

In medical education, and according to Talbot (2004), disciplinary competency is built upon the four-steps process: first the selection of syllabus that gathers the required knowledge the student will require in order to be competent, secondly the design of the methodology upon the student will learn, thirdly the building of assessment tools and their application and finally determining whether the student has,

or not, the required disciplinary competencies. Regarding the second half of the process, Talbot (2004) presents a dilemma for the evaluator: as the grading process of the assessment tools becomes easier, the difficulty level for the alumni shrinks. That is, the tool may present that the graduate has all the disciplinary competencies needed but may not be competent in the medical field. Harris et al. (2010) propose that having different assessment tools may mitigate this problem. Abu-Rish et al (2012) found that the most popular assessment is the Attitude-perception-satisfaction survey while the least common is the skill performance ratings.

The first part of the process demands different approaches, so that each student may be able to learn the needed disciplinary competencies. Harris et al (2010) express that the evaluator must ask themselves if the skills that the future medical professional will need are strictly epistemological, or if they will need other "enabling skills".

Soft skills or Transverse Competences

Citizenship in higher education can focus upon program contents, teacher-student relationships, social organization of learning activities, institutional and participation culture, and academic learning applied in the community. All five of these are interconnected and mutually influence one another. Personal construction, reflections, observation, and practice, all contribute to the students' ethical learning. For some authors, higher education programs must embrace a socializing role in which students have an active participation in current social problems (Venet Muñoz, 2019). Accordingly, social linking of their classroom activities, non-formal procedures in education, and diverse paths for social contact can serve as boosters for students' learning.

Ethical and citizenship-related competencies are pivotal for efficient and effective professional practice and to act constructively and with justice in a democratic society; as they contribute to pacific interaction (Bernate). As institutions encourage tutors to include activities of this sort, more and more graduates will achieve better performance in their everyday tasks and help build stronger communities. Therefore, they contribute to a more inclusive, democratic, and worthy society. With this in mind, health sciences' programs must be designed according to the most relevant societal needs, that is, addressing common diseases, regarding their risk factors, etiology, clinical manifestations, complications, diagnosis, therapy, prognosis, etc. In each of these, students must learn the best practices and those most suitable to their context, and that of their patients. Here, educational level, income, working habits, etc. are crucial to guide patients in the best decisions related to their health. From this point of view, universities contribute to society development towards higher inclusion, equity, justice and wellbeing.

For some authors, students must have activities in their program to apply what they are learning in their courses (Martínez Martín, 2006). This application in the community is part of the citizenship competencies universities must embrace and encourage. Providing a social meaning to the academic content enables students to develop a strong social commitment. An example of this is their participation in NGOs and foundations with ties to the university, therefore, providing specific tasks for students to engage. Usually, these activities are voluntary for students, which diminishes the general interest of NGOs, as they might have periods with no students and therefore, these programs must be assigned to their own personnel; and they must continue funding them despite the absence of students. On the other hand, students participating in these, tend to contribute to improvement in social conditions, social cohesion, and building a deeply inclusive society. Another example, which is drawing attention recently, is the service-learning method. In this, students learn by providing the community with the concrete

applications of what they have learned so far in their program (Martínez Martín, 2006). This requires tutors to design activities students must find appealing. They must find a way to communicate effectively with the community members, according to the proposed goal for this activity. Also, they must adjust the disciplinary language to lay words to enable the members of the community to take advantage of their participation in the activities.

Out-of-the-classroom learning opportunities are very engaging for students. Recent studies show the more students connect with real life problems and situations, the more they engage in their tasks and embrace the projects they are involved in. Programs must hive higher flexibility in the way students interact with one another, and with the community; thus identifying the community needs to take advantage of their strengths and build upon their weaknesses for social improvement (Venet Muñoz, 2019). Programs must transcend the classroom walls and extend to the public spaces, where common problems must be faced and solved with the community's best interest at hand. Integration of students in the social environment with proactive, creative, and innovative ideas for strategic planning and problem solving, is one of the areas universities are trending nowadays.

Dialogue in their living spaces, building solidarity bonds, highly tolerant interactions with one another, differences' acceptance with respect, all strengthen the social network and make it possible for our communities to grow in stronger social ties and commitment. Table 1 depicts a description of the transversal competences.

Citizenship Competences

According to Heredia (2013), social responsibility arises from recognizing one is part of a community, in a social group and time in history. Therefore, one must respond to the current situations in the community, with one's tools trying to improve the quality of life of all those pertaining to the group.

Derived from autonomy, or individual freedom, one must respond to one's individual actions and decisions. For some authors, recognized citizenship competences are: social perspective and sought of justice and common good; respect for diversity; conflict management and solution; democratic participation; respectul rule of law; democratic use of authority and citizen power. In this sense, solidarity and sense of unity all contribute to the individual commitment towards the growth and development of their community. Everyone contributes with their own skills, knowledge, etc. therefore, as a whole, the society lives in a more just and peaceful environment.

Every discipline can contribute towards this goal. As the transversal competences of communication, empathy, effective listening can all support the disciplinary ones, according to the community situation. Cordero (2018) points out that including these types of activities in which the students actively participate in community projects with a close contact with the community, translates to better understanding of their role as professionals.

Digital Competencies

Experts in the Eu defined five digital competences in 2016. Later, their work was further developed into the understanding of levels of proficiency in each of these, as well as the contribution of each in the diverse undergraduate programs and the compelling need to recognize these as clues for state-of-the-art training of healthcare professionals who are up-to-date.

Some experts have defined the most important digital competences: Digital health literacy;effective management of health sciences' information; health communication; digital health sciences' content creation; health sciences' team networking; and data management and analysis. All these are currently required for effective digital communication in different audiences among varied platforms, social media, etc.

According to Masters (2017) the medical professional needs to be prepared for the e-patient. Some digital competencies that are indispensable are the know-how of social media, and use of the internet as a tool for both receiving and sharing. Masters (2017) makes enfasis that in this new technological age, the patient is now the owner of the most important tool regarding their health: information. It is the responsibility of the medical professional to teach them critical thinking while using the web regarding their symptoms and diseases. Medical professionals need to be aware of current trends and concerns their e-patients may have. Technology must be embraced as a tool in order to achieve the soft and disciplinary skills each professionals in training need.

Disease Awareness Campaign

To promote citizenship in students directed to patient education, we conducted an educational strategy for engaging them in a patient disease awareness campaign. The students were required to participate as teams in an Instagram campaign, as this is currently one of the most popular social media platforms. Teams were instructed with step-by-step activities towards the goal. FInally, students assessed the audience's learning and engagement with an online survey.

This strategy provides an opportunity for developing both disciplinary and transversal competences. The first, related to the topic of the campaign itself. The second, associated with those required for an effective performance in the community. Among these last ones, citizenship stands out, as the students' social responsibility are addressed in the aims of the campaign.

Citizenship competencies include acting with autonomy and conscientiousness in society.

This work addresses particularly the digital competencies of health sciences' digital content creation and health sciences' communication. First, learners address the audience with a professional health goal; connect and interact with the audience in a digital platform; with effective use of the internet for valuable digital content broadcasting which attracts the audience's attention. Also, they effectively use digital tools for content creation; use appropriate citation for respect for intellectual property, author's rights and licences; use digital tools for knowledge sharing with the target audience; adjust the content to current relevant health issues with creativity, with focus in solving common health problems in the community.

Issues, Controversies, Problems

Currently, higher education is changing towards providing better learning opportunities for students that encourage community awareness. Some of the healthcare programs are community-based, while others are community-oriented. In the former, the primary attention is focused on the community as a means for learning and activities are generally related to the community's needs. In the latter, most of the courses are carried out in the school, in classrooms, and some are developed in the clinic or community. In this case, the community practices are less compared to the first. In any case, the design of activities for each course can bear in mind the development of transversal competences, such as citizenship. There are some universities whose primary attention is towards training professionals who mostly go into a postgraduate

program. In these, the intensity of community-related activities is less as compared to those programs where most of the students will not seek a postgraduate degree.

Some private universities find it controversial to involve their students in a wide variety of community activities. Still in these programs, including activities with a profile aimed towards the development of social responsibility in students will be very regarding both for the students and the community. As a team, they can both collaborate and the results can be followed-up by future generations of students, which will have a greater impact on the community's health.

Establishing close contact and trust with the community requires some time, and leaders in the community must also be involved in these activities for them to be successful. Some social groups are more open than others, in the latter, having a member of the community as part of the team is crucial.

SOLUTIONS AND RECOMMENDATIONS

A major limitation of the project was the amount of time that the alumni had for building the social media campaign. A narrower selection of the target audience and more research regarding the behaviour of e-patients may have built a stronger campaign. The selection of the social media was done by the facilitator. Professionals in the making should research the social media usage of the target audience, in order to build the campaign around those demographic patterns. Such campaigns may include a variety of social platforms and digital instruments that may have not been explored in this project.

Given that only one campaign was done and there were no follow-up campaigns along the course, there were no observations concerning any change in conducts or habits of the target audience, that is, evaluate the impact of the campaign on the health of the e-patients in the long run. Such evaluation may go beyond the time that most professional courses usually have.

Another limitation of the project is the lack of assessment regarding the transversal competencies, even though it is inferred that those were acquired during the campaign. The evaluation should measure the level at which transversal competencies and citizenship were developed, such as communication, social responsibility, among others.

FUTURE RESEARCH DIRECTIONS

This research can be developed in different health sciences' areas and it can be implemented in different levels of health sciences' training, since the initial years of the training program. Also, they can include interdisciplinary health sciences teams with a holistic approach to the community's needs. As teams, different disciplines can develop better strategies to encourage patients, relatives, friends, etc. to become involved in their own health as they have a better understanding of the diseases and the modifiable factors within their reach.

These ideas can contribute to other areas of professional and graduate training programs. Opening the activities to include non-healthcare areas can be challenging to the facilitators, but can be achieved with a robust team of committed teachers and administrators. Since most universities have well-defined administrative roles in different programs, their contribution and collaboration is fundamental for the success of this strategy.

Ongoing citizenship competences can be addressed and assessed in students all over the world, throughout their professional training programs. This can be done both in theoretical and practical courses, as both can include activities focused on the development of these skills. Research in this field can be encouraging for the learners themselves, as they can see their contribution to the community and reflect upon their professional and personal development in these.

CONCLUSION

Students in health sciences' programs must engage in activities to enhance the development of soft skills and transdisciplinary competencies, which they require for their professional practice. Educating in citizenship competences is a priority worldwide. Patients are good allies in fighting diseases and active participants when involved in the decisions related to their own health issues. To truly understand the health implications of personal choices, one must place themselves in a broader spectrum, in which family members, friends, co-workers, colleagues, and healthcare professionals all play important roles in individual and societal health issues.

Continuous patient and family education in healthcare sciences, according to their level of literacy in the area and their particular interests is mandatory. Applying undergraduates' knowledge in favor of the community's empowerment aids in building more just societies.

ACKNOWLEDGMENT

We thank the school of medicine directives at Tec de Monterrey for their support to medical education research. Also, to the students participating in our courses where the implementation of the innovation was embraced by them will great enthusiasm.

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KEY TERMS AND DEFINITIONS

Campaign: A set of actions aimed to obtain a particular objective. Usually held in the community.

Citizenship: Competences related to the social responsibility of learners and professionals, in which one becomes an active participant working to improve the quality of life of the community, which he or she sees as their own.

Competences: Set of knowledge, skills, attitudes, and behaviors a learner should develop to efficiently perform as a professional.

Digital Competences: Competences related to the use of technology applications, in which the user is proficient in the use of effective communication skills, technological background and state of the art user of the internet, new technologies, etc.

Disciplinary Competences: Competences related to the area of expertise, those related to the professional performance of a specific discipline or area.

Disease Awareness: The mechanisms by which the health professionals teach the patient and their family members about their diseases, to collaborate as a team towards better follow-up of the patient and self-management of the modifiable factors related to his or her disease. This contributes to better health results for the patient.

Soft Skills: Also known as transversal competences, refers to those common to all the professional areas, despite the discipline of study, which enables the learner to perform effectively in the society.

Transversal Competences: Competences common to all professionals, related to the general performance in society, with peers and public, that enable the learner to effectively perform despite the specific discipline of study; also known as soft skills.

Chapter 7
They Won't Teach You This in School:
Education in Type 2 Diabetes Mellitus, a Social Media Campaign

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ABSTRACT

Diabetes mellitus (DM) has shown growing global morbidity, thus becoming a public health priority. In 2017, approximately 425 million people suffered from diabetes, and it is estimated that by 2045 the number will increase to 629 million. Type 2 diabetes mellitus (DM2), with 90% of reported cases, is

DOI: 10.4018/978-1-7998-8783-6.ch007

the most common type and is followed by type 1. In 2018, 8.6 million people over 20 years of age were diagnosed with diabetes in Mexico. This represents 10.6% of the population. In some states with a higher incidence such as Nuevo León, it is estimated that 12.6% of the population above 20 years has been diagnosed with DM. This chapter seeks to inform about type 2 Diabetes Mellitus, its way of acting and complications that it entails, and how social media can be advantageous in patient education.

ETIOLOGY AND RISK FACTORS

As a multifactorial disease, the causes of DM2 involve genetic, metabolic, and environmental factors:

- The genetic factor can be seen in people with first-degree relatives with DM2, they have a 5-10 times higher risk of developing the disease. There are at least 100 genes associated with a low or moderate risk of developing DM2 and some interfere with insulin secretion (McCulloch, 2019).
- Metabolic and environmental factors sometimes are related. A sedentary lifestyle and visceral obesity lead to a higher risk of having this disease since more than 80% of the cases of DM2 are associated with obesity. Weight loss along with diet changes have been shown to reduce insulin resistance and improve glucose tolerance. (Abbas, 2015).
- A BMI of ≥25 Kg/m2, classified as overweight, and the lack of physical inactivity can be considered as decisive factors. Other determinants: ethnicity, a previously identified IFG (impaired fasting glucose) or A1c (glycated hemoglobin) of 5.7 to 6.4%, history of gestational DM or giving birth to a child with a birth weight >4kg, hypertension (≥140/90 mmHg), HDL cholesterol concentration <35 mg/100 mL (0.90 mmol/L), triglyceride concentration >250 mg/100 mL (2.82 mmol / L) or both, medical history of polycystic ovary syndrome or acanthosis nigricans, as well as cardiovascular disease background (Jameson, 2018).

PATHOPHYSIOLOGY

In most cases, multiple genes responsible for pancreatic development and insulin synthesis, secretion, or activity are involved while monogenic DM2 rarely occurs. Some of which are frequently associated with the development of the disease are listed below:

- SLC30A8 (*Solute Carrier Family 30 Member 8*), HHEX/IDE (*Homeobox, hematopoietically expressed; Insulin-degrading enzyme*), and KCNJ11 (*Potassium Inwardly rectifying channel subfamily J member 11)*, involved in the development of β cells (McCulloch, 2019).
- Polymorphisms in the TCF7L2 gene (transcription factor 7-like 2) have been associated with an increased risk of DM2.
- Mutations in MODY 2 and MODY 4 (Maturity Onset Juvenile Diabetes), although they rarely occur, have an autosomal dominant inheritance pattern and are associated with insulin resistance and its altered secretion, mainly in people inside the normal weight range and under 25 years of age (Chatterjee, 2017).

Metabolic defects are associated with insulin resistance, due to an altered response of peripheral tissues to insulin, especially skeletal muscle, adipose, and liver tissue. This results in the inability to inhibit

gluconeogenesis in the liver, causing high fasting blood glucose levels. Additionally, smooth muscle glucose uptake and glycogen synthesis after a meal are impaired, leading to postprandial glycemia. The inhibition of lipase protein activity in adipose tissue is also affected, which causes an accumulation of free fatty acids and in turn amplifies the state of insulin resistance. Finally, there is a reduction in the expression of GLUT4 transporter on the surface of skeletal muscle cells. It is known that one of the mechanisms by which physical activity improves glucose sensitivity is by increasing GLUT4 (Gaster, 2001).

In the early stages of the disease, β cell function increases to counteract insulin resistance and maintain euglycemia. However, as the disease progresses, β cells' ability to adapt to the disease's long-term demands is depleted, inducing a transition to a state of relative insulin deficiency (Gaster, 2001).

The risk of diabetes increases proportionally with body mass index. Insulin resistance is frequently associated with central obesity, also known as abdominal or visceral obesity; this is because central adipose tissue is more lipolytic than peripheral adipose tissue, which explains free fatty acid accumulation (McCulloch, 2019).

The excess of free fatty acids causes an excess of other toxic cytoplasmic mediators that decrease insulin signaling, increasing gluconeogenesis. Regarding adipose tissue, besides being a fat deposit, it functions as an endocrine organ that secretes hormones called adipokines, some of which promote hyperglycemia, and others, such as leptin and adiponectin, has the opposite effect as they reduce blood glucose. Adiponectin concentrations decrease in obesity, this contributes to insulin resistance as well (Spranger, 2003).

Simultaneously, in response to the excess of free fatty acids or blood glucose, cytokine-mediated inflammation takes place, this generates insulin resistance and a decrease in β-cell function (Figure 1).

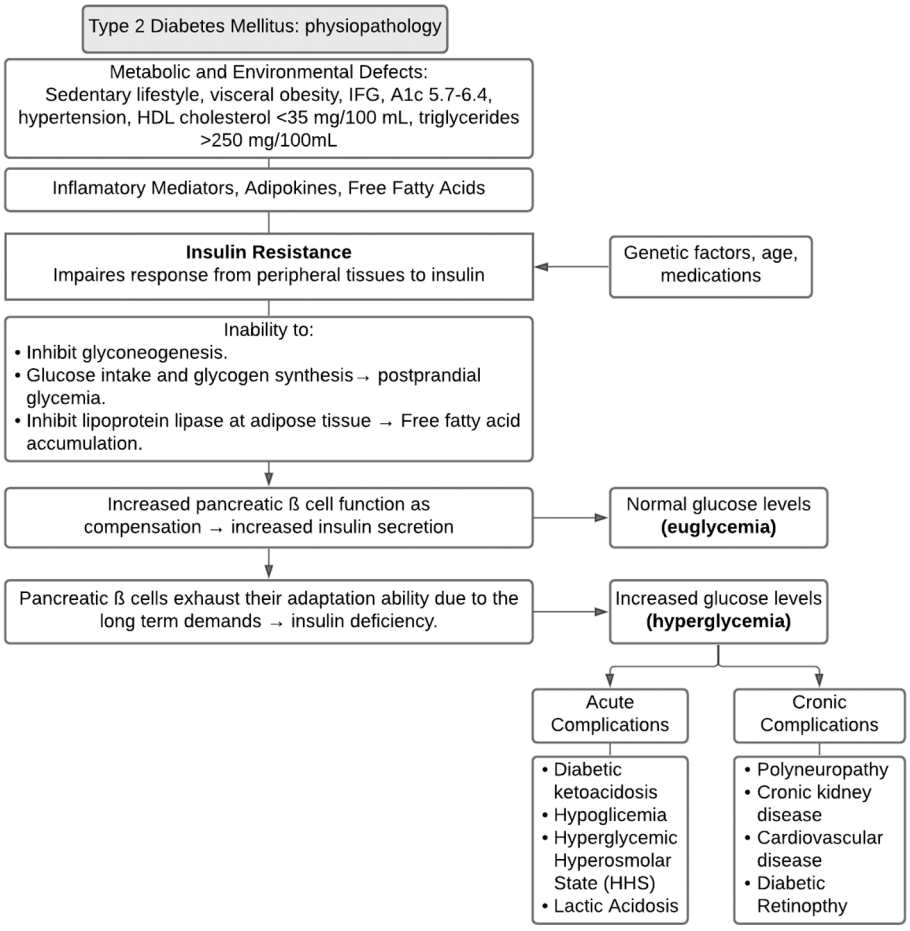
CLINICAL MANIFESTATIONS

Symptom onset of DM2 generally appears in middle or advanced ages. The symptoms develop insidiously and progressively over weeks or months and the finding of hyperglycemia is frequent even in asymptomatic patients. According to Inzucchi & Lupsa (2020), signs and symptoms are variable, however, the most frequent are the following:

- Hyperglycemia (blood glucose levels ≥200 mg/dl).
- Polyuria, since hyperglycemia produces compensatory mechanisms through urine, which causes renal elimination of glucose; that is, from lower to higher osmolarity, which leads to a hyperosmolar hyperglycemic state and this, in turn, triggers the polyuria reaction.
- Polydipsia, excessive urination generates a state of dehydration that leads to the development of excessive thirst.
- Polyphagia, as there is no glucose entry into the tissues, the brain sends signals for the patient to constantly feel hungry.
- Weight loss, mainly due to the loss of muscle by catabolic processes.

Some other clinical manifestations that could emerge include: blurred vision, dry skin (Goyal R., 2019), oral disorders such as gingivitis (Inzucchi, 2020), extreme fatigue and weakness, irritability, and mood changes, paresthesia, or tingling (Hackett, 2009).

Figure 1. Type 2 Diabetes Mellitus: physiopathology (Chatterjee, 2017), (Gaster, 2001), (McCulloch, 2019), (Spranger, 2003)
Source: Chatterjee, 2017; Gaster, 2001; McCulloch, 2019; Spranger, 2003



DIAGNOSIS

The findings in **table 1** contribute to the prevention of the illness, because if they demonstrate the existence of insulin resistance the patient is in time to stop the progression to diabetes. ADA suggests screening the population that is over 45 years old, every three years, also constantly screen the population that is overweight or obese (BMI >25 Kg/m^2). It is uncommon that a patient with diabetes mellitus type 1 gets a hyperglycemic period without any symptoms, but when there's the uncertainty of the diagnosis of DM1 demonstrating the presence of antibodies such as AD-65, IA-2/ICA-512, ZnT8, and insulin can clarify the diagnosis. (Jameson, 2018).

Table 1. ADA diagnostic criteria for Diabetes Mellitus

American Diabetes Association (ADA) Diagnostic Criteria for Diabetes Mellitus and Insulin Resistance		
	Insulin Resistance	**Diabetes Mellitus**
HbA1	5.7 - 6.4	≥ 6.5%
FPG	100-125 mg/dL	≥ 126 mg/dL
OGTT	100-199 mg/dL	≥ 200 mg/dL
RPG		≥ 200 mg/dL
HbA1: glycosylated hemoglobin. **FPG**: fasting plasma glucose. **OGTT**: oral glucose tolerance test. **RPG**: random plasma glucose.		

Source: Jameson, 2018

TREATMENT

Specific treatment is determined by the doctor based on age, health status, disease progression, and tolerance to certain medications. Firstly, it seeks to eliminate symptoms and stabilize blood glucose levels. In the long term, it intends to prolong life and prevent possible complications to improve the patient's quality of life (Gardner & Shoback, 2018).

A balanced diet that limits carbohydrate intake and substitutes some calories with monounsaturated fats is recommended. Examples of monounsaturated fats are olive oil, canola oil, or oils found in avocado and nuts, as they can help in lowering triglyceride plasma levels and increase HDL cholesterol.

Additionally, weight reduction through calorie restriction is an important nutrition goal. Cholesterol should be limited to 300 mg per day, and patients with LDL cholesterol above 100 mg/dl should limit their dietary cholesterol intake to 200 mg per day. High protein intake can lead to the progression of kidney disease in patients with diabetic nephropathy; in this case, it is recommended to reduce protein intake to 0.8 kg/day. Finally, food with a high soluble fiber content such as oats, cereals, and beans is recommended, due to its favorable effects on cholesterol plasma levels (Gardner & Shoback, 2018).

The regular practice of physical activity for at least 30 minutes during 5 consecutive days, not only increases muscle glucose uptake but also improves insulin sensitivity and allows weight control, which prevents obesity progression and its consequences.

According to Laudo and Puigdevall (2016), drugs for the treatment of hyperglycemia in DM2 are classified as:

1. Sulfonylureas are often prescribed to treat hyperglycemia.
2. Metformin, which acts primarily on the liver and the peroxisome proliferator-activated receptor (PPAR) agonists, Rosiglitazone and Pioglitazone, its main effects are found in skeletal muscle and adipose tissue.
3. Those that affect glucose absorption: α-glucosidase inhibitors such as Acarbose and Miglitol.
4. GLP-1 receptor agonists and DPP-4 inhibitors, whose effects are analogous to those of incretin.
5. Other medications include pramlintide, which lowers glucose by suppressing glucagon and slowing gastric emptying.

Insulin should be administered to people with type 2 diabetes whose hyperglycemia does not respond to diet therapy or other diabetes medications.

Implement preventive measures, such as regular foot inspections to prevent the development of the diabetic foot, as well as regular monitoring of hemoglobin A1c levels.

PROGNOSIS AND ASSOCIATED COMPLICATIONS

According to the American Diabetes Association (ADA, 2020) type 2, diabetes mellitus can't be cured, but when patients are educated and oriented they can prevent their health deterioration. On the other hand, patients that don't have adequate control of their glucose levels struggle with different complications that affect multiple organ systems. In general, these complications can be classified as acute or chronic.

ACUTE COMPLICATIONS

Among the acute complications of DM, hypoglycemia, diabetic ketoacidosis (DKA), hyperosmolar hyperglycemic state (HHS) and lactic acidosis stand out. Hypoglycemia is an exception to the other acute complications as it is not a hyperglycemic crisis, but quite the opposite. This is the most common complication in patients under insulin therapy. Causes of hypoglycemia include uncooperative attitude in patients, counter-regulatory system problems, and diabetes complications. Symptoms of glycemia close to 54 mg / dL include tachycardia, palpitations, sweating, tremors, nausea, and hunger. These start to appear due to sympathetic and parasympathetic stimulation. When this crisis is not noticed by the physician and glucose reaches 50 mg / dL, neuroglycopenic symptoms can occur, such as irritability, confusion, blurred vision, dysarthria, among others. A decrease below 30 mg / dL can lead to impaired consciousness and seizures (Gardner & Shoback, 2018).

DKA is mainly related to increased insulin needs, which is why it is common in patients with type 1 diabetes during times of stress such as infections, trauma, heart attack, or surgery (Gardner & Shoback, 2018). However, one-third of DKA cases correspond to patients with DM2, who can also present with ketoacidosis under severe stress conditions, such as sepsis, trauma, or major surgery. The triggering mechanism for this complication is the reduction and action of insulin, or high levels of counterregulatory hormones, mainly glucagon (Martín, et al. 2019).

In the pathophysiology of ketoacidosis accelerated gluconeogenesis, glycogenolysis, and deficient glucose uptake by peripheral tissues occur, as well as an increase in circulating free fatty acids. Hepatic gluconeogenesis is the main mechanism for hyperglycemia in ketoacidosis, but renal gluconeogenesis contributes as well. Adipose tissue plays an important role too since there's a higher activity of hormone-sensitive lipase due to low insulin concentrations and glucagon activity. This increases circulating free fatty acids, which are oxidized to acetoacetate and β-hydroxybutyrate in the liver's mitochondria, resulting in ketonemia and acidosis (Karslioglu, Donihi, Korytkowski, 2019).

Osmotic diuresis is the result of the accumulation of ketone bodies and hyperglycemia. This causes a decrease in GFR and the loss of extracellular fluid, which leads to hypovolemia and a subsequent decrease in GFR (Karslioglu, Donihi, Korytkowski, 2019).

Contrary to ketoacidosis, HHS tends to occur mostly in DM2 since a higher concentration of circulating hepatic insulin can inhibit lipolysis, this could explain the absence of ketone bodies. The pathogenesis

of HHS differs from that of diabetic ketoacidosis, because there is a higher degree of dehydration in the patient due to osmotic diuresis and, as stated before, there's an absence of ketosis (Karslioglu, Donihi, Korytkowski, 2019). When serum osmolality exceeds 300 mOsm/kg, lethargy and confusion develop, if the state worsens to 330 mOsm/kg, coma may occur (Gardner & Shoback, 2018). More details of the pathophysiology of DKA and HHS can be reviewed in Figure 2, while the clinical findings of each are presented in Figure 3.

Figure 2. Pathophysiology of DKA and HSS (Karslioglu, 2019)
Source: Karslioglu, 2019

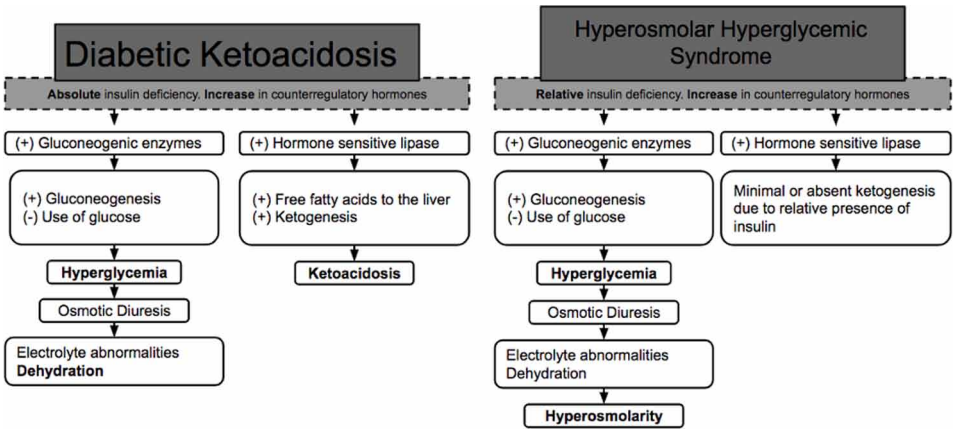


Figure 3. Clinical findings in DKA and HHS (Gosmanov, 2018), (Arroyo, 2016)
Source: Gosmanov, 2018; Arroyo, 2016

	Diabetic ketoacidosis (DKA)			Hyperosmolar Hyperglycemic Syndrome (HHS)
	Mild	Moderate	Severe	
Plasmatic glucose (mg/dL)	>250	>250	>250	>600
Arterial pH	7.25-7.30	7.0-7.24	<7.0	>7.3
Serum Bicarbonate (mEq/L)	15-18	10-15	<10	>18
Urinary Ketones	Positive	Positive	Positive	Minimum o Negative
Serum Ketones	Positive	Positive	Positive	Minimum o Negative
Anion Gap	>10	>12	>12	Variable
Serum Effective Osmolarity	Variable	Variable	Variable	>320 mOsm/kg
Mental status	Awake	Awake/Drowsiness	Stupor/Coma	Stupor/Coma
Dehydration	6L			9L

CHRONIC COMPLICATIONS

Different metabolic and enzymatic pathways contribute to the development of DM complications, see Figure 4. The following are the main chronic complications of diabetes.

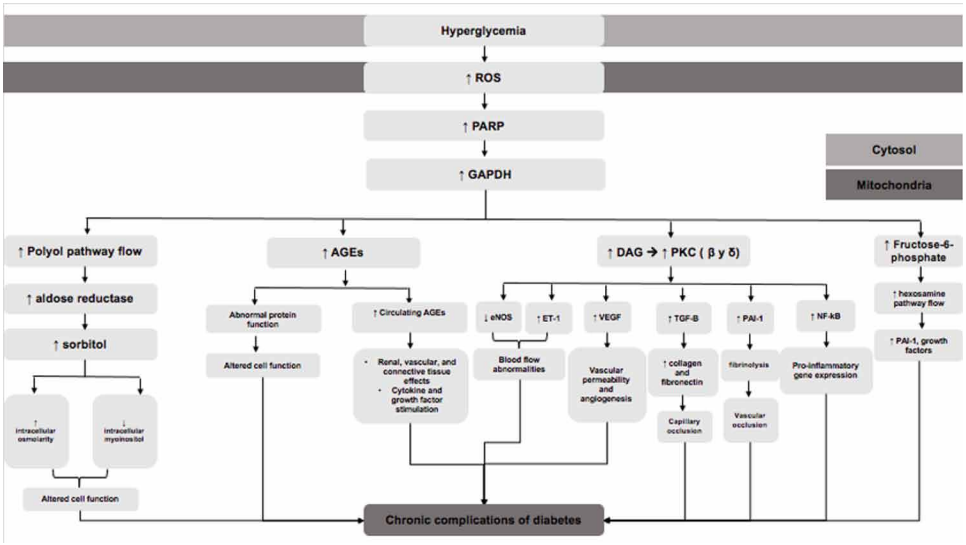
1. **Polyneuropathy**: The most frequent complication of diabetes. (Feldman, 2019). In diabetes, a complex series of metabolic and vascular factors change the balance between nerve fiber damage and repair. The most affected are sensory, distal, and autonomic fibers, thus leading to progressive loss of sensation. (Feldman, 2019). Lack of protective sensitivity can lead to foot ulcers, which is attributed to ⅔ of lower limb amputations that are carried out for non-traumatic causes in patients with DM (Páez, et al., 2016). Hyperglycemia triggers an interruption of energy in the peripheral nervous system, this interruption leads to the production of reactive oxygen species (ROS), which damage the nerves. On the other hand, activation of the polyol and hexosamine pathways, together with the formation of advanced glycation end products (AGEs), exacerbate oxidative damage. These pathways constantly occur with the continuous production and accumulation of ROS, contributing to the chronic damaging of peripheral nerves. (Feldman, 2019)
2. **Chronic Kidney Disease (CKD):** Diabetes is the leading cause of chronic kidney disease and end-stage kidney disease in the world. CKD is a complex disease in which several etiologies converge, these are ultimately superimposed on changes in glomerular hemodynamics, oxidative stress, inflammation, tubular atrophy, and interstitial fibrosis. (Mottl and Tuttle, 2020)
3. **Chronic hyperglycemia** that appears in diabetes results in the production of AGEs and reactive oxygen species. Both metabolic products activate intercellular signaling for proinflammatory and profibrotic gene expression that mediate cell injury. (Mottl and Tuttle, 2020). Likewise, high glucose levels promote the activation of enzymatic chains that favor the production of sorbitol, activation of protein kinase C (PKC), and the hexosaminidase pathway (Navarro, et al., 2008). In turn, the activation of all these metabolic pathways and products promotes the production of pro-inflammatory cytokines that participate in the development of chronic kidney disease. (Navarro, et al; 2008)
4. **Cardiovascular Disease:** There's a negative impairment of cardiac physiology due to structural and functional abnormalities in the absence of congenital heart disease, coronary artery disease, hypertension, and significant vascular disease. This disease will end in heart failure with reduced or preserved ejection fraction failure since cardiovascular disease predisposes to any type of ventricular dysfunction, which leads to heart failure (Páez, et al., 2016).
5. **Ocular Disease:** Ocular affection is characteristic of this disease, it is microangiopathy that affects small retinal vessels, arterioles, capillaries, and venules. In diabetic retinopathy, vascular injury is the basis of complications, as endothelial damage appears. On the other hand, the increase of glucose and sorbitol, which are end products of metabolism, together with hematological changes and anatomical changes in the basement membrane and pericytes, as well as physiological changes due to reduced blood supply and the breakdown of the blood-retinal barrier, influence the pathogenesis of diabetic retinopathy (Moreno, et al., 2013).

EXAMPLES OF OTHER PATIENT EDUCATION STRATEGIES

General Education Strategies

Patient education is not a recently discovered issue and it represents an area of opportunity that has evolved with the sole purpose of improving and thus giving greater scope to health promotion. Hoving et al.

Figure 4. Molecular mechanisms that converge in the chronic complications of diabetes. ***ROS*** *(reactive oxygen species);* ***PARP*** *(poli ADP ribose polymerase);* ***GAPDH*** *(glyceraldehyde-3-phospate dehydrogenase);* ***AGEs*** *(advanced glycation end products);* ***eNOS*** *(endotelial nitric oxid synthase);* ***ET-1*** *(endothelin-1);* ***VEGF*** *(vascular endothelial growth factor);* ***TGF-B*** *(transforming growth factor beta);* ***PAI-1*** *(plasminogen activator inhibitor-1);* ***NF-kB*** *(nuclear factor k-B);* ***PKC*** *(protein kinase-C) (Jameson, et al., 2018)*
Source: Jameson, et al., 2018



(2010) describe this evolution, some of these changes are attributed to the consequences of globalization being changes in culture and behavior related to lifestyles such as diet, exercise, and safety measures to prevent exposure to hazardous substances. Therefore, as time passed, these transitions changed health promotion messages and actions. At first, transferring knowledge was exclusively fundamental, eventually, the model became more complex; psychological and behavioral studies introduced the concepts of influence and self-efficacy of social media in patient education, becoming a challenge for health professionals. This highlights the importance of patient empowerment through educational strategies and health awareness, in self-management and shared decision-making.

The acquisition of new self-management skills arises in an environment of respect, in which the strategies promote an egalitarian dialogue that gives space for feedback and participation. As far as it has been sought to encourage patients to apply critical thinking in decision-making, there has been a transformation from a unidirectional model of patient education in which the patient received information without contributing anything, to a bidirectional model in which the patient and their family are more involved in decision-making and play an active role in their health care. Garcia et al. (1997) demonstrated the positive effect on the progression and treatment of diseases such as diabetes mellitus. It was stated that an efficient pedagogical model required a simple message, the breaking of a unidirectional information scheme, a language easy to understand without taking into account educational background, the use of necessary resources, and the prioritization of preserving the population's health.

Using the study, technological media and resources were not considered, nevertheless, the project *Interactive Communication and Education in Health and Its Application in Diabetic Patient Control*

doesn't dismiss that they're useful depending on the purposes of each investigation. It is pointed out that active and responsible participation on behalf of the population over its self-care is crucial and implementing communication models that benefit such participation. They used as a method a case-control study from 1992 to 1993 that took place at Centro de Atención al Diabético of the Instituto Ecuatoriano de Normalización (INEN). There were 80 participants, 50 followed an interactive education model (n=50) and 30 the traditional one (n=30). The results showed that those who participated in an interactive education model gained a greater amount of knowledge about the disease ($P < 0,05$), treatment adherence was significantly greater ($P < 0,02$), there was more responsibility, autonomy, and security over the treatment ($P < 0,01$), and presented a decrease in blood glucose levels ($P < 0,02$) (García et al., 1997).

Riquelme (2012) emphasizes the importance of providing information through proper means to have better control over patients' education and lifestyle which are health-defining factors. This depends on their ability to learn new skills that allow them to be aware of their reality through experiences, their knowledge, and their capacity to change after receiving new information. In addition, the learning model proposes to start by being aware of the situation, to later deepen in it, and finally be capable of acting. It features an analysis technique where the receptor is called upon to be critical about their situation and directed to seek solutions on their own. The method introduced by Riquelme (2012) consists of first identifying the target public, then gathering the participants, after this carrying out an intervention to establish at the end an evaluation that rectifies the participants' learnings.

The importance of patient education and the evolution of teaching methods throughout history is illustrated by the use of different strategies that involve, for example, traditional methods such as pamphlets, and more recently websites and social media. Over the last decades, health specialists have made a great effort to introduce innovative digital strategies that focus on patient education. Significant beneficial changes have been demonstrated in diabetic patients in the cases where they constantly collaborate in decision making within their treatment, an improvement in their quality of life and metabolic control can be seen especially during the first months (Millaruelo Trillo, 2010). Since diabetes is a chronic disease that requires long-term treatment, patients are demanded to be able to master a certain lifestyle that relies on themselves, ranging from simple procedures such as a balanced and healthy diet to more complicated ones like the use of insulin pump therapy.

There are new technologies that focus on educating healthy people and scholars to prevent diabetes; others that while educating, also monitor blood glucose, blood pressure, and weight of patients with type 2 diabetes; further, there are mobile applications that promote physical activity (Chávez Elorza, et al. 2019). Instagram is a tool chosen by health professionals as it has around 300 million active users per month and more than 70 million images are uploaded daily (Instagram.com/press).

Yi-Frazier et al. (2015) carried out a project similar to ours since they used the platform Instagram, called "Photovoice". It aimed to provide information to patients with type 1 diabetes, they were asked to post for 3 weeks personal images that depicted the disease. Most of the posts shared advice, recipes, medications, and humor. Images were followed by a text that described them, and users were asked to keep their *inbox* open for better interaction, discussion, and doubt solving. "Photovoice" has also been used by other groups of patients with different diseases, including adolescents with chronic illnesses such as cancer and adults who suffer from obesity or with intellectual disabilities. The authors concluded that the results met their expectations as an aid during the treatment of said patients and they felt empowered since, for those who have learned through experience, social media can make it easier for them to connect with others who have lived similar events.

Instagram is just one among thousands of active social media that can be used for health promotion, Cooper et al. (2014) describe the case of a nurse that had type 1 diabetes, who after starting an account on Twitter said "Through this community, I have learned a lot more about diabetes despite having suffered from it for 34 years and being a nurse. For example, by joining discussions, now I feel more confident about using insulin pump therapy and other procedures I had rejected". Physicians should look at this exposure to social media as an opportunity, rather than a threat, and take advantage of it.

MAIN FOCUS OF THE CHAPTER

Educational Strategies for Diabetes Mellitus

Diabetes education is critical for people who present risk factors and those who have already been diagnosed with diabetes (Pilar Hevia V., 2016). To fight diabetes world prevalence, different strategies have been implemented over the last decades to encourage the prevention of metabolic diseases, these have promoted the importance of carrying out physical activity, having a balanced diet, not smoking, maintaining weight, among others.

Some countries have developed initiatives and certifying bodies for diabetes educators, such as the American Association of Diabetes Educators (ADCES) in the United States or the International Diabetes Federation (IDF) with its headquarters in Chaussée de La Hulpe in Belgium (Pilar Hevia V., 2016). Moreover, the results of interventions in Finland, China, India, the United States, and Japan have demonstrated that the implementation of programs endorse the adoption of healthy lifestyles and can reduce the development of type 2 diabetes mellitus (DM2) up to 58% in a high-risk population.

For instance, the project Diabetes Attitudes Wishes and Needs (DAWN) carried out in 2001 (Hevia, 2016) was a multinational study that included 13 countries across four continents (Diabetes, 2013). Its goal was to call for improved care for patients with this metabolic disease by creating and refining strategies of educational programs focused on diabetic self-control, as well as providing psychosocial support and improving patient-centered care policies (Pilar Hevia V., 2016).

In Latin America studies focused on diabetes prevention have also been performed. In 2016, a study that included three municipalities of the Province of Buenos Aires evaluated the well-being, eating habits, and physical activity of 500 participants. They had a follow-up every 6 months for two years. During these months, subgroups of 15 people were made for them to attend group seminars held monthly during the first year of the intervention and bimonthly during the second year. Additionally, anthropometric measurements and laboratory analysis results at 0, 12, and 24 months were taken into consideration. Due to the positive response of participants and their attachment to the program, it was certain that this project could facilitate the use of diverse health promotion techniques in the public security sector (Gagliardino et al., 2016).

In 2016 the results of a study carried out in Carabobo, Venezuela was published. Such study had 80 participants and lasted 12 months, during this time participants attended month eight theoretical sessions and four practices concerning diabetes prevention. The study evaluated participants' knowledge about the disease and the risk that each of them had of developing diabetes before and after the educational interventions. After the interventions, a significant decrease in the risk of participants becoming diabetic and an increase in their understanding of the disorder were shown (Leal et al., 2017).

Patient education strategies focused on diabetes prevention have also been adopted in Mexico, as is the case of programs such as DiabetIMSS and prevenISSSTE, these aim to provide patients and their families with the necessary information for them to achieve metabolic control goals and identify complications beforehand for proper management (Figueroa et al., 2014). Another case took place in 2017 when 39 patients with DM2 from a Seguro Popular clinic at Bokobá, Yucatán attended 15 conferences. Before and after these, participants' lifestyle was evaluated through the questionnaire IMEVID which asks for aspects such as nutrition, physical activity, knowledge about DM2, therapy adherence, among others. Thus, the participants' knowledge about DM2 was determined. Overall, initial knowledge was 25.7 out of 100 points and it significantly increased after the conferences to 79.7. In addition, at the beginning of the study only three people had glycosylated hemoglobin levels under control and by the end of the intervention, the number of people with controlled levels increased to ten (Canché et al., 2019).

Talking About the Pandemic: An Introduction to Why the Format Had to Change

Given the context of the COVID-19 pandemic, the need for a fully digital campaign arose in line with the global trend of transferring all educational activities to an online format. As mentioned earlier, Instagram was the online platform of choice because of its high daily reach in users between 18 and 34 years old (Bargueño, 2020). Even though the average age of people with DM2 in Mexico is older, we are convinced that a major challenge for the health sector is promoting the prevention of chronic degenerative diseases long before its onset; that is to say, by providing information and raising awareness among young people. Through several longitudinal studies around the world and in Mexico it has been demonstrated that once a person has the right information about a disease and becomes aware of the damage it causes, both physically and psychologically, they look for ways to avoid it.

After analyzing and interpreting longitudinal studies that proved that educational interventions on individuals have a great impact, observing DM2 prevalence and its high mortality rate in our country, and realizing the impact we have over Mexico's public health sector as to future health professionals, we decided to launch an awareness campaign. Since the results obtained were positive, other health professionals need to start carrying out similar practices. The reported data gathered from Encuesta Nacional de Salud y Nutrición (ENSANUT) in 2018 supports that current diet and physical activity patterns are not as favorable as expected in pursuing an ideal lifestyle. Moreover, according to the Federación Mexicana de Diabetes, DM2 is the second cause of death in the country.

Campaign Description and Impact Evaluation

The campaign "diabetesdiaries.emis" was launched by Health Sciences students during the Fall Semester August-December 2020. This campaign was designed for the subject Fisiopatología del Sistema Endocrino, with the professor's support who, as the group leader, guided the students to search for relevant information about diabetes. Following this, they promoted the disease's prevention and diffused its consequences through an Instagram account. The campaign's target audience was composed of Instagram users who had diabetes or were relatives of patients with diabetes and sought information about the disease.

Instagram was the social media of choice to reach the objectives set for the campaign since it is a platform that allows users to interact with their followers with the use of text messages, images, videos, *Insta stories*, these last posts are short videos and pictures that are deleted after 24 hours and allow users to publish surveys and links directed to online surveys.

The campaign's teamwork used said tools within the platform to have a greater engagement, so the published information could reach a wider audience. Demographic characteristics such as age, sex, or geographic location were not taken into account since the campaign pursued that its information reached as many people as possible and created an impact on them.

Most Instagram users interact majorly with *Insta stories* because its access is faster and the platform encourages its use, making them become an important tool for the diffusion of information and news mainly among young people (Vázquez, 2019). This is the reason why the campaign's team kept active the account "diabetesdiaries.emis" by posting *Insta stories* for its followers to know about new posts and the survey that was planned to be published by the end of the campaign. The main participants of the campaign were 287 Instagram users who were active followers of the account "diabetesdiaries.emis". At the end of the campaign, a sample of 152 users between the ages of 16 and 35 was taken from this population and they were asked to answer a survey that evaluated their knowledge about diabetes. This survey was published on different social media being Instagram, Whatsapp, and Facebook.

IMPACT EVALUATION

The campaign was executed by sharing information regarding diabetes through an Instagram account under the name"diabetesdiaries.emis". Such information included risk factors, the definition of diabetes, a description of insulin, an explanation of the events that lead to insulin resistance, signs and common symptoms, methods used in the diagnosis of diabetes, differences between type 1 and type 2 diabetes, ways to prevent the disease, and healthy snack ideas. The information provided to the population of the study aimed to educate them and identify if by receiving these facts they changed aspects of their lives and expanded their knowledge about the disease. The campaign took place for 2 weeks and had a total of 12 publications, of which 9 contained the previously mentioned information. The campaign's Instagram account earned 287 followers and a total of 395 likes distributed among its 12 publications, being 78 the maximum number of likes one of them received.

At the end of the campaign, a short 23-item survey was released for a week to identify the scope of the campaign in terms of the audience learning about the disease and receive feedback on the campaign. Out of 287 followers, only 152 answered the survey, this represented 53% of the population reached with the account's publications. The majority of the answers came from people between the ages of 16 and 24, this agrees with the average age of Instagram users that was mentioned before. Of these, 66% were women and 33% were men (Figure 5). Regarding risk factors, which was one of the first questions to understand the impact of the campaign, the results showed that 139 people belonged to the population at risk, and 52 had a sedentary lifestyle (**Table 2)**.

Participants were asked for feedback on which topic about diabetes they considered the most beneficial in their case, the option with the highest number of votes was *prevention* with 110 votes (Figure 6), the second was *risk factors* with 104 votes and the third place was for *signs and symptoms of DM2*. On the other hand, the uploads that had the lowest impact were: *What is insulin? What is insulin resistance?*, and *Comparing Type 1 and Type 2 Diabetes*.

In the process of evaluating participants' learning, it was shown that before the campaign, 52.4% of them knew little or nothing about diabetes. By the end of the campaign, 53% of those who answered the survey said they had learned a lot and 35% responded that they didn't learn much about the disease (Figure 7). Part of the most relevant data from the survey was the interest of the population in getting

Figure 5. Age and gender of surveyees

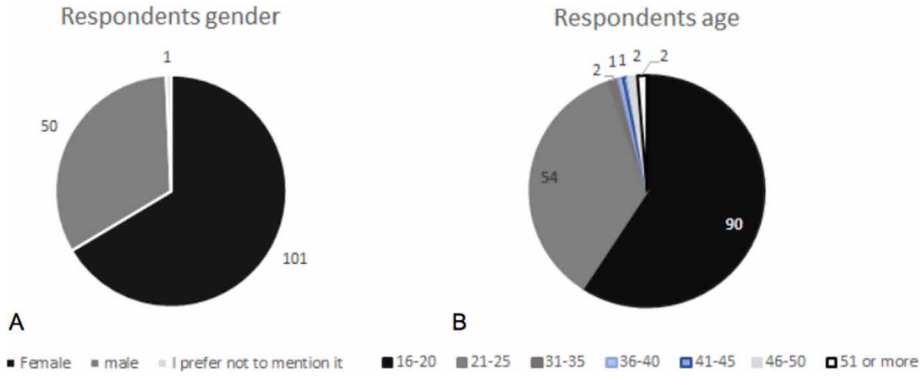


Table 2. Risk factors for developing type 2 diabetes mellitus

Risk Factors	Responses
Be Hispanic, Afro-American, or Asiatic	139
Being sedentary	52
Affected first-degree relative	29
Being overweight or obese	29
Have a waist circumference >90 cm being a man or > 80 being a woman	26
High visceral fat	17
Being a smoker	10

Figure 6. Publications with greater utility in the population

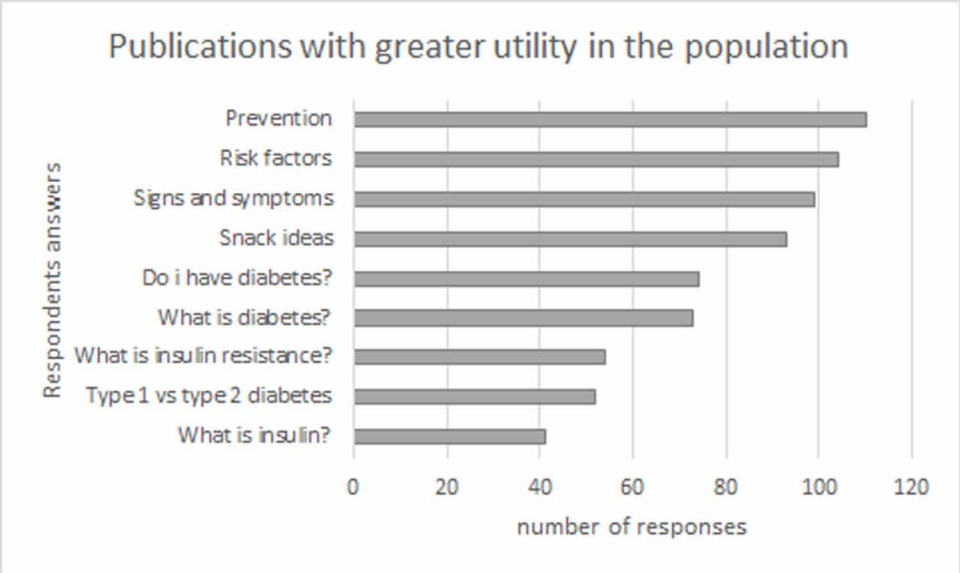
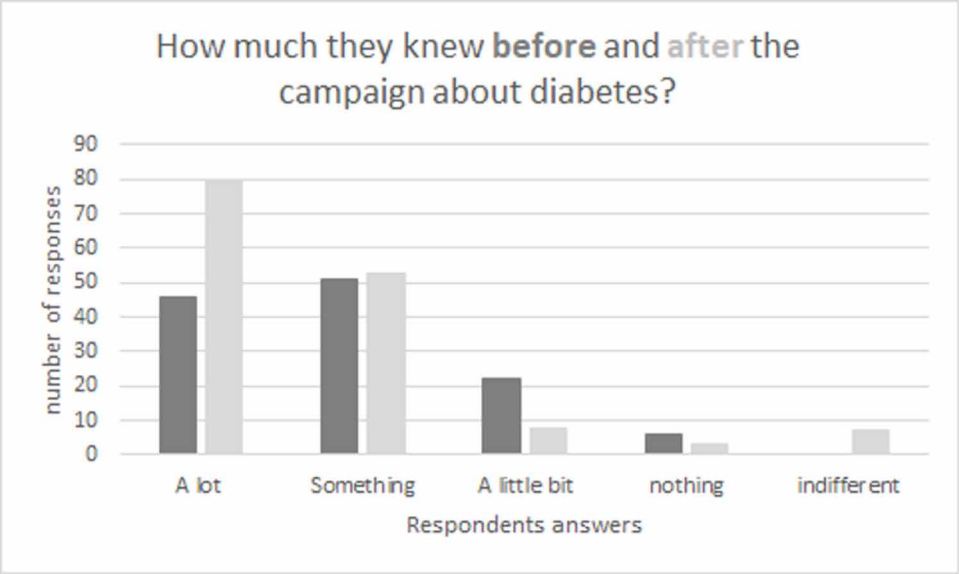


Figure 7. How much the respondents knew before and after the campaign about diabetes



informed and making changes in their lifestyles since 73.3% of the studied population felt motivated to make changes in their lifestyle to take action and prevent the development of DM2 (Figure 8). Finally, to confirm how much the audience learned, 5 items were used in a test applied to the population of the study. Table 3 exposes the percentage of correct answers regarding these questions.

Starting on October 26, 2020, nine *Instagram posts* and several *Insta stories* (previously described) were uploaded, this shared information concerning diabetes mellitus. From all the uploads, those that

Figure 8. The motivation of the respondents to change their lifestyle after the campaign was done

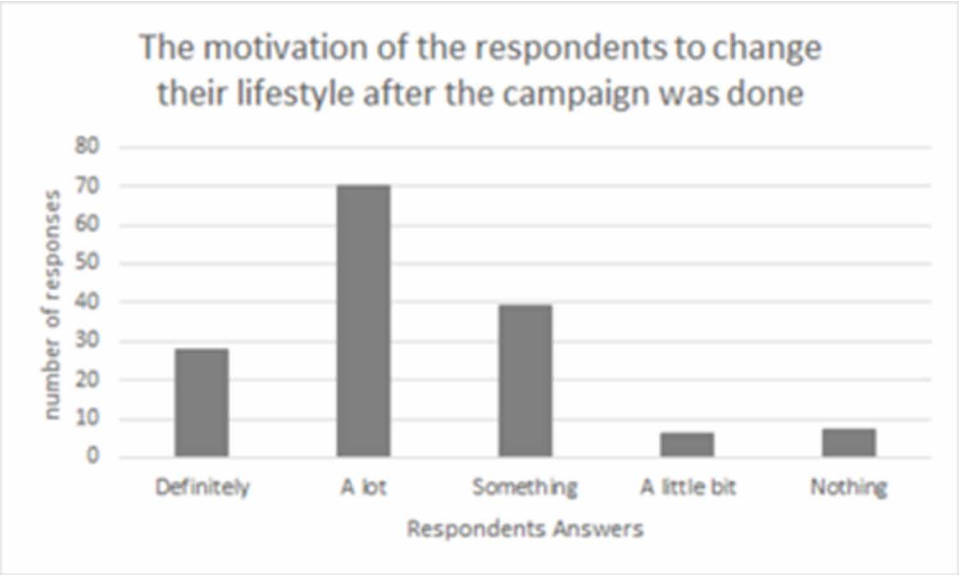


Table 3. Questions about DM2 and their respective percentage of assertiveness by the surveyees

QUESTION	PERCENTAGE OF CORRECT ANSWERS
Choose the characteristic that differentiates type 1 diabetes from type 2	96.1%
While being in a fasting state, if my glucose is in 95 mg/dL, do I have diabetes?	87%
What is insulin resistance?	81.5%
Which one of the following could be present in type 2 Diabetes Mellitus	81.5%
True or False, insulin is a hormone that helps glucose (sugar) enter cells in the muscle and liver	80.9%
If someone has fasting glucose levels of 140 mg/dL, it can be deduced that ….	78.1%
What is the main difference between type 1 and type 2 diabetes?	65.5%

had the greatest amount of interactions, being *likes* or *shares*, were selected since they represented the ones that had a considerable impact. As seen in Figure 9, *posts* were uploaded in an order that seemed like an infographic, these consisted of a cover that introduced the topic followed by another picture that contained a brief description of it. The images observed in Figure 9 were chosen as the campaign's first upload since they were seen as useful to introduce the disease and its pathophysiology in a way easy to understand. This had a significant amount of interactions, being 78 *likes*, and became the one with the highest engagement. It described how type 2 diabetes mellitus is a chronic disease that affects the body's glucose metabolism and the role insulin plays in it.

Describing the origin of the disease and some diagnostic values found in insulin resistance were considered as a didactic strategy for the campaign. A detailed description of what insulin resistance involves and laboratory findings that characterize it can be identified in Figure 10. Instagram users that had access to this information had the opportunity to understand, through a brief explanation, the mechanism of resistance and its relationship with the subsequent development of diabetes. The laboratory tests included in Figure 10 are important in the diagnosis of insulin resistance.

Figure 11 points out diabetes risk factors. This set of images was chosen as one of the first three uploads due to its relevance in the prevention of the disease. This *Instagram post* was selected from all 12 publications since it was the third one in the list of those that had the greatest number of interactions. It shared the main causes of the disease such as being Latin, African American, or Asian, family history of diabetes, being overweight, high visceral fat, abnormal cholesterol, and triglycerides levels, high blood pressure or receiving treatment for any of this, and history of gestational diabetes or polycystic ovary syndrome. An additional picture that included more specific risk factors was uploaded, these included the following: suffering from fatty liver disease, the use of glucocorticoids or antipsychotics, endocrine and genetic diseases. The information shared in the images from Figure 11 intended to alert Instagram users that interacted with the campaign on how they could be predisposed to develop type 2 diabetes mellitus and consider choosing a healthier lifestyle.

This was the first set of pictures shared in the Instagram account, it was considered useful in the introduction of the disease and its physiopathology in a way easy to understand. This Instagram post had a significant amount of interactions, being 78 *likes*, and became the one with the highest engagement. It describes how type 2 diabetes mellitus is a chronic disease that affects the body's glucose metabolism, and the role insulin plays in it. It included an image that represented graphically the disease's pathophysiology.

Figure 9. What is type 2 diabetes?

These images are relevant as they explain in a detailed way what insulin resistance involves and laboratory findings that characterize it. Instagram users that had access to this information had the opportunity to understand, through a brief explanation, the mechanism of resistance and its relationship with the subsequent development of diabetes. The laboratory tests included are important in the diagnosis of this stage that potentially leads to diabetes.

This set of images was one of the first three uploads due to its relevance in the prevention of the disease. This *post* was selected since it was the third one in the list of those that had the greatest amount of interactions. It shared the main causes of the disease such as being Latin, African American, or Asian, family history of diabetes, being overweight, high visceral fat, abnormal cholesterol, and triglycerides levels, high blood pressure or receiving treatment for any of this, and history of gestational diabetes or polycystic ovary syndrome. An additional picture that included more specific risk factors was uploaded,

Figure 10. What is insulin resistance?

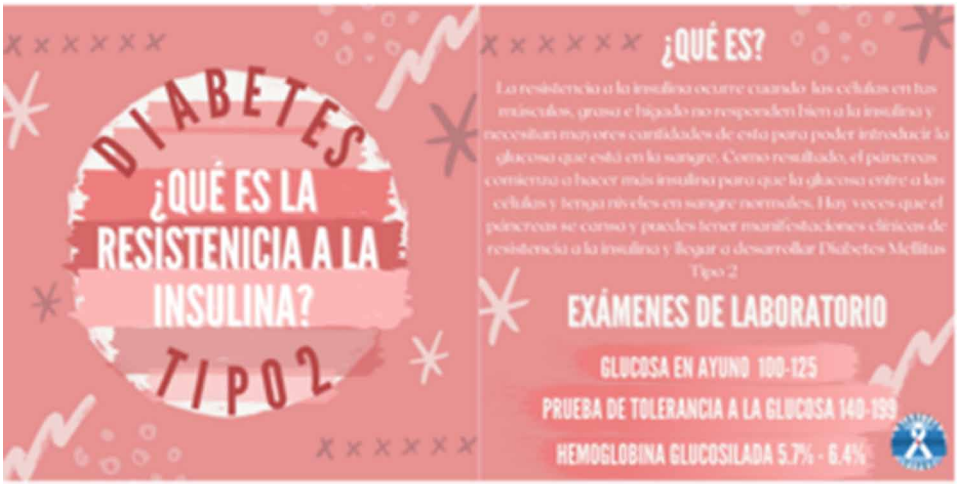
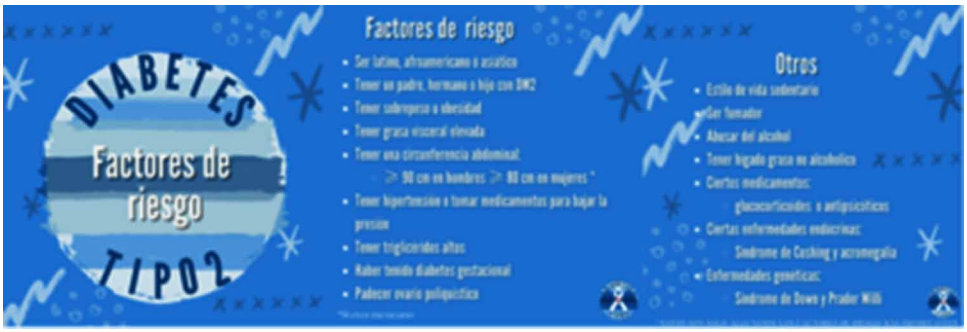


Figure 11. Risk Factors



these included the following: suffering from fatty liver disease, the use of glucocorticoids or antipsychotics, endocrine and genetic diseases. The information shared in these images intended to alert Instagram users that interacted with the campaign on how they could be predisposed to develop type 2 diabetes mellitus and consider choosing a healthier lifestyle.

SOLUTIONS AND RECOMMENDATIONS

Directions for Future Studies

Social confinement imposed by COVID 19 became an opportunity to reach a greater audience through social media. In the beginning, designing a strategy to approach the corresponding audience for the campaign was a significant issue since 69.7% of Instagram users from Mexico have between 18 and 34 years of age (Bargueño, 2020) and the average age of patients with type 2 diabetes mellitus in Mexico is 60 (Rojas-Martínez, 2017). However, the campaign setting that education over such a prevalent disease should be addressed to a young population who is interested in changing habits, for this reason, the attention of Instagram users that followed similar accounts were sought. Another obstacle was writing the information that would be shared understandably; nevertheless, this was solved by using animated figures.

Usually, most campaigns that focus on chronic degenerative diseases consist in the presentation of the disease and do not highlight the importance of their prevention. This limits the engagement with the audience since presenting solely the disease is merely expositive. Identifying since the beginning which messages did not go with the campaign's goals and keeping in mind that shared information had to be written in a simple way that didn't diminish its quality or profoundness was key. Carrying out the campaign as a team made it become a project with a modern vision that used misconceptions that the population had to explain what diabetes is.

Reaching an interested audience or one that would benefit from the chosen subject is one of the most important factors to consider when carrying out a campaign through social media platforms. In this case, Instagram is a platform that has a wide variety of content that competes for users' attention. Information that appears on its main page is determined by an algorithm that depends on the content that each user interacts with, consequently, the fact that users follow an account does not mean that they will be able to see all of its uploads. This became a problem since a method to call all users to see the account's content had to be found.

The main challenge faced during the execution of the campaign was reaching patients and their relatives. Although the chosen social media platform made it possible to reach those who had an active account and that followed the campaign's account, this limited the number of people who were able to interact with its content. To overcome this, benchmarking was applied by analyzing the accounts that shared content similar to the campaigns. Another strategy was to focus on publishing relevant information in a visually attractive way that portrayed self-care and avoided the assumption that studying health-related material is complicated.

CONCLUSION

Diabetes mellitus type 2 is a multifactorial disease that leads to an increase in blood glucose levels and triggers a series of clinical manifestations and complications. Knowing the clinical features and diagnostic criteria of the disease is fundamental for health professionals to identify diabetic patients and take care of them on time, to avoid chronic complications such as nephropathy, retinopathy, neuropathy, and cardiovascular diseases. Nevertheless, the population, in general, plays an important role too, even if they don't get access to accurate information all the time. This is the reason why social media should be used to share truthful health-related information, based on published studies, to get users to know or become interested in ways to improve their quality of life. This can be achieved by changing lifestyle and being able to identify, or at least wonder when one's health needs to be attended by a professional.

The fact that this information can be accessed by an immense part of the population is advantageous for each person to be aware of ways to prevent not only diabetes but other chronic degenerative diseases too. This campaign showed that society is interested in learning more about diabetes's risks and characteristics. Taking this into account, it is now up to health professionals to provide this information in an accessible way so each individual can act upon their lifestyle.

ACKNOWLEDGMENT

The completion of this chapter could not have been possible without the help of Dr. Nancy Segura and Dr. Mildred López, for their guidance, teaching, and endless support throughout our investigation. To Dr. Gabriel Salinas, who advised and helped us prioritize the key concepts during the writing of this chapter.

And last but not least, we would like to extend our appreciation to those who took the time to participate in the social media campaign, interacting with the posts and answering the surveys, whose names may not all be enumerated but made an important contribution to the completion of this project.

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

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KEY TERMS AND DEFINITIONS

Gestational Diabetes Mellitus: Diagnosed during the second or third trimester of pregnancy.

Insta Stories: Short publications made through the Instagram platform, which are only available 24 hours at the user's profile. The publications can be images (with a maximum duration of 8 seconds) or short videos (with an approximate duration of 18 seconds).

Instagram: A social network in which users can publish through images and short videos. Description of which could be included.

Insulin Resistance: Altered response of peripheral tissues to insulin, especially skeletal muscle, adipose, and liver tissue.

Other Specific Types of Diabetes Mellitus: Due to other causes: these include monogenic diabetic syndromes, exocrine pancreas disease, and diabetes-induced by other diseases, drugs, and chemical products.

Type 1 Diabetes: Caused by the autoimmune destruction of pancreatic ß cells, triggering an absolute insulin deficiency.

Type 2 Diabetes: Caused by the progressive loss of insulin in pancreatic ß cells, frequently due to a basal insulin resistance.

Chapter 8
Dyslipidemia Awareness Campaign:
A Beautiful Day to Save Lives

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ABSTRACT

Dyslipidemias are a group of disorders characterized by abnormal blood lipid levels, which can present with a different course and impair significantly the quality of life. In recent years, the disease has had a peak in its incidence being an entity poorly treated in clinical practice; thus, the purpose of this intervention was to create an awareness campaign in Instagram to educate the community about this condition. As a result, 20 posts were created, and an overall engagement of 112 followers showed that the objective was successfully achieved, and it is a growing area for extensive research in the context of future prevention and treatment.

INTRODUCTION

The lack of patient education related to the consequences of high levels of cholesterol and triglycerides represents an evident obstacle to the goal of reducing its levels in ambulatory patients, Qayyum, Chatth, Bhullar, Katsetos, and Schulman (2007) state that the gap between the achievement of the guidelines for

DOI: 10.4018/978-1-7998-8783-6.ch008

patients with dyslipidemias, the actual clinical practice and its results are wide and the reasons behind the poor achievement of the Adult Treatment Panel III of the National Cholesterol Education Program guidelines although unclear should consider factors specific to patients, such as depression, personality or other psychiatric disorder, or health beliefs. Thus, considering the first recommendation given to patients with dyslipidemia is dietary and lifestyle changes, the design of newer strategies to improve patient education is an important area of interest. Despite the approach proposed in the campaign emphasizes the use of social platforms to educate patients, it is important to mention other studied tactics that could be integrated to strengthen patients' knowledge like it is the Educative Interventions for dyslipidemias that took place in the Unidad de Salud Oziel Montecristo in Brazil (Rivero Truit and Pérez, 2019) on which patients were teach divided within random groups of up to 4 people through television, DVD, banners. Over a period of 6 months, the patients were able to construct a supporting network with their peers, among whom it was possible to personalize the doubts and progress. The results indicate that this education strategy yielded a high level of compression of dyslipidemia increased with respect to the beginning of the project, in contrast to the control groups followed in the project.

In contrast, the educational interventional study realized by the team of De Cássia, Alves, and Teixeira (2014) on children and adolescents of Brazil enlights the alternative of distinguishing peoples' lipid profile by educating on the importance of a healthy diet and health promotion, cooking workshops on healthy eating as well as interaction with the family of the participants of the study providing them with workshops nutrition and leading discussions about healthy eating and food preparations. The students were given six different classes, each fifty-minute long over a nine-month intervention period where theory and short internet videos were discussed with a dietician's guidance. Additionally, at schools, healthy food was provided and at homes, their families aided with healthy lifestyles as a result of the seminars given. Therefore, rather than directly teaching about the dyslipidemias themselves, the researchers address the prevention of the alterations of lipids and cholesterol in the blood by focusing on changing lifestyle decisions that reduce the cardiovascular risk factors of dyslipidemias. Additionally, an important takeaway of this study is the healthy eating habits that the participants kept following after the intervention ended, as it is now a great challenge for patients to stick to adhere to newer nutrition plans.

Nevertheless, as Pellisé and Sell (2009) remark, the traditional models of patient education as previously analyzed, in which the patients interact face to face with a health professional are being displaced peoples' recent practices in which they tend to rely on internets inaccurate information with regards to their diseases without consulting a medical opinion. Consequently, the high prevalence of dyslipidemias together with their health repercussions are a relevant call to action for the construction of friendly, reachable and trustworthy platforms that reproduce the success of previous campaigns at a greater scale. The results from a systematic review of programs of online patient education for type 2 diabetes or cardiovascular disease throughout 2005 to 2018 showed a positive feedback of the patients. Said results illustrated improvement through the combination of their weight, physical activity, knowledge, social support and quality of life. All this shows the potential benefit for patients with dislipidemias from online sites with general information about their health conditions as well as ways to track and better their health (Wooley, Hadjiconstantinou, Davies, Khunti and Seidu, 2019).

Table 1. Causes and risk factors of hypercholesterolemia and hypertriglyceridemia

Etiology	Hypercholesterolemia	Hypertriglyceridemia
Primary	Familial hypercholesterolemia (phenotype 2a) due to: ● Familial hypercholesterolemia ● Polygenic ● Familial defective apolipoprotein B100 ● Familial hyperalphalipoproteinemia	Familial hypertriglyceridemia (Fredrickson classification 4). Deficiency of lipoprotein lipase or its cofactor, apoprotein CII (Fredrickson classification). Hepatic lipase deficiency (Fredrickson classification 2). Primary mixed hyperlipidemia with hypercholesterolemia: ● Dysbetalipoproteinemia (Fredrickson classification 3) ● Familial combined hyperlipidemia (Frederickson classification 2b).
Secondary	Anorexia nerviosa. Cholestasis. Drugs (cyclosporine, protease inhibitors, progestogens). Hepatocarcinoma. Hypothyroidism. Nephrotic syndrome	Obesity and metabolic syndrome Diabetes Mellitus. Acromegaly. Cushing ‘s Syndrome. Stress, sepsis, burns. Chronic renal failure. Lipodystrophy. Alcohol. Drugs (estrogens, glucocorticoids, HIV treatment).
Physiological	Pregnancy and puerperium. Postprandial period. Cholesterol increases due to advanced age. Winter season.	Pregnancy.

Note: Causes and risk factors section within table was elaborated gathering information of characteristics for each type of etiology based on Semenkovish, C., & Goldberg, I. (2020) article.

DYSLIPIDEMIAS

Etiology

The study of dyslipidemias or alterations of the lipid and cholesterol metabolism is very extensive due wide range of pathologies that converge in a state of hyperlipidemia, hypercholesterolemia, or both, classified in Table 1 according to Semenkovish and Goldberg (2020). These pathologies can be analyzed considering their etiology, by primary causes, this means, those whose origin derives from a mutation for the components of lipid metabolism, or secondary causes, which arise mainly from an excess in the consumption of fats and cholesterol, from underlying diseases or from the consumption of harmful substances (Rozman et al., 2020).

Hypercholesterolemia (type I) is a consequence of the decrease or absence of the activity of the enzyme lipoprotein lipase (LPL), responsible for the degradation of triglycerides for their utilization or storage. On the other hand, hypercholesterolemia (type II), is associated with mutations in the low-density lipoprotein receptor gene (LDLR), proprotein convertase subtilisin kexin 9 gene (PCSK9), or in the apolipoprotein B gene (apoB-100). Familial combined hyperlipidemia (type III), refers to a defect in the apoB-100 gene that occurs with autosomal dominant inheritance, resulting in increased apoB-100, VLDL, and LDL lipoproteins.

However, decreased hepatic uptake with overproduction of cholesterol and decreased lipolysis leads to familial dysbetalipoproteinemia (FHD, type III). Familial hypertriglyceridemia (HTF, type IV) resides in the mutation of genes leading to the overproduction of VLDL lipoproteins. Finally, the type five dyslipidemia phenotype is defined as a combination of phenotype one and four, where patients have elevated

triglyceride and cholesterol levels, however, its etiology includes hereditary diseases and consequences of the patient's lifestyle that are present in the previous phenotypes.

Risk Factors

The events that make a person more likely to suffer from dyslipidemia will depend on whether the outcome is primary or secondary dyslipidemia. In the first one, the loss, mutation, or gain of function of the involved genes in the metabolic pathways of lipids and their transport can promote one of the five phenotypes. On the other hand, an unbalanced diet, obesity, stress, diabetes mellitus, metabolic syndrome, underlying renal and/or endocrine diseases, drugs, alcohol, and cigarette consumption or pregnancy, can induce the development of secondary dyslipidemias as seen in Table 4 (Semenkovish and Goldberg, 2020), as well as the appearance or exacerbation of the primaries.

Physiopathology

A revision of the 5 types of primary dyslipidemias is made in the following paragraphs.

Type 1: Familial Hyperchylomicronemia.

Familial hyperchylomicronemia is an autosomal recessive disorder that in 80% of the cases is a consequence of the decrease or absence of the activity of the enzyme lipoprotein lipase (LPL) that is placed in the endothelium and its primary function is to degrade triglycerides into fatty acids so it can be transported into the cells for later utilization or storage. The disease is characterized by high concentration of triglycerides and chylomicrons in serum (Burnett, Hooper, 2017). Moreover, it can be produced by mutations associated with the function of the LPL like in apoprotein C-II (ApoC-II), apoprotein A-V (ApoA5), high-density lipoprotein binding protein 1 (GP1HBP1), and lipase factor 1 (LMF1) (Burnett, Hooper, 2017) those mutations are mainly seen during infancy or in teenagers. Figure 1 represents the interaction of a chylomicron with the lipoprotein lipase located on the endothelium as an important step for the use and change of triglycerides and cholesterol for peripheral tissues.

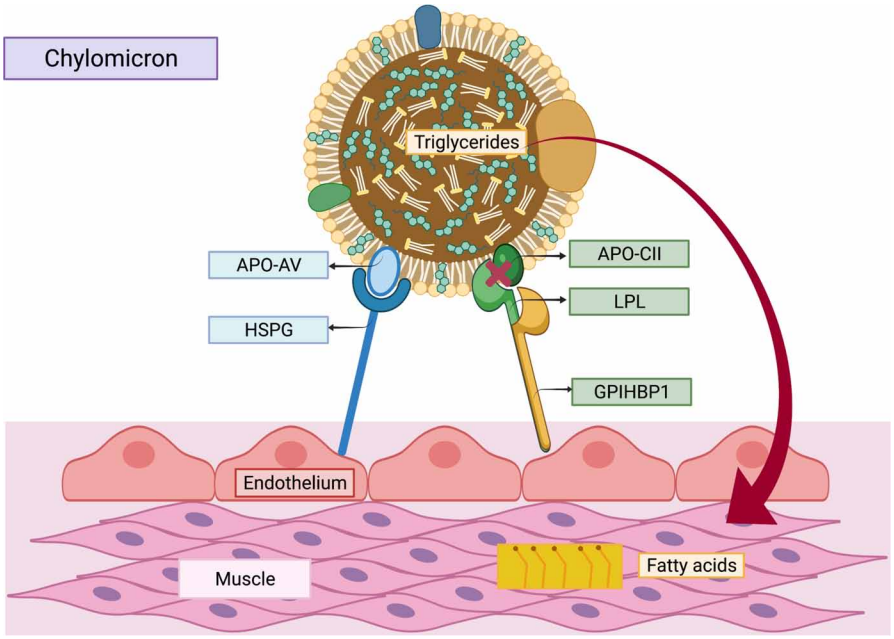
Type 2a: Familial hypercholesterolemia

There are 2 types of the second phenotype, the first (2a) is known as familial hypercholesterolemia, with an autosomal dominant inheritance, it is caused by the mutation in one or more genes involved in the catabolism of cholesterol bound to low-density lipoproteins (LDL-C), like the receptor of low-density lipoprotein (LDLR), or by the gain of function mutations in the gene subtilisin kexin 9 convertase protein (PCSK9) showed in figure 2 (Rosenson, Durrington, 2020). The disease is characterized by high levels of LDL-C in serum, and a high risk of early-onset atherosclerosis.

Type 2b: Familial Hyperlipidemia

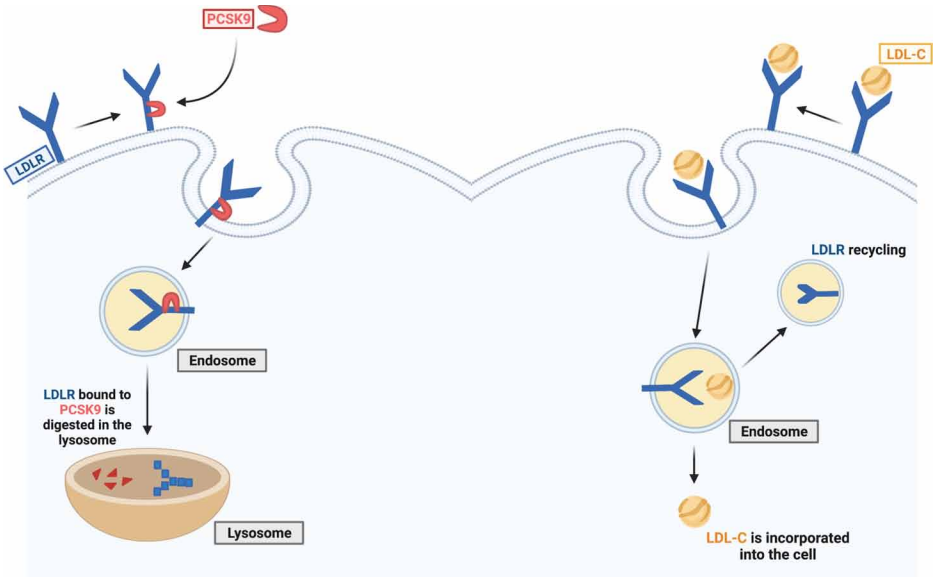
The second type (2b) known as familial mixed hyperlipidemia is the most common genetic disorder associated with a high risk of early-onset cardiovascular disease (Brahm y Hegele, 2016). It is considered to be initiated by two pathways: the first one is autosomal dominant and it involves, normally, the gain

Figure 1. Familial hyperchylomicronemia
Source:
Created with BioRender.com.



of function mutation of the gen apolipoprotein B-100 (ApoB-100), causing an increase in VLDL and dense and small LDL lipoproteins, and finally, high amounts of cholesterol and triglycerides in plasma, also there is a decrease of HDL (Rosenson y Durrington, 2020). In a second way, abnormalities in one or

Figure 2. Type 2A: Familial hypercholesterolemia. Funcionamiento de PCSK9



more genes of the lipoprotein and/or lipids metabolism (as shown in table 2), and environmental factors can induce a rise in free fatty acids, that in turn will elevate VLDL synthesis, it is important to mention that the mutation of 2 or more genes are needed in order to have the second presentation of the disease (Taghizadeh, Mardani, Rostami, Taghizadeh, Bazireh y Gheibi, 2018).

Table 2. Genes associated with the development of the 2b phenotype of Frederickson

Genes with suggested roles in the pathogenesis of FCHL	
Genes involved in the dysfunction of the adipose tissue	GPR77; leptin receptor; HSL; PNPLA2; PPARG; USF1
Genes linked to hepatic fat and overproduction of VLDL	ApoE; GCKR; OSBPL10; USF1
Genes involved in the metabolism and clearance of triglycerides rich lipoproteins	ApoA-I; ApoC-III; ApoA-IV; ApoE; CETP; GALNT2; LCAT; LIPC; LPL; RXRG; USF1
Genes involved in the clearance of LDL.	ATF6; LDLR; PCSK9

Note: Genes associated with type 2b phenotype section within the table was elaborated gathering information of characteristics based on Taghizadeh, et al. (2019) and Brouwers, et al. (2012) article.

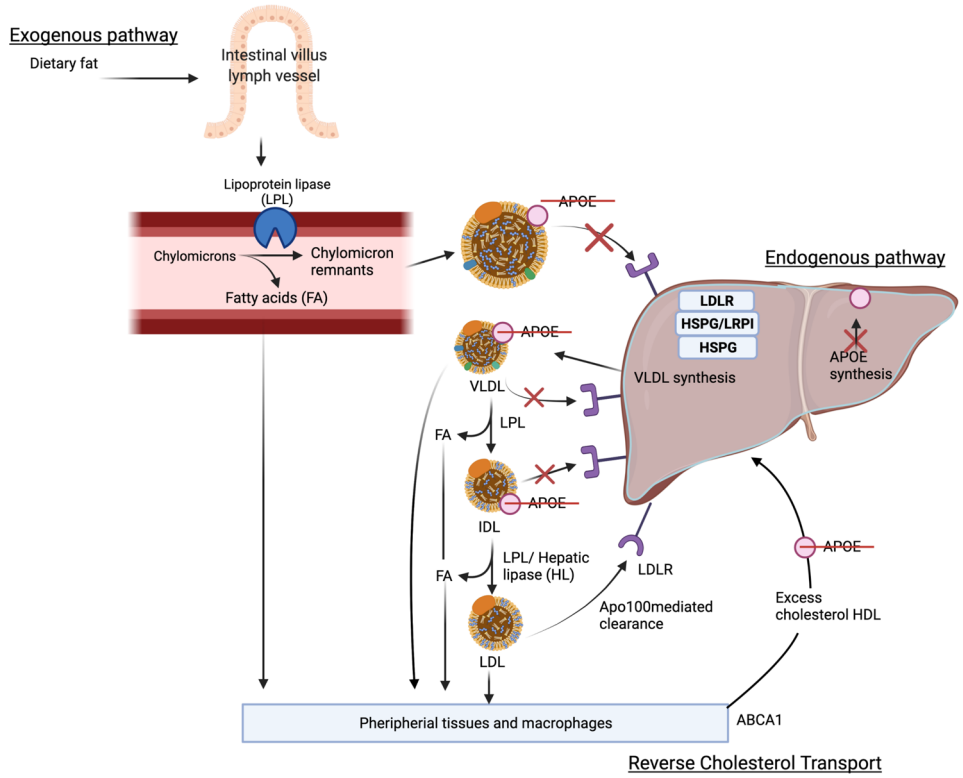
Type 3: Familial Dysbetalipoproteinemia

This disease is the result of recessive (90%) and dominant (10%) mutations in the ApoE gene (Blum, 2016) whose protein function is metabolic regulation as a ligand of low-density lipoprotein receptor (LDLR), LDL receptor-related protein I (LRPI) and heparan sulfate proteoglycan (HSPG), causing decreased hepatic uptake of lipoproteins as illustrated in figure 3 (Sniderman et al., 2018). This disease is characterized by hypercholesterolemia and hypertriglyceridemia due to the accumulation of very low-density lipoprotein (VLDL), chylomicron remnants, intermediate-density lipoprotein (IDL), and low levels of low-density lipoprotein (LDL) in the circulation. It requires a trigger factor for its appearance, it can be the coexistence of another illness or physical stress, like pregnancy (Brites et al., 2012).

Type 4 and 5: Hypertriglyceridemia due to High Levels of VLDL

Phenotype 4 has an autosomal dominant heritage, but it is thought to be polygenic. It is induced by the mutation of genes that lead to the overproduction of VLDL lipoproteins, thus causing high levels of triglycerides. Most of the patients that course with the disease are also heterozygotes for LPL mutations (Chait, 2019; Maio & Dowd, 2017) and normally asymptomatic, unless the presence of stress or other concomitant diseases, when it can be symptomatic (Chait, 2019). On the other hand, type 5 it's defined as the combination of the 1 and 4 phenotypes, in which the patients have high levels of triglycerides and cholesterol with an elevation of both VLDL and chylomicrons as a consequence of heritage and the patient's lifestyle (Rozman et al. 2020).

Figure 3. Familial dysbetalipoproteinemia
Source: Created with BioRender.com.



Clinical Manifestations

The clinical presentations in dyslipidemias are similar since the phenotypic repercussions that manifest are the result of the accumulation of cholesterol particles in the endothelium wall, consequences of high levels of triglycerides and cholesterol in the blood. The main thing that differs is the location where the signs are manifested.

Patients with elevated triglyceride levels often have a silent onset of manifestations, and over time skin lesions and eruptions such as xanthomas and xanthelasmas, lipemia retinitis due to infiltration of retinal lipids, and even hepatosplenomegaly due to the overload of lipid transport in these organs, in more severe cases triglyceride-mediated pancreatitis associated with hyperchylomicronemia may develop. On the other hand, the manifestations expressed by hypercholesterolemia also include skin lesions and can characteristically appear in the tendons and arteries. These patients are at high risk of developing cardiovascular problems at an early age due to the large accumulation of LDL within the endothelium. (Semenkovish & Goldberg, 2020). Table 3 has classified some of the manifestations that patients present according to their underlying alteration, either cholesterol or triglycerides.

In primary dyslipidemias, according to Frederickson's phenotypes, there are certain manifestations that occur specifically in one type, while there are others that are more general, for example in type 1 and 5 similarities such as pancreatitis and eruptive xanthomas are observed, while that in the other

phenotypes, xanthomas are located in certain parts of the body and there is also an association with an increased risk of coronary artery disease. These differences can be observed in table 4.

Table 3. Clinical manifestations of hypercholesterolemia and hypertriglyceridemia

Hypercholesterolemia	Hypertriglyceridemia
● Cholesterol plaque formation ● Aortic valve calcifications and stenosis ● Cholesterol deposition in tendons, mainly in the Achilles tendon - related to orthopedic discomfort ● Formation of xanthomas in the tendons of the hand ● Xanthelasmas ● Premature corneal arcus or arcus senilis ● Myocardial infarction	● Pancreatitis ● Eruptive cutaneous xanthomas on the trunk, buttocks, and extremities (characteristic of phenotype 1 and 5) ● Lipemic plasma ● Retinal lipemia (milky appearance of the vessels in the retina) ● Bright red / orange tuberculous xanthomas on palms (characteristic of phenotype 3) ● Palmar xanthomas, produce yellow deposits on the ridges of the palms (characteristic of phenotype 2)

Note: Clinical manifestations section within table was elaborated gathering information of characteristics for hypercholesterolemia and hypertriglyceridemia based on Yuan, Z-Al-Shali and Hege (2007) article.

Table 4. Diagnostic chart for Frederickson phenotypes

	Types of dyslipidemias					
	Type 1	Type 2a	Type 2b	Type 3	Type 4	Type 5
Symptoms and complications	Abdominal pain. Fatigue. Pancreatitis. Symptoms of forgetfulness and difficulty in concentration.	Chest pain (premature coronary artery disease). Premature atherosclerosis. Calf cramps. Stroke-like symptoms (trouble speaking, drooping on one side of the face). Diabetes mellitus.			No symptoms (may present early age coronary artery disease).	Hepatomegaly. Pancreatitis.
Physical examination	Eruptive xanthomas. Lipemia retinalis (Blood vessel milky in color due to increased chylomicrons. Hepatosplenomegaly.	Achilles heel xanthoma. Xanthelasmas (Cholesterol deposits on the eyelids). Obesity.		Palmar xanthomas. Tuberous xanthoma.	Obesity.	Eruptive xanthomas. Obesity. Lipemia retinalis.

Note: Diagnostic section within table was elaborated gathering information of symptoms and complications as well as physical examination based on Wolska, & Remaley (2021) article.

Diagnostic

The diagnosis of each type of dyslipidemia is obtained by gathering information on symptoms and complications, a physical examination, medical history, and laboratory tests. These tests usually include the lipid profile and on certain occasions lipoprotein or gene studies. Currently, lipid profile screening studies are being carried out to determine cardiovascular risk, a biochemical profile is also made to measure concentrations of LDL, total cholesterol, HDL, and triglycerides for a prediction of the risk of atherosclerosis (Feingold, 2020). Family history and clinical manifestations, for example xanthomas or vascular disorders, should also be evaluated. Studies performed according to each dyslipidemia are shown in Table 5.

Table 5. Diagnostic and treatment table for Frederickson phenotypes.

	Type 1	Type 2a	Type 2b	Type 3	Type 4	Type 5
Laboratory results	● Elevated TG levels (> 880 mg/dl) ● Circulating ApoB-II levels (>120 mg/dl)	● Elevated total cholesterol with LDL > 200 mg/dl ● Family history: <40 years a LDL >200 mg/dl >40 years a LDL > 250 mg/dl	● HF premature cardiovascular disease ● High levels of LDL/VLDL ● ApoB >120 mg/dL ● Elevated levels of cholesterol and/ or TG	● Genetic testing for ApoE ● High levels of IDL ● Elevated TG levels (>300 mg/dl) ● Very low density lipoprotein test (VLDL)	● High levels of VLDL ● TG (>200 mg/dL)	● High levels of VLDL and QM ● TG > 880 mg/dl ● Normal levels of LDL
Treatment	Alipogene tiparvovec (discontinued). Volanesorsen (pending approval).	Statin therapy. PCSK9 inhibitors. Plasmapheresis.	Statin therapy.	Bile acid sequestrants. Fibrates. Nicotinic acid.	Statin therapy. PCSK9 inhibitors.	Nicotinic acid. Gemfibrozil. Fenofibrate.

Note: Diagnostic and treatment section within table 8 was elaborated gathering information of laboratory results for each type of Fredrickson phenotypes based on Berberich and Hegele (2013) article and Feingold (2021).

Treatment

The general treatment of dyslipidemias is based on the clinical manifestations presented by the patient, as well as the serum lipid concentrations measured in laboratory tests, also the changes according to whether there is a genetic alteration that affects the transport of lipids. Pharmacological treatment may vary according to the alteration, in the event of hypertriglyceridemia, hypercholesterolemia or a mixed disorder, the age of the patient is also important and they should be accompanied by changes in life-style, this being the best and most effective way to reduce the complications of the different types of dyslipidemias, which includes a dietary change, reducing the amount of saturated fat consumption and increasing fiber consumption, this to maintain the adequate weight of the patients. It is also essential to exercise and avoid risk factors such as tobacco, alcohol intake and follow the diagnosis plan according to the condition. The five types of primary dyslipidemias share pharmacological treatment according to the patient's alteration, as well as these changes in lifestyle and diet in order to improve the prognosis of the disease (Feingold, 2020). The diagnosis and specific treatment of each one of the dyslipidemias, based on the bibliography exposed in the physiopathology, is observed in Table 5.

Complications

According to Quispe R., et al. (2019), triglyceride levels above 1000 mg/dl predispose to a higher risk of developing acute pancreatitis, as a consequence of lipid accumulation in the blood that triggers ischemia leading to multiorgan dysfunction. In the same way, hyperchylomicronemia is associated with neuro-psychiatric complications. In addition, hypertriglyceridemia and low-density lipoprotein (LDL) leads to extravasation of lipids from plasma to tissues for subsequent deposition, and to promote the onset of premature atherosclerosis, premature coronary heart disease, and myocardial infarction.

Prognostic

Dyslipidemias represent a major risk factor for coronary heart disease and stroke. In the presence of insulin resistance or metabolic syndrome, it can develop atherosclerotic CVD, or peripheral arterial disease. Therefore, the correct and constant management of lipid alterations, with a lifestyle change, can improve cardiovascular morbidity and mortality (Kopin and Lowenstein, 2015).

Classification

Nowadays, it is suggested to analyze hereditary dyslipidemias also referred to as primary dyslipidemias based on Fredrickson phenotypes, which are based on an analysis of triglycerides and cholesterol in relation to lipoproteins that are increased in the blood. Such classification includes 6 categories, which are shown in Table 6. Secondary dyslipidemias, on the other hand, usually have similar characteristics that resemble some of the primary phenotypes, but their pathophysiology depends on the underlying cause (Rozman et al. 2020).

Table 6. Description of the classification of dyslipidemias according to Frederickson.

Phenotype	Name	TG	Cholesterol	Elevated lipoprotein	Cause	
I	Hyperchylomicronemia	↑↑↑ >99 percentile	↑	Chylomicron	Familial hyperchylomicronemia	
IIa	Hypercholesterolemia	↑	↑↑ >90 percentile	LDL	Familial hypercholesterolemia (apoB ≥90 percentile)	
IIb	Combined hypercholesterolemia	↑	↑↑	LDL y VLDL	Elevated apoB100 levels (apoB ≥90 percentile)	
III	Dysbetalipoproteinemia	↑	↑	VLDL and chylomicron remaining	Homozygous for apoE2 combined with poor dietary habits, obesity, diabetes, insulin resistance, hypothyroidism, or pregnancy.	
IV	Hypertriglyceridemia	↑↑ > 90 percentile	↑ > 90 percentile	VLDL	Familial hypertriglyceridemia Sporadic hypertriglycemia	
V		↑↑ > 99 percentile	↑	chylomicron VLDL	Obesity, diabetes, alcoholism, oral contraceptives, among others	

Note: Classification section within table was elaborated gathering information of characteristics for each type of Fredrickson phenotypes based on Meisenberg, & Simmons (2012) article.

COVID-19 PANDEMIC

Due to the global conditions that have arisen as a result of COVID-19 at the beginning of 2020, in which the personal, work and school lifestyle had to be modified, to migrate as much as possible in person to the online mode. Regarding the medical school environment, new innovative ways were sought to bring scientific information to the general population, which had the characteristics of being accessible to

all, but at the same time was attractive enough to draw the attention of recipients, without losing sight of the fact that the content of what was transmitted had to be sufficient, understandable and valuable.

Typically, topics are addressed with talks given by medical professionals at conferences, or directly in consultations when people are already at risk or suffering from the disease or syndrome. Currently, this strategy was replaced by the delivery of information through the use of social media such as Facebook, YouTube, and Instagram; here it is observed that the different contents are of great value because they are dynamic and the receivers can provide feedback on what is read, understandable for the general population, and aesthetic to attract people's attention. This proposal represents a success because medicine is shifting towards a prevention approach where patients, traditionally limited to recipients, can become more involved in their health. The aforementioned is important in relation to the topic discussed in this article since dyslipidemias and COVID-19 have something in common, which is their risk factors that generate susceptibility in the patient so that their immune system is not sufficiently prepared to control diseases. Lange, K. W., & Nakamura, Y. (2020), emphasize the importance of maintaining mental and physical health in good conditions to overcome the pandemic, also they mention some factors that contribute to non-communicable diseases and can interfere with immunity, all of them related to habits like tobacco, alcohol abuse, change in sleep patterns and obviously nutrition and exercise. They remark about food and nutrition playing a crucial role in maintaining a healthy body weight and also for the prevention of comorbidities, as well as exercise can contribute to physical and mental well-being that is constantly undermined by social isolation, aiming to inform people and provide them with the option of reducing their risk factors and leading a better quality of life.

This has been possible because of the relevant information that is now very accessible, within reach, and allows them to reflect on what they have learned in their daily habits, in addition, another advantage that should be mentioned is the opportunity for the different areas of health to be actively involved in campaigns to publicize different points of view on the same disease, so that the information transmitted becomes even more meaningful to all readers.

Considering the radical changes that took place, especially in the health area, where information related to the current situation of the pandemic, and other medical issues, can have an extremely useful role or be an obstacle to learning. Therefore, the main goal of the use of social media is that the medical staff, both students and professionals, inform the audience by providing valid and reliable information with the objective of improving life quality, represented by different strategies to communicate important health messages in a way that is accessible and easy for people to understand (Smith & Judd, 2020). This objective is present in the vocation of health professionals and, despite the current unfavorable circumstances, the professional identity has been put out to test through the physical, emotional, and psychological adaptation by which the medical staff has had to go through to continue looking for a way to care for patient's health in the general population and provide useful and updated information.

Intervention Proposal

A campaign was conducted through the Instagram social network that sought to raise awareness and inform the public about what dyslipidemias are, how to diagnose them, and how to prevent them. To do this, 20 eye-catching infographics were designed with relevant and understandable information, which were published over 7 days.

Considering the reach of the online platform on which the social project was developed, a diverse group of people benefited. At first place is the population suffering from dyslipidemia or at risk of

developing one. The information shared in the campaign allowed them to eliminate the fear and prejudice that was generated by the lack of knowledge in society of these clinical conditions. In addition, they learned about the measurements to take in order to prevent the disease and recognize when it is necessary to call a doctor or go to the emergency room. Second, people who live with a person who has dyslipidemia benefited by identifying complications of the condition, what to do in the event of an emergency, and how they should receive care. Finally, the students who led the awareness project also benefited by learning about the development of online campaigns, how to synthesize information, and how to use colloquial terms to express themselves with patients.

Researching Mexicans' most health deteriorating illnesses, there is an association to blood dyslipidemias and early presentation of myocardial infarctions. This is alarming, because both are conditions closely linked to lifestyle (food, exercise, etc.), modifiable to prevent them, thus the topic we chose was to raise awareness of this situation with the objective of contributing to reducing this prevalence.

The campaign was held during the school's online semester August-December 2020 through the social media Instagram, people from different cities in Mexico joined. It was conducted in collaboration with the subject of: physiopathology of the endocrine system by fifth semester medical students of a university in northern Mexico. To achieve this, the first step was to look at diseases and their prevalence in this country. Consequently, a report was written in which all the information was entered in an orderly and logical manner. Having this, a division of the information was made into principal and important topics and then proceeded to make small infographics that would serve as publications. For the realization of these, a color palette and the same background were defined to look even.

We created a new Instagram account, and shared it by convenience to friends and acquaintances to follow and pass it on. On October 26, 2020, the campaign began with 1 daily publication over 10 days. At the end of the project, a survey of the followers of the Instagram profile served for assessment of the work to measure their knowledge from the information learned with the platform, as well, to have an evaluation of the most accepted strategies. This information is attached to the report so that changes can be made to future projects within appendix.

Public' Response to the Campaign

The growth of the campaign through the Instagram mobile application started with the goal of getting followers from Instagram users that were considered to need or want information about dyslipidemias. Such as people with lipid profile alterations, family members of patients with dyslipidemias as well as members of the health environment. In order to obtain this, a catchy name and a well-informed bibliography were collected, information that later on helped in the design of the infographics that were designed. The project was conducted fully in Spanish as it is the main language spoken in Mexico, therefore the content created as well as the username used on Instagram was in Spanish, "Epidemia DisLipidemias" which translates to Epidemic of Lipidemias. The initial references of the account provided information of who we were, where we were from, and what was the purpose as an account.

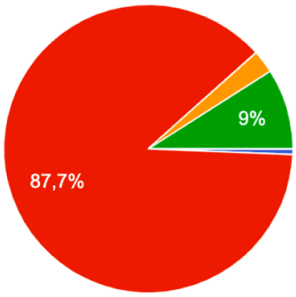
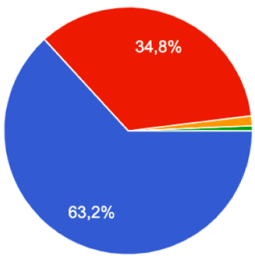
The main purpose behind the campaign was to communicate through the platform to deliver content with potential benefits for patients, thus we shared the information as Instagram posts in the form of small infographics and a caption that explained it all more thoroughly. To do this we first divided all the information we wanted to share into subcategories, and then into days and specific hours of the day. Once the poster campaign ended, the campaign was assessed via a Google form questionnaire with 12 true or false items. The survey focused on the participants' perspective of the information included in

the publications, and the knowledge that the followers acquired. This questionnaire was facilitated to the users via Instagram stories and the description of the account.

The Instagram profile "@EpidemiaDeLipidemias" reached a total of 129 followers over the span of 2 weeks. 20 different posts were published with an average of 19 likes and 1.4 comments-per-100-likes. 19.42% of the followers were engaged constantly, meaning they either liked or commented on every post. Online dynamics held during the active days of the acute like questions poll as *"How much do you know about dyslipidemias?"* received a total of 155 responses, which reflects a 26-person difference between the Instagram followers and the poll's answers, attributed to the fact that the followers were encouraged to share the poll with non-followers of the account.

Characteristics of the followers of the account are described in table 7, Most of the participants (87.7%) were 18 to 25-years old, consistent with the engagement that other studies have reported. For example, Villanti et al. (2017) reported that 97.5% of people were between 18-24 years old on any kind

Table 7. Samples of the infographics that were published during the campaign

Followers' characteristics	
Age	 The age of the majority of the people that participated in the Instagram account ranged between 18-25 years, representing 87.7% of the followers. 9% of the people had between 40-60 years, leaving people under 18 years and between 25-40 representing less than 5% of the followers.
Gender	 63,2% of the followers referred to themselves as women, 34,8% men while 2% preferred not to say their gender or chose the option of non-binary.

of social media. In the campaign, 63.2% of participants were female, 34.8% male, and 1.3% decided not to reveal their gender.

Participants´ final survey answers were analyzed and evaluated according to skills that each question evaluated shown in Table 8. On average 50% of participants responded correctly to each of the 12 questions included in the questionnaire. The element most frequently answered incorrectly was item 10 "High cholesterol is more harmful than high triglycerides", where 54.2.% of the participants wrongfully assumed that cholesterol levels were more deleterious in contrast with triglycerides, this common misconception evidence the need of emphasizing that as dyslipidemias alter both cholesterol and triglycerides levels, the two parameters should be equally analyzed as part of diagnosis and follow up of treatments. However, given the overall pattern of the response of the participants the campaign was successful at defining dyslipidemias, understanding risk factors and lifestyle changes that can prevent the disease, and complications associated with high cholesterol and/or triglycerides.

Table 8. Results of the questionnaire taken by Instagram followers after the campaign

Skill evaluated by the questionnaire	Description of the performance of the Instagram followers
Understanding of basic concepts of lipids and cholesterol (question 1 and 2)	A little over half of the participants showed having a good understanding of the concepts of cholesterol, lipids, fats, and triglycerides, all of which were explained during the campaign.
Identifying the risk factors of dyslipidemias (question 3, 4, 11,12)	Participants understood the primary and secondary etiologies of dyslipidemias and their respective risk factors: 65.2% correctly stated that secondary causes of dyslipidemias are more common and marked their relationship between the diet (78%) and alcohol consumption (87.1%). The possibility of genetic mutations leading to dyslipidemia was also identified by 76.1% of the participants because they answered correctly to item 4 evaluating the likelihood of having dyslipidemia if their dad and/or grandparents suffered from one.
Ability to interpret a lipid profile and distinguishing among the different types of cholesterol (question 5, 6, and 10)	70.3% were able to identify between "good" cholesterol HDL and "bad" cholesterol LDL, at the same time 94.% comprehended the relationship the risk of having high levels of triglycerides even in non-obese patients. 54.2% preceded cholesterol more dangerous
Identifying prevention measurements for the development of dyslipidemia (question 8)	92.5% were aware of the benefits of working out even if there isn't a weight loss, which is particularly satisfying because one of the first-line recommendations for patients suffering from dyslipidemia.
Knowledge of the consequences of dyslipidemias (question 7 and 9)	The manifestations and consequences related to changes in lipids and cholesterol such as pancreatitis were accurately indicated in 96% and loss of vision 74.4% of the cases respectively.

EXAMPLES OF CONTENT SHARED IN THE INSTAGRAM ACCOUNT

Examples of posts that were shared to the community through the Instagram account made during the Dyslipidemias campaign are shown in table 3. In the first infographics, we began by creating content that informed us about the diseases that would be discussed during the course of the days, in order to attract as many interested people as possible. Similarly, it developed and introduced a "character" that would act as the logo of the campaign as illustrated in infographic 1 within table 9. In this case, an adipose cell was designed to act as the narrator during the campaign and be present in the "profile stories" type posts mode of the Instagram platform. With respect to the publications made on campaign day, they all had in their main image questions that would announce the topic to be discussed in the infographic(s) contained in each daily update. This strategy is very useful as it guides readers to know what questions

the information embodied will answer, as well as motivates them to ask new questions regarding dyslipidemias, and keep them expectant throughout the campaign. Infographics were first formulated with basic questions such as "What are dyslipidemias?" (Infographic 2), which focused on including as much text as possible and technicalities that prevented readers from understanding. Cartoon-like graphics were

Table 9. Samples of the infographics that were published during the campaign

Infographics		
 Infographic 1	 Infographic 2	 Infographic 3
 Infographic 4	 Infographic 5	 Infographic 6

included to improve the understanding of written information, as concepts such as arteriosclerosis refer to phenomena that are distinctive to us of dyslipidemia, and they cannot identify a patient with the naked eye, therefore adding photographs would be irrelevant.

As the campaign progressed, infographics of the greatest public interest were postulated, including manifestations and complications of hypertriglyceridemia and hypercholesterolemia (infographic 3). The relevant design of these creations results in the inclusion of real photographs of the consequences of these pathologies in the face of precarious care on the part of the patient. Thus, patients, people at risk, and people close to individuals with these diseases are made aware of the internal state of their body.

Infographics 4 to 6 all belong to the same publication made in the last days of the dyslipidemia awareness project, which reiterated the recommendations that anyone at risk or suffering from dyslipidemia should follow. It is important to mention both in publication and on other occasions the importance of going to regular check-ups with doctors and nutritionists who can help people to have a better knowledge about the manifestations that they identify as well as the personalized measures for each one is underlined.

SOLUTIONS AND RECOMMENDATIONS

The COVID-19 pandemic is a milestone that came with new demands of an online life that implied new challenges and opportunities. People were more curious about these diseases because of the fear of illness and the comorbidities associated with the new coronavirus. Although it was hard to adapt to an online platform, the great curiosity of the general public towards their chronic illnesses and the desire of the research team to inform patients was a motivation to build this campaign. Although social media platforms allow for the information to reach wider audiences, capturing people's attention presented itself as a newer hurdle that was faced counter with the aid of some artistic people and advice from Instagram influencers. Also, a longer campaign and more interactive activities with the public would have given the project better results, therefore this should be considered for future campaigns that would like to develop the same teaching strategy.

One of the main challenges faced in the campaign was that the research was based on both primary and secondary dyslipidemias, as the information added about primary dyslipidemias was very summarized because of the low prevalence compared to secondary, while the recommendations and advice were adapted to dyslipidemias in general. The campaign had greater interest because it was possible to address a topic with its prevention and characteristics in a broad way, despite the prevalence and the fact that the primary and secondary were coupled to adapt the recommendations to the general population.

The planning stages for the communication strategies that were to be utilized during the campaign, provided the skill of delivering veracious and timely information to enable the target audience to recognize the issues of interest. It is known how complicated it is to compile the information and to be able to translate it into words understandable to the general public, as presented above. Getting the information out to the population with the aim of preventing future diseases and /or correct diagnosis despite the pandemic was fulfilling; at the same time, the interaction with the public given through the positive comments was rewarding.

DIRECTIONS FOR FUTURE INVESTIGATIONS

Within the campaign there was constant feedback on the way in which dyslipidemias were addressed so that the general public could understand them, this should be the main task to be aware of and considered as a starting point for other researchers that want to develop future projects about prevention of diseases; also the creativity and design for the creation of the posts is essential as they helped by engaging the audiences. In addition, another indispensable feature is the writing and development of the main points of the diseases, for this reason, synthesis tables were created, based on the collection of databases from different studies and articles, and this must be taken into account in other investigations. Furthermore, a timeline was created to organize the upload of the information in several posts with anticipation, thus

creating a better aesthetic of the account as well as helping followers comprehend and correlate all the posts made. It should be noted the importance of keeping the organization of the posts as a means to have better control over the Instagram account and create more engagement with the people who reach the account for the first time.

Regarding the campaign, the use of Instagram as a way to transmit information is a great way to reach more people in a world where information is really hard to find. The study of this type of project should be longer in order to have significant outcomes within the followers and the research investigation. Lastly, another recommendation for further research in educating throughout social media is that it should be multidisciplinary, because although the information is medical, the design and the management of the social media should be done by people specialized in the field, in order to have a better impact on the followers.

CONCLUSION

Although there are still many doubts and misinformation on the subject of dyslipidemias, its manifestations, and causes, these being a set of genetic and environmental factors. Due to the aforementioned, it is extremely important to make this information known to the population, given the current increase in the prevalence of these conditions; likewise, it is essential that the different etiologies leading to dyslipidemia are recognized and in case of predisposition, such as hereditary dyslipidemias described earlier in this article. In addition, knowing their pathophysiology and the way in which the respective clinical manifestations behave, a search for new treatments could be undertaken in order to improve the lifestyle and quality of life of the people who suffer from them. For the reasons previously mentioned, it was decided to create an awareness campaign through the Instagram social network, since being a very far-reaching platform it is possible to use dynamic and understandable information to educate about the subject. It is important to highlight that this type of project is functional not only during the pandemic, this being the pretext that allowed the possibility of starting a new format, but also with the development of new technologies and the impact of social networks that allow innovation in the field of educating the patient through the media in an active way. Moreover, through the surveys collected, it was found that there is a great area of opportunity in the field of research. It is concluded that the objective of the campaign was achieved since valuable feedback was obtained from the population, both in the health area and others, however, the scope was limited, so that later studies could include a greater public, as well as proposing other activities that attract the attention of the current population and thus expand both the quality and the quantity of shared data. All this in order to educate people about different diseases and the search for modifications to lifestyle factors that may benefit the individual.

ACKNOWLEDGMENT

This research did not receive any specific grant from any funding agency in the public, commercial or non-profit sectors. Special gratitude to Dr. Nancy de los Ángeles Segura Azuara and Dr. Mildred López Cabrera who advised, led and motivated the development of the project. An important appreciation to BioRender.com for the platform where the figures one, two, and three used in this document were created, it is important to mention that the illustrations started from scratch, using a new design. Finally,

the Tecnológico de Monterrey is appreciated for providing access to its database and clinical resources as well as Judith Moreno Carrizales, Astrid Nieto Gutiérrez, Hugo Alberto Peña Martínez and Fernando Ferreiro Osorio for their contribution sharing the online campaign through their social media.

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KEY TERMS AND DEFINITIONS

Apolipoprotein: Protein that binds to lipids to form different classes of lipoprotein particles (chylomicron, HDL, LDL, IDL, VLDL) in the blood and enable transport to different organs.

Atherosclerosis: Proliferative lesion of the medial and intimal layer of the arteries, which subsequently invades the arterial lumen. Caused by focal lipid deposition in the vascular wall, with chronic fibrotic and inflammatory reaction.

Cholesterol: A fat-like steroid alcohol, an essential component of cell membranes and bile that contributes to the body's absorption of fats and fat-soluble vitamins. It is a precursor of bile acids and the synthesis of steroid hormones.

Chylomicron: Plasma lipoprotein that transports lipids. It consists of a large droplet of triacylglycerols stabilized by an outer layer of phospholipids and protein.

Dysbetalipoproteinemia: Rare type of hyperlipoproteinemia caused by the accumulation of an abnormal lipoprotein "β-VLDL."

Hypercholesterolemia: Increased plasma cholesterol levels above 200 mg/dL. It is considered a risk factor for the development of atherosclerosis and ischemic heart disease.

Hyperchylomicronemia: Increased plasma concentration of chylomicrons. It is part of type 1 hyperlipoproteinemia, due to a deficiency of the enzyme lipoprotein lipase, and in type 5, associated with elevated VLDL particles.

Hypertriglyceridemia: Elevation of triglycerides in the blood, above the reference values of 150-199 mg/dL.

Lipoprotein: Composed of a lipid and a protein. According to their density, they are classified as high, low, and very low density.

Triglycerides (TG): Glycerol molecule in which the three hydroxyl groups are esterified by fatty acids. Elevation of their plasma concentration leads to hyperlipidemia.

APPENDIX

Table 10. True or false questionnaire used for evaluating comprehension of dyslipidemias

True or false questionnaire evaluating comprehension of dyslipidemias		
Statement	**T/F**	**correct answer**
1. The words “lipids” and “fats” mean the same thing		True
2. Dyslipidemias are diseases that affect all the lipids in the body		True
3. A high carbohydrate diet can cause dyslipidemia		True
4. If my dad and/or grandparents have dyslipidemia, it is more likely that I would have one.		True
5. “Good” cholesterol is the HDL one		True
6. Only people who are very obese have high lipids		False
7. Pancreatitis is the inflammation of the pancreas and can be a very serious complication of high triglycerides		True
8. Exercising is beneficial in dyslipidemia even when you do not lose weight		True
9. Loss of vision is a consequence that can develop an patient with a dyslipidemia		True
10. High cholesterol is more harmful than high triglycerides		False (both levels should be closely analyze)
11. Alcohol increases blood lipids		True
12. Secondary dyslipidemias are more common than primary ones		True

Chapter 9
Ending Health Promotion Lethargy:
A Social Media Awareness Campaign to Face Hypothyroidism

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ABSTRACT

Hypothyroidism is a condition characterized by a deficit of thyroid hormones that leads to a low metabolic rate, typically associated with lethargy. The causes are diverse and may vary from congenital defects and autoimmune disorders to iodine deficiency, the latter being easily preventable with the appropriate strategies. For this chapter, the authors documented a social media awareness campaign via Instagram, whose purpose was to do popular science about hypothyroidism's symptoms to promote early detec-

DOI: 10.4018/978-1-7998-8783-6.ch009

tion and prevention. This campaign took place from October to November 2020 amid the COVID-19 pandemic. The campaign consisted of informative posts and engaged the audience via questionnaires through Instagram stories. Lastly, an online questionnaire was shared to assess the gained knowledge of the viewers and evaluate the campaign's efficacy. The social media awareness campaign showed to be a feasible way to educate the community, enabling efficient health promotion strategies through digital platforms.

PRESENTATION OF THE DISEASE

Definition and Epidemiology

Hypothyroidism (HT) is a condition characterized by a deficit of thyroid hormones. Physiologically, the correct hormonal secretion implies a good functioning of the endocrine organs involved in the hypothalamic–pituitary–thyroid axis (HPTa). In HT, the pathological state of hormonal hyposecretion occurs through two main mechanisms: a high elimination rate or a low hormone synthesis, later on they are classified based on their etiology as either an autoimmune disease or an iodine deficiency, the latter constitutes the most common cause of HT worldwide (Hueston, 2020). Therefore, as a preventive technique, government entities from multiple developed countries decided to fortify frequently consumed foods (such as table salt) with iodine, in order to reduce the prevalence of HT. Therefore, leaving iodine deficiency aside, Hashimoto's autoimmune thyroiditis disease represents the most common cause of HT in industrialized countries (Fitzgerald, 2020).

Etiology

The causes of hypothyroidism are diverse, and their incidence varies widely between populations and geographic regions. In iodine-sufficient areas, the most common cause of hypothyroidism is Hashimoto's disease, also called chronic autoimmune thyroiditis. In iodine deficient areas, the lack of absorption of this component continues to be the leading cause of goiter and hypothyroidism (Chaker, 2017). Other causes of hypothyroidism include radioiodine treatment, neck radiation, thyroid deposits of amyloid or iron, among others (Chiovato, 2017).

Classification

Hypothyroidism can be classified in multiple ways. It can be categorized into a primary, secondary, or tertiary disorder depending on the lesion location along the HPTa (*Table 1*). Primary hypothyroidism is characterized by a loss of function of the thyroid gland itself, whereas in secondary hypothyroidism there is a pituitary condition that leads to TSH deficiency. Finally, the disease is classified as tertiary when there is an inadequate release of TRH from the hypothalamus. The overall result is a dysfunction of the thyroid gland leading to a deficient production of T3 and T4 hormones (Chaker, 2017). Furthermore, hypothyroidism can also manifest due to a peripheral organ resistance of thyroid hormone-dependent tissues to the action of T3 and T4 (Chiovato, 2017). However, both secondary and tertiary hypothyroidism, along with the peripheral resistance, are fairly uncommon causes representing <1% of cases (Chaker, 2017).

Hypothyroidism can also be classified based on the onset of the disease; congenital hypothyroidism manifests since birth, otherwise, if the onset of symptoms occurs later in life, it is classified as acquired

Table 1. Causes of hypothyroidism and their classification

	Primary	Secondary	Tertiary
Congenital	Thyroid agenesis Defects in: Iodine transport (pendrin mutations) Organification (TPO deficiency) Thyroglobulin synthesis TSH receptor	TSH deficiency Structural anomalies in TSH TRH receptor defects	Structural anomalies in TRH
Acquired	Thyroiditis Hashimoto Postpartum Quervain's Riedel's Subacute Thyroid infiltration Amiloidosis Hemocromatosis Sarcoidosis Escleroderma Iodine deficiency Iodine excess (Wolff-Chaikoff effect) by intake by drugs (amiodarone) Iatrogenic Radioiodine treatment Radiation Thyroidectomy IFN-alpha therapy	Hypopituitarism Pituitary adenoma Sheehan syndrome Traumatic injury Pituitary infiltration Hemocromatosis Iatrogenic Pituitary ablative therapy Radiation	Hypothalamic dysfunction Traumatic injury

hypothyroidism. Moreover, distinctions can be made according to the clinical presentation of the disease. If the condition develops as a mild form, it is known as Euthyroid Sick Syndrome, characterized by a limited range of symptoms due to an impaired conversion of peripheral T4 to T3 despite normal levels of TSH. HT can also be asymptomatic; in which case it would be referred to as subclinical hypothyroidism. Finally, the disease can be called clinical hypothyroidism if typical symptoms are present and low levels of both T3 and T4 are confirmed (Chiovato, 2017).

Risk Factors

Hypothyroidism is characterized by a wide clinical spectrum. Consequently, the risk factors involved in the disease's appearance are directly related to the specific cause of it. Nevertheless, there are common predisposing elements among the different etiologies (Chaker, 2017). Some examples of them include: exposition to deficient or excessive iodine-content diets (Luo, 2014; Teng, 2006); personal or familiar history of autoimmune diseases or being female, due to a higher incidence of these pathologies in this gender (Strieder, 2003); advanced age; and specific chromosomopathies such as Down and Turner syndromes (Chaker, 2017). It is worth noting that particular etiologies may or may not follow similar behaviours in individual cases; risk evaluation must be done separately for each patient based on the clinical analysis.

Pathophysiology

The pathophysiology behind HT is both congenital and acquired presentation. Two main mechanisms are involved in congenital HT: thyroid dysgenesis and agenesis. In the embryo, an error involving the migration of the developing thyroid will result in aplasia, hypoplasia or ectopy. A strong genetic influence has been affiliated to some transcription factors (Wassner, 2018). Dyshormogenesis can occur when protein coding genes that regulate thyroid hormone synthesis suffer mutations (Makretskaya et al., 2018). Nonsense mutations in the TPO gene lead to failure in the organification of iodine (Ma et al., 2015). Polymorphisms in the SLC26A4 gene are responsible for disrupting the transport of iodine from the follicular cells to the colloid (Mukherjee et al., 2017). Missense mutations in the TG gene alter the structure of thyroglobulin, impairing its normal intracellular transport. Loss of function mutations in the TSH gene result in misfolding of the TSH receptor protein, preventing it from reaching the cellular surface (Targovnik et al., 2019).

Acquired HT is most commonly associated with autoimmunity, especially in Hashimoto's Thyroiditis. In this disease, autoantibodies against TPO and TG attack and destroy the thyroid tissue (Caturegli et al., 2015). A variant of Hashimoto's Thyroiditis called Riedel's Thyroiditis, is characterized by the infiltration of fibrosis, resulting in the disappearance of the thyroid parenchyma. Its etiology remains unknown, but it may be associated with diseases in which IgG4 is involved (Galofré et al., 2016). Another autoimmune presentation, called postpartum thyroiditis, manifests exclusively in women after giving birth. This reaction is caused by an elevation of the immune system that follows its suppression during pregnancy, but the presence of a genetic autoimmune predisposition is necessary for the disease to develop (Nguyen & Mestman, 2019). In Quervain Thyroiditis an infectious process is responsible, making it subacute and autolimited. The inflammatory response causes a release of stored thyroid hormones (initial thyrotoxicosis) followed by a temporary loss of normal thyroid function (Galofré et al., 2016). Although there are different causes behind thyroid dysfunction, Hashimoto's Thyroiditis remains as the main pathology involved in hypothyroidism.

Clinical Manifestations

The clinical presentation of HT varies, since patients may be asymptomatic, present mild manifestations, or have highly complex clinical presentations; depending on the type of HT and the quality as well as the adherence to treatment. Generally, the vast majority of patients present some alteration that generates the slowing down of the basal metabolic processes and the accumulation of glycosaminoglycans in the interstitial space (Surks et al., 2019).

Commonly, fatigue, lethargy, weight gain, decreased appetite, constipation, depression, dementia, dry skin, alopecia, cold intolerance, and memory loss are part of the classic hypothyroid presentation (Orlander, 2020). For more specific symptoms of each type of hypothyroidism see *Table 2*. Also, HT can lead to the development of hyperprolactinemia, since the deficiency of thyroid hormones promotes an excessive secretion of TRH due to a lack of negative feedback; the increase in TRH, as a consequence, stimulates the secretion of prolactin. It is important to keep the patient under medical surveillance (Shenenberger et al., 2011).

Hyperprolactinemia is directly responsible for other clinical manifestations such as amenorrhea, galactorrhea, sexual dysfunction, decreased libido, and hypogonadism (Shenenberger et al., 2011).

Table 2. Clinical manifestations of hypothyroidism according to its cause (Orlander, 2017).

Type of hypothyroidism	Symptoms
Hashimoto's Thyroiditis	● Painless goiter ● Neck and throat pain (caused by mass bulge) ● Feeling of obstructed throat ● Hashitoxicosis: Transitory period of hyperthyroidism caused by the liberation of stored, preformed thyroid hormone
Congenital Hypothyroidism	● Cretinism o Failure to thrive o Intellectual disability o Neurological defects
Quervains Hypothyroidism	● Painful goiter ● Fever ● Dysphagia ● Elevation of erythrocyte sedimentation rate

Diagnosis

In order to detect HT, certain laboratory tests must be done. Determining TSH and T4 serum levels is the most accurate method to make the diagnosis, since these biochemical markers have direct influence on thyroid functioning and hormonal actions. The American Thyroid Association has established TSH levels greater than 10 mlU/L as a diagnostic criteria for primary HT (Centanni et.al., 2017). Alternative and complementary studies include imaging techniques, such as ultrasound and scintigraphy, or testing for thyroid specific antibodies. These are fundamental for HT etiology determination.

Treatment

The main focus of HT treatment remains in the replacement of the lacking hormone and providing the most important substrates related to a proper thyroid hormone synthesis. Of course, treatment and all of the pathology management may vary depending on its etiology, patient's condition, disease development, etc.

The most common replacement therapy is levothyroxine, a synthetic form of thyroxine. The posology features depend on the thyroid condition, the amount of hormone production, and symptomatology. This drug has been approved for pregnant patients as well, therefore, it is useful for gestation-triggered HT. Its effects start to show after 1 to 2 weeks of treatment and most of the cases must continue with the treatment permanently.

Complications

In patients with hypothyroidism, myxedema coma is the most characteristic complication. It is described as a state of severe HT with a mortality rate of up to 50% if left untreated (Lee, 2020). Clinical manifestations are mainly neurological; they include lethargy, confusion, altered state of consciousness, and coma (Ross, 2019).

Other complications are related to specific causes of HT or are secondary to its course of treatment. Subacute thyroiditis can cause thyrotoxicosis as well as vocal cord paralysis if the tissue destruction or

inflammation are severe enough. One long term complication can be chronic HT, which occurs in up to 10% of cases of Quervain thyroiditis (Lee, 2020). Iatrogenic complications also exist and include adrenal crisis, osteoporosis, and heart problems (Orlander, 2020). Other complications can be presented as well in more discrete percentages.

Prognosis

With the correct treatment, hypothyroidism has a good prognosis, allowing the patient to live a normal life. However, in children, congenital hypothyroidism could lead to a severe intellectual disability. For adults, the patient's status can evolve to a coma or even death with heart failure being the most common cause (Patil, 2020). Without the appropriate medical observation hypothyroidism could increase the risk of morbidity and mortality.

CAMPAIGN STRATEGY EXAMPLES

Over the past two decades fast-coming technologies have allowed information to become widely available. For the medical community, this has opened the door to new opportunities for patient education and disease awareness. With a variety of previously used, enhanced or innovative methods, these awareness campaigns enrich any step of patient care. These strategies are not only preventive, Stella et. al. (2020) suggest they could also lead to earlier patient screening and diagnosis which in turn leads to prompt and more effective treatment. In order to obtain greater involvement from health professionals, it is imperative that these information disseminating techniques become better known.

In a systematic review of different strategies, Schipper et al. (2015) suggest that the success of any disease awareness campaign depends on the grade of involvement of patients.These involvement can be fostered through a well structured plan, tailored to a target population. This includes providing scientific information through a friendly general public language, avoiding medical technicisms that might foster a barrier, as well as considering possible social or cultural limitations of the context in which the implementation would take place. Once the audience is established, it is imperative to focus on the key messages the campaign should center around. Even if some content may have been previously implemented successfully with health care workers, it can not be assumed that patients will respond to the same communication strategies.

While in the past there has been a heavy reliance on printed materials, such as posters and pamphlets, Schipper et al. (2015) also suggest that a more diverse and repetitive method is more effective to obtain retention of information. Professionally led press conferences, easy access information in public libraries, books or images designed for all ages including children, are some of the examples provided. Special emphasis is made in methods that directly include patients, such as online forums where patients can interact with one another or involving them in the actual planning of future campaigns. Above all, these strategies should aim to be as inclusive as possible in order to achieve its desired reach. As for the manner of execution, it is only logical that it adapts to the ever changing technologies that make communication possible.

Digital

Considering the impact of the ongoing pandemic due to COVID-19, it was necessary to look into alternative methods for patient education that could leverage technology and virtual settings for learning. Lessons could be drawn from the transformation of the educational process within adult learning. For example on implementing a two-step digitization process that requires first, the digitalization of multiple learning activities, followed by evaluation and assessment strategies (Mohammad et al., 2020). The first, could focus on lectures, seminars and small assignments in teams with a facilitator to guide the dynamics. The last, and often underexplored is the feedback after to guarantee knowledge acquisition.

Some of the digital tools that are widely available are Blackboard learning for content delivery and Zoom Cloud meetings for synchronous interaction. For communication purposes, social media platforms such as WhatsApp can be used. The results showed an overall good acceptance of the learning strategy within the subjects. Hence, the importance of a well-structured feedback platform can be emphasized, as it allows for constant evaluation of the tools used within the practice. However, digital platforms such as Blackboard learning and Zoom are mostly utilized and directed towards students, and simpler, more accessible tools such as social media might be preferred for healthcare marketing and patient education, considering they also allow virtual interaction.

Wakefield and collaborators (2014) talked specifically about the use of mass media campaigns to change health behavior. In their research, it is mentioned that although mass media such as television, radio or newspaper allow for passive exposure only, they have the ability to reach a large population rapidly and repeatedly. Overtime, these mass media campaigns can produce changes that either prevent harmful behavior or promote positive habits, dependent on other factors such as availability to services, products and health programmes. The benefits a mass media campaign offers might come advantageous on a virtual learning campaign, which could also benefit from new technologies like social media to allow a more active interaction between the subjects and the campaign promoters.

For this Particular Disease

While hypothyroidism is a frequent and potentially life-threatening thyroid pathology, its treatment is rather simple and inexpensive. Hence, social awareness is key for early diagnosis and adequate management. In the past, several strategies have been used for patient education and evaluation of knowledge. In India, numerous studies have been made regarding the knowledge and practices of patients diagnosed with hypothyroidism. These survey-based studies, as the one made by Sethi et al. in 2018, evaluated the impact the patient's knowledge had on the management of their disease. These approaches aim to help the physician to identify the existing areas of opportunities in patient education.

Another documented awareness campaign was held by the Thyroid Federation International during the 2016 Thyroid Awareness Week. This campaign was called "Catching the butterflies: spotting the symptoms of thyroid disorders in children", whose purpose was to educate parents and children about the signs and symptoms of two common thyroid pathologies, hyperthyroidism and hypothyroidism. These diseases were represented by two characters, ''Hypo'' and ''Hyper''. Hypo was a blue butterfly living with hypothyroidism; he was characterized by moving slowly, having growth problems, being sluggish and feeling tired very often. Hyper, conversely, had hyperthyroidism and was described as a thin, overactive and fidgety pink butterfly. He was irritable and easily upset. In this case, the usage of

cartoons was a suitable strategy for patient education considering the age of the audience, making the information simple and accessible for children.

Another thyroid awareness campaign was held by the Thyroid Cancer Spanish Association in 2004. AECAT's main goal was to educate about the thyroid gland, its functions and some of its pathologies. This was made through a webpage where information about the thyroid gland could be found. Also, they presented to the audience four interactive webinars titled, "Thyroid and mental health", "Hypothyroidism, Hyperthyroidism and Health", "Thyroid hormones in gestation, thyroid cancer and pregnancy", and "Practical aspects of thyroid hormone replacement therapy".

Despite none of these educational strategies being reported or published in scientific journals, these campaigns show multiple strategies that have proven to be successful for social awareness and patient education, as they provided accessible and reliable information while adapting to the age of the audience. However, digital promotion approaches in the area need to be further explored and tested since they allow for remote interaction in the context of a pandemic.

FORMAT ADAPTATIONS IN VIEW OF GLOBAL PANDEMIC

The SARS-CoV-2 virus has had an impact on our health systems; it has shed a light on the importance of prevention and early treatment of diseases that could worsen the outcome of a possible infection. Also, since the virus began to spread in early 2020, a lot of misinformation has circulated around the world. Because of this, both large organizations and healthcare professionals have begun to recognize the necessity of awareness and appropriate diffusion of evidence-based facts. Hence, the relevance of this study and the elaboration of social awareness campaigns to educate patients with reliable sources is highlighted. Despite hypothyroidism not being directly linked to Coronavirus Disease (COVID-19) patient outcome, it is another example of an easily treated disease when caught on time.

When COVID-19 was declared a pandemic by the World Health Organization at the beginning of March 2020, most non-essential in-person activities were suspended worldwide. Because of this, the campaign had to be entirely virtual, which took place in fall of the same year. These circumstances gave the opportunity to tackle misinformation in the same place it mainly originates, social media. A virtual campaign also allowed for a larger audience to be reached, without the physical limitations of distance. Although the campaign had to be adapted to these means, using *Instagram* through our @Dailythyroid account became a successful approach for broad informative distribution about hypothyroidism.

CAMPAIGN DESCRIPTION

The present campaign had the sole objective of scientific divulgation; the given information was aimed for the general public aiming to promote basic education about hypothyroidism. The basic aspects of the disease were covered, including the definition, causes, risk factors, diagnosis, treatment and prognosis. Considering the campaign was directed to the general public, which includes any individual not related to the study or practice of health sciences, technicalities and medical terms were avoided or simplified, in order to transmit the desired information in an understandable yet complete manner. Considering the limitations of the ongoing COVID-19 pandemic, the work had to be done in a manner that would allow distance interaction such as digital platforms. The professor behind the idea had the initiative to use *Ins-*

tagram as a network for scientific divulgation with the vision of transmitting to the followers of the page trustful information about the disease as the team applied their knowledge of the endocrinology subject.

The development and execution of the campaign was made following a series of organized steps. Prior to the campaign, the steps were as follows: preliminary review of literature, selection and organization of the information, gathering of visual resources, design of the *Instagram* page, elaboration of infographics, and publication scheduling. Once all of this was achieved, the campaign was implemented on *Instagram* as the user *Daily Thyroid*.

Instagram social network was the media selected to implement the campaign. The *posts* were distributed strategically, where topics regarding hypothyroidism were explained in a friendly way for the general public, making the information attractive for the user. Several visual tools like infographics, diagrams and images were elaborated to achieve this objective. In order to assure patient learning and establish a closer interaction with the subjects, there were several feedback interventions, where the audience could ask the inquiries that might have arisen from the information given, which were later answered at the end of the campaign. Also, the users had the opportunity to apply their knowledge through simple quizzes that were available the last days of the campaign.

After all the *posts* had been published, an ending survey was applied to gather final information about the impact, perception and knowledge the followers acquired through the whole campaign. At this point, a control group that did not have access to the campaign was also established, in order to compare the knowledge of those who had access to patient education through the campaign and those who did not through their test results.

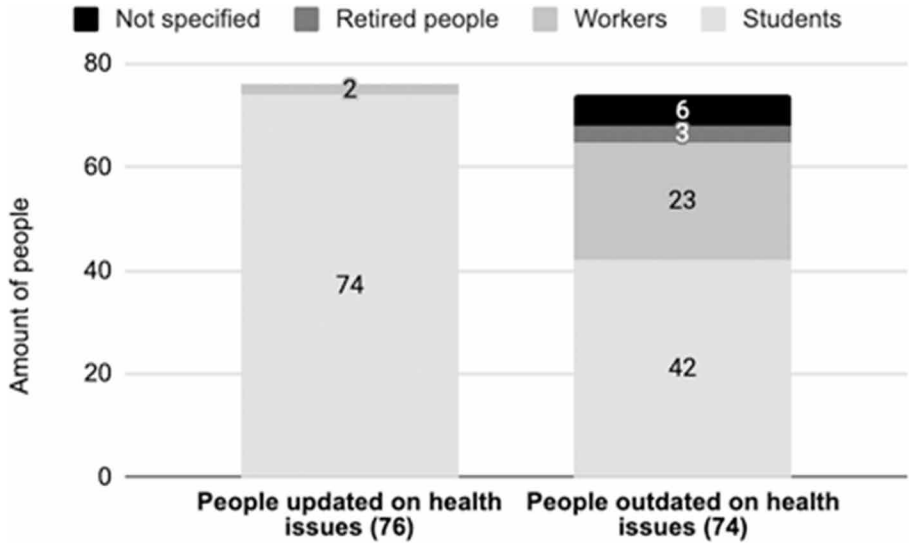
The whole process behind the campaign spanned the months of October and November of the year 2020. The implementation of the campaign, meaning the period between the first publication and the closure of the surveys, comprised the weeks from October 26th to November 8th of the same year. As it was previously mentioned, the use of social media was the selected method for dissemination, with an *Instagram* page being the platform of choice thanks to its popularity, giving the user the opportunity to consult the information whenever they want in a simple way.

Campaign Impact

The @Dailythyroid I*nstagram* account acquired a total of 193 followers. 9 posts were made, which reached a mean of 178.66 viewers, each one appearing on screen an average of 251 times, and with a range between 16 and 62 interactions per publication. For impact evaluation, an electronic survey was conducted. It was shared with the followers via *Instagram Stories* and participation was elective; a total of 150 replies were obtained. From the 150 respondents 93 were women, 55 were men and 2 didn't specify their sex. The majority of the sample (118) had an age ranging from 18 to 25 years, followed by a group of 22 people that declared having or being older than 36 years. As seen in *Figure 1*, 116 out of the 150 respondents were students, 25 were workers, 3 were retired, and 6 people didn't specify their occupation. When the sample was divided by having or not having a health-related occupation, 76 of the respondents (50.66%) were classified as "people updated on health issues" and the other 74 (49.33%), as "people outdated on health issues".

Knowledge obtention and experience satisfaction were the two indicators studied to measure the campaign's success. In order to assess the obtained knowledge and compare it, two electronic surveys were conducted via *Google Forms*: the impact survey and the control survey. The impact survey was applied to the followers, who were the target public of the campaign and which occupation distribution

Figure 1. Sample distribution based on occupation. The left column was assigned to the groups classified under the definition of "people updated on health issues". The right column was assigned to the groups classified under the definition of "people outdated on health issues".



was described previously. In contrast, the control survey was applied to people which had no contact with the campaign and which were external to a health-related occupation and therefore, outdated on health issues. The sample size for the control survey was 65. For the evaluation of the experience satisfaction of the participants of the campaign, only the first survey was used.

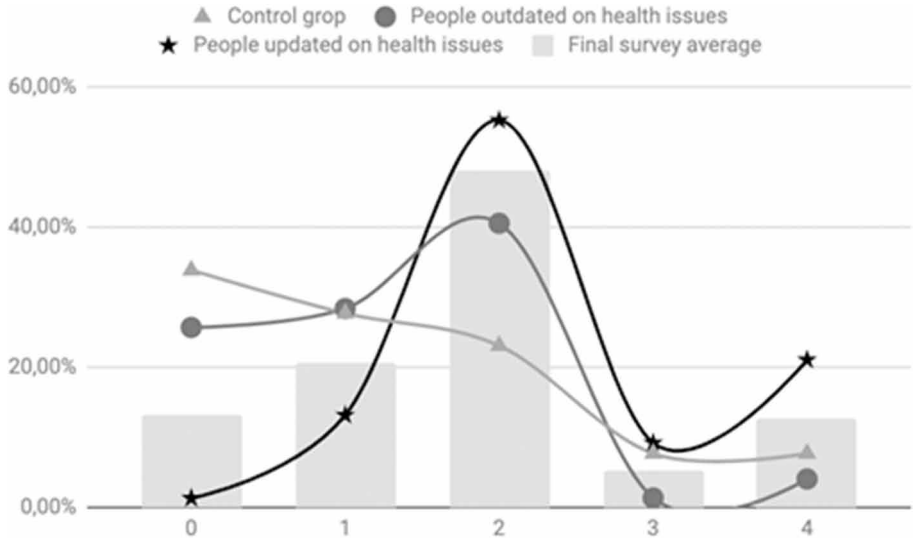
The impact survey was composed of eleven questions. Three of them asked about personal information (age, sex and ocupation); five items evaluated the satisfaction of the experience, from which four were dicotomic questions and one was a open elective question for final comments; the last three questions were made to asses the obtained knowledge. These final items were multiple choice and contained 4 options, they summed for a total of 4 points (one of them had a double correct answer), and they covered the illness definition, symptomatology, related and nutritional factors; the same ones were the only questions included in the control survey. Finally, impact survey replies from *health issues outdated respondents* were compared against the control survey replies to evaluate the obtained knowledge.

Out of the group of people updated on health issues, 100% declared having previously heard the term "hypothyroidism", however, 13.15% were not familiarized with the signs and symptoms of this disease. In terms of identifying hypothyroidism, 100% of the people in this group indicated feeling capable of applying preventive measures and identifying it, moreover, 97.37% considers that the *Instagram* page influenced in a positive way both their lifestyle and care for their thyroid.

In the group of people outdated on health issues, 25.65% mentioned not having heard the term hypothyroidism before and 67.56% indicated not knowing the signs and symptoms of the disease. Nevertheless, 79.73% of the respondents in this group now feel capable of applying preventive measures and identifying the disease. In addition, 94.6% think that the page benefited their lifestyle and care of their thyroid.

The open elective question in the satisfaction section of the survey provided valuable insight from the respondents in regard to the impact of the page. Here are the examples of two comments left by respondents who appreciated and expressed their gratitude for the provided content:

Figure 2. The graph shows a comparative of the percentile distribution of the scores obtained by the different groups in the obtained theoretic knowledge section of the applied surveys. The back columns correspond to the total distribution of the impact survey for this campaign (n=150). The line with stars represents the scores obtained on the impact survey by the group of people updated on health issues (n=76). The line with circles represents the scores obtained by the people outdated on health issues (n=74). The line with triangles represents the score obtained by the control group (n=65).



I loved it, personally, I modified my lifestyle to incorporate enough iodine to my diet. Thanks!" - **R118M**

*I thought the page was really good, congratulations! The organization, writing and design in each publication really caught my attention. I didn't know of hypothyroidism before and its effects on our health, thanks to you I find myself more informed and attentive to this matter***R-132F**

On the other hand, some of the comments focused on giving constructive criticism for the improvement of the campaign:

You could translate the name to Spanish to reach more people. I speak English and the first time I looked for the page I miswrote the name by a letter, and it didn't show up. My niece has hypothyroidism and the page would really help my mom and sister but they struggled to find it because they don't speak English. - **R50F**

In the obtained theoretic knowledge section of the survey, the mean score obtained by the people updated on health issues and outdated on health issues was of 2.35/4 and 1.29/4, respectively. Taking both groups into consideration, the mean score in this section was 1.83/4. To make a comparison with the control group, their mean score on the same survey was 1/4. The score distribution among the previously described groups can be observed in *Figure 2*.

Figure 3. The picture shows a post published in the DailyThyroid Instagram page in which the statistics on hypothyroidism in Mexico are shown.

POST DESIGNS

The posts shown in *Figure 3* were chosen to share in the media due to their high impact contents. It is of great importance to provide veridic and statistical information about the actual burden of hypothyroidism in their own country to our followers, this way they can understand how necessary it is for them to know about the disease presented in the infographics.

The color palette chosen had the sole goal of attracting the viewer's attention and interaction with the *post*, that is why some shades of bright orange and light cream colors were the most accurate, looking forward to reach more users. As well, the different typography emphasizes in bringing out the most important information, that is the reason bold and thick letters were used; on the other hand, smaller yet visible letters were utilized to enrich the subject. Also, certain iconic images were used to capture and entertain the audience

The images shown in *Figure 4* had the main purpose of giving a general introduction to the hypothyroidism topic by providing a brief, comprehensible explanation of its main causes and the difference between its 2 types of presentations. They were given a similar design as the previously seen posts with the objective of giving formality and a distinguishing pattern to the *Instagram* page. Even though they followed a similar format, the color palette was changed on purpose to provide dynamism to the social page, yet choosing a captivating mix. Certain symbols and images were used to catch the eye of the public and provide a more in-depth explanation.

References were also provided at the foot of page in one of the posts, in order to allow the reader to do a deeper research on the topic of their choosing. The sequence of the posts was organized this way so the explanation that is intended to give works properly for the audience, either it is part of the scientific field or general public; therefore, explaining simple subjects first, then complex ones (such as the types of presentations of the disease) was found to be the best organization.

The purpose of the three visual resources shown in *Figure 5* was to provide the public with basic information about iodine's properties and contribution to the human body, such as its important role in the production of thyroid hormones, the different types of food that contain it, and the recommended daily amount of this nutrient by the Food and Drug Administration (FDA). In the last two pictures, some illustrative images were used as a resource to make them more attractive and easier to learn the key points for the readers.

Figure 4. The picture shows a post published in the DailyThyroid Instagram page explaining the basic and most relevant information about hypothyroidism and its etiology.

In addition, some sentences were written and emphasized specifically to exhort viewers to take conscience on the proper consumption of iodine among every meal and the benefits it brings with it, in the hope that it will also motivate them to share this information with other people and contribute to prevent the development of hypothyroidism due to lack of iodine intake. Similar to the other posts presented before, the colors and typography were selected to maintain the page's harmony and make it pleasing for the viewer's eye.

Figure 5. The picture shows a post published in the DailyThyroid Instagram page in which the key points about iodine's function is summarized.

SOLUTIONS AND RECOMMENDATIONS

Nowadays, digital platforms are the main source of communication. Their easy access and their ability to gather many people makes them a great option for social and educational interactions. They are also ideal in situations where physical presence is not plausible. Moreover, while the "Daily Thyroid" campaign was being performed, the COVID-19 pandemic was also happening; limiting the application exclusively to have an online presence and interaction. These circumstances pushed the project to take a different approach in order to meet the campaign objectives. Even though having the accessibility of close contact and interaction with people would have helped with the engagement of the audience, "Daily Thyroid" was still able to attract and inform its audience about hypothyroidism through visual content without any problems. That was feasible due to the fact that all of our target audience had *Instagram* accounts and access to the internet. If that weren't the case, another feasible solution would be the posting of informational posters and pamphlets, proceeding with a questionnaire conducted by a well-equipped staff member.

Hypothyroidism Campaign Learnings

During the time that information about hypothyroidism was being posted on social media, the team of content creators found out that there would be some issues with the potential of obstaculizating the proper diffusion of information. Since this campaign was 100% online, the level of awareness was not as it would have been if promoted in an in-person modality. From this particular aspect, the team learned that a useful tool to disseminate information on a larger scale could have been to combine efforts with other campaigns in spanish with a similar approach. Also, it could have been a significant boost to encourage the audience to keep on sharing every post on their social media. This way, an important learning for the team is to try new resources and look for other groups working on the same goal to have a higher scope.

Recommendations for Future Investigation

The authors have recognized some strengths and weak points that can be taken as recommendations for future similar campaigns. Choosing the correct social media is essential, "Daily Thyroid" had a concrete objective: in order to promote scientific information about the impact of thyroid dysfunction in a person's life, the campaign provided basic thyroid related information to the audience. For this purpose *Instagram*, a friendly digital platform in which pictures and graphics are easily distributed, was used. The campaign focused on establishing a real dynamic interaction with the follower with the application of diverse digital strategies as challenges in *Instagram stories*. Therefore, it is highly recommended to reinforce this strategy in order to accomplish the goal of spreading useful information among communities in future campaigns. The originality and quality of the profile posts composition allows for a better recognition of the campaign, which means that the approach to the public was efficient. Nevertheless, it could be a good addition to use an informal language or other type of resources to catch the attention of younger readers. Furthermore, in order to reach a wider audience, it could be useful to allocate some budget specifically for advertising on the social media platform used for the campaigns. Lastly, to allow the obtention of more accurate results and better conclusions, it is crucial to evaluate the knowledge of the topic at the beginning of the campaign, not only at the end.

Limitations

The campaign had a few limitations and areas of opportunity. Regarding the lack of time, the information needed to be posted in a window of two weeks, which only allowed to specifically cover the general aspects of hypothyroidism through a limited number of daily posts. Having more time for the campaign would have allowed more in-depth content and better engagement with the audience. Moreover, a longer campaign could have fitted not one, but multiple evaluations of the users' knowledge through time, which would have yielded a more accurate result of the campaign's impact. Finally, money also represented a big limitation; with more economic resources, researchers could have invested in marketing and promotional strategies in order to reach a much larger and specific audience.

CONCLUSION

A digital campaign through social media was potentially the most effective method for patient education, allowing easier and faster interaction while also adapting to the ongoing limitations of the COVID-19 pandemic, during which direct contact with the campaign followers was not possible. The main limitations faced during the process were shortness of time as well as a lack of budget. Despite these limitations, an overall acceptance from the followers was exhibited and analyzed through the results obtained from the survey. These results demonstrated the positive impact of our campaign, given that most of the people surveyed now considered themselves capable of identifying relevant aspects of the disease such as its main symptoms, its possible causes, and how to prevent it all together. The knowledge portion of the survey applied to the participants confirmed that the campaign achieved its main objective of informing people. The obtained average score of the knowledge portion of the survey was higher than the average of the control group. This includes the group of "people outdated on health issues", who also scored higher than the control group.

It is of the utmost importance that campaigns like this continue to take place, as they facilitate the process of patient education. Another key benefit to this sort of campaign is its marked potential to be one of the best ways to prevent diseases, which entails a big impact on all health systems. It is also worth mentioning that, although the use of digital tools and alternative platforms was strongly influenced by the need to adapt to the current situation, these methods could be repeated after the pandemic and regardless of social distancing mandates. These updated measures used to reach patients must aim to revolutionize the way healthcare professionals promote well being and disease awareness.

ACKNOWLEDGMENT

As medical students, hard work like the present would not have been possible without the help, mentoring, encouragement and the love for teaching of those people who guided us through the realization of this chapter. The authors want to express the most profound gratitude to their professors, doctors Nancy Segura and Mildred López, who supported them during the months it took for the planning and the writing of this work, giving them part of their time, accompanying and advice in order to get the best possible results to obtain experience in the field of medical and educational literature.

Lastly, the researchers also want to thank all the people who participated in the campaign through social media. The obtained results and the analysis were the base for the writing of this chapter and would not have been possible without their trust and their participation.

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KEY TERMS AND DEFINITIONS

Amenorrhea: Lack of menstrual bleeding in women during reproductive age.

Autoimmunity: Abnormal immune response against specific proteins or cells that belong to the body.

Endocrine System: A series of glands and organs in charge of hormonal production, secretion and reabsorption that regulates metabolism, sex behavior, development, etc.

Galactorrhea (Pathology): Milk production in the absences of a pregnancy.

Gene: Essential component of the genetic information. The multiple combinations lead to individual differentiations of the organisms.

Hormones: Molecules that orchestrate the signalization process in living organisms through organ interaction. Promoting the coordinate function of the structures in order to maintain the homeostasis.

HPTa: Hypothalamic–Pituitary–Thyroid axis.

HT: Hypothyroidism.

Hyperprolactinemia: Oversecretion of prolactin to the blood (>20-25 ng/ml).

Hypogonadism: Reduction or absence of sexual hormones that reflects on the gonads.

Iodine: Chemical element used by the thyroid as an indispensable substrate for the hormonal production.

Parenchyma: Essential organ tissue.

Physiology: The good biological function of the body.

T3: Triiodothyronine.

T4: Thyroxine.

TG: Thyroglobulin.

TPO: Thyroid peroxidase.

TRH: Thyrotropin releasing hormone.

TSH: Thyrotropin.

Chapter 10
Social Media Campaign as a Tool for Patient Education of Disease Prevention and Health Promotion:
Digital Health Campaign on Osteoporosis Knowledge

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ABSTRACT

Public awareness campaigns have played a crucial role in improving the health of communities, as they directly affect people's perception and behavior towards a specific topic, especially on disease prevention and health promotion. This can be seen in campaigns focused on, for example, infectious disease prevention such as HIV, tuberculosis, dengue, and more recently, COVID-19. Formerly, awareness cam-

DOI: 10.4018/978-1-7998-8783-6.ch010

paigns took a very traditional approach using printed promotional materials, in-person conferences, and television and radio commercials as their primary way of reaching their target audience. This chapter describes an alternative method for reaching new audiences, in a society where social media has taken over as the public's main source of information and entertainment. These platforms can be used to extend important public health information to connect with and educate the public. The authors believe that this approach may increase the public's response towards emerging public health concerns as well as aid the digitalization of medicine through the evolution of telemedicine.

INTRODUCTION

The current state of technological advances and social media presents novel opportunities to reach the public and create awareness about any health-related issues. Society has come far from public health campaigns based on printed flyers and televised interviews or presentations. It is now possible to reach a specific target group depending on the social network used, and more importantly, directly into the public's hands through electronic devices.

Nowadays, media resources are one of the main pillars in health education, promotion, and disease prevention. However, with an excessive amount of information available and the question of source reliability, the need to develop well-structured and well-founded campaigns for the public by health professionals arises. These campaigns must be comprehensible, attractive, and a motivation factor to the audience for them to be successful, useful, and objective in promoting health and potentially preventing disease development.

This chapter aims to present digital social media public health campaigns to communicate and inform the public about health promotion and disease prevention, specifically regarding osteoporosis. An Instagram campaign was conducted, after which a survey was applied to measure the knowledge of the public on the subject following their education from the posts made throughout the campaign. This chapter will discuss the general aspects of osteoporosis and the importance of its prevention, various established patient education interventions, the campaign design process and the results obtained with the public health measure executed, aspects about social media campaigns and their importance, and limitations, recommendations, and research directions regarding social media campaigns for patient education.

BACKGROUND

Osteoporosis

In 2016, it was estimated that globally 200 million people had osteoporosis, a common metabolic disease defined as a skeletal disorder in which bones have inferior strength and are at risk of pathological fractures (NIH [National Institutes of Health] Consensus Development Panel on Osteoporosis Prevention, Diagnosis, and Therapy, 2001). According to the International Osteoporosis Foundation, 1 of 3 women over the age of 50 and 1 of 5 men will suffer an osteoporosis-related fracture in their life (Sözen, Özışık, & Başaran, 2017). Osteoporosis was chosen as the focus for the social media campaign due to its high and rising worldwide prevalence and the aging population.

Etiology and Classification

Osteoporosis can be divided into primary and secondary, based on the cause and the course of treatment. Primary osteoporosis is known to be bone loss related to the natural aging process; it can be further divided into two types. Type 1 or postmenopausal osteoporosis affects women after entering the stage of menopause, where the loss of estrogens, the female sex hormones, creates a negative balance in the bone resorption that leads to bone loss. Senile osteoporosis is defined as type 2 primary osteoporosis. It equally affects people and is developed because of the decreased mechanical pressure associated with the reduced physical activity performed at later ages, and because of changes in nutrient absorption in senior adults, primarily vitamin D and calcium, also resulting in low bone deposition and increased bone resorption (Keen M, 2021).

On the other hand, secondary osteoporosis is related to clinical states that disrupt normal bone metabolism, enhancing bone resorption or diminishing bone deposition. Some of the most common conditions that may give rise to this disease are hyperparathyroidism, hyperthyroidism, intestinal malabsorption, Cushing's Syndrome, and the use of drugs such as corticosteroids and L-thyroxine (Ganesan, Jandu, & Roane, 2020).

Risk Factors

The risk factors for osteoporosis can be classified into three main categories: non-modifiable, modifiable, and secondary risk factors (Pouresmaeili, Kamalidehghan, Kamarehei, & Goh, 2018). The non-modifiable risk factors include menopause because estrogen levels decrease, age, as it lowers osteoblastic activities, and genetic defects associated with calcium metabolism. Modifiable factors consist of body mass index and lifestyle, which considers the diet, tobacco and alcohol use, vitamin D and calcium daily intake, sedentarism, among others. Meanwhile, as mentioned in the last section, the use of certain drugs, most commonly glucocorticoids, and diseases like rheumatoid arthritis, diabetes mellitus, dementia, and cancer may indirectly cause osteoporosis and are considered secondary risk factors (Hermoso de Mendoza, 2003).

Pathophysiology

The mechanism of osteoporosis depends on the etiology, yet all causes give rise to the disease by increasing bone resorption by cells called osteoclasts or by decreasing bone formation by cells called osteoblasts. The most studied pathophysiologic mechanisms include those of primary osteoporosis and some of secondary osteoporosis.

Senile osteoporosis development is linked to increased bone sensitivity due to the reduced physical activity in senior adults, which minimizes the bone matrix by excessive production of matrix-degrading enzymes and renders the tissue porous and prone to fractures. Additionally, changes in the microbiome and the digestive tract give rise to decreased absorption of key bone nutrients, including ions like calcium and hormones like Vitamin D (Föger-Samwald, Dovjak, Azizi-Semrad, Kerschan-Schindl, & Pietschmann, 2020).

Postmenopausal osteoporosis is characterized by a lack of estrogen. This hormone normally lowers the bone tissue's sensitivity to parathyroid hormone, increases the production of calcitonin, accelerates calcium intestinal absorption, reduces calcium renal excretion, and has a direct inhibitory effect on

osteoclastogenesis and osteoclast activity, all of which directly and indirectly lead to a reduction and/or inhibition of bone resorption and an increased bone deposition (Ji & Yu, 2015). Consequently, after menopause estrogen deficiency leads to the opposite outcome, enhancing osteoporosis development.

As to secondary osteoporosis, the disease is most commonly associated with glucocorticoids. In this case, osteoporosis develops because of inhibition of osteoblast activity, increased osteoblastic apoptosis, increased osteoclastic activity, and decreased vitamin D-dependent calcium absorption. Furthermore, glucocorticoids alter the levels and activity of various other hormones, including growth hormone (GH) and gonadotropins, which indirectly affect bone metabolism and may enhance osteoporosis development (Mirza & Canalis, 2015).

Clinical Characteristics

The multifactorial etiology of osteoporosis renders the diagnosis difficult and the clinical evolution of each patient variable. Fractures are the main finding when diagnosing osteoporosis, caused by a reduction of bone mass and quality related to the progressive decrease in bone radiodensity and demineralization; they usually happen in the advanced stages of the disease. The evolution of this pathology is gradual and silent, commonly presented as asymptomatic until the bone breaks under specific physiologic stress situations (Dobbs, Buckwalter, & Saltzman, 1999).

On examination, bone fissures may be found anywhere on the skeleton, excluding the skull. The most common fractures occur in the spine (vertebrae), the hip (femur), and the shoulder. They usually take place spontaneously while carrying out daily chores and their incidence increases with age, race, and gender, with women more commonly affected. Because these occur without the presence of significant trauma that could lead to the fracture, they are defined as pathologic fractures. Osteoporosis may also be clinically characterized by chronic pain, disabilities related to loss of skeletal functions, and, in extreme cases, distinct comorbidities (see *Complications*) and death. Another common complaint in patients is height loss due to vertebral compression caused by multiple vertebral fractures (Sözen, Özışık, & Başaran, 2017).

Diagnostic Methods

Given that osteoporosis is a disease that affects bone mineral density (BMD) and the microarchitecture of bone, the diagnostic criteria are primarily radiographic. The two main diagnostic criteria are the quantitative determination of BMD from dual-energy x-ray absorptiometry (DEXA) and the fracture risk assessment tool (FRAX) (Casiano, 2015). Both criteria are effective in establishing the risk of pathological fractures due to the demineralization present in osteoporosis. Additionally, a thorough history and physical examination should be performed, focused on family history of osteoporosis and/or parental hip fractures (Kanis J, 2004).

Complications

The main physical complications of osteoporosis are fragility fractures, also known as pathological fractures. Fragility fractures result from using an exceptionally low energy force, which normally would be insufficient to break a bone.

Specific lesion location along with the nature of each patient can disturb their daily activities through functional limitations caused by the disease, and they might cause patients to be prone to develop ulcers and thrombosis (Liu, Chao, Wang, & Wu, 2018). Fractures healing irregularly may lead to chronic inflammation and pain, arthralgia, arthrosis, residual rigidity, deformities, among other symptoms or conditions. Vertebral compression fractures are responsible for several secondary complications, such as chronic back pain, lumbar lordosis, pulmonary and gastrointestinal problems (Varacallo, & Fox, 2014).

Other than the physiological problems, patients may experience social and psychological sequels. Job loss or job change may be common for people with osteoporosis, and it results in reduced income and loss of medical insurance coverage, which may affect their access to medical services and their quality of life. Additionally, social isolation, low self-esteem, and depression are frequent in these patients (Gold, Shipp, & Lyles, 1998).

Prognosis

Osteoporosis has a favorable prognosis if bone loss is detected in the early phases and proper intervention is undertaken. Patients can increase bone mineral density (BMD) and decrease fracture risk through exercise, a calcium-rich diet, and the appropriate anti-osteoporotic medication. In addition, patients can decrease their risk of falls by participating in a multifaceted approach that includes rehabilitation and environmental modifications. Worsening of medical status can be prevented by providing appropriate pain management and, if indicated, orthotic devices (Whitaker, 2021). Additionally, it has been shown that educational programs are effective in improving osteoporosis prevention and management (Morfeld, Vennedey, Müller, Pieper, & Stock, 2017).

Other Patient Education Strategies

Many health services focus on disease treatment, but it has been established that disease prevention is more effective and has more benefits to guarantee a better quality of life and lifespan in comparison to disease treatment (Rheinberger, Herrera-Araujo, & Hammitt, 2016). Population and patient education are essential for a successful preventative strategy (Laaser & Kovacic, 2007), and public education campaigns regarding health concerns have always been the cornerstone of public health.

General

In previous times, technology and electronic devices such as computers, smartphones, and even cable television weren´t a commodity as available as they are today, where 90% of adults in the U.S have access to the Internet (Hernandez-Garcia I, 2020).

Traditional solutions to promote public health for disease prevention have been to develop printed materials to deliver in communities and health centers; organize campaigns and conferences in schools and community centers; and offer workshops and projects to extend health information to the public (Laaser, & Kovacic, 2007). Another widely used method that has been used to communicate valuable information is the radio, where campaigns are conducted and can reach even isolated communities, or orally by healthcare workers (Holst, Sukums, Ngowi, Diep, Kebede, Noll, & Winkler, 2021).

Digital

As technology continues to improve, communities have learned to adapt to function along with the new communication systems. As such, it can be said that today the internet is the most researched encyclopedia in the world. People can now find anything that they want to know in the blink of an eye, but with the advantage of having millions and millions of data and resources, it has come to a point where it gets more difficult to discern and select reliable sources of information. This has become a public health concern since 80% of Internet users in the U.S search for medical information on the internet (Chen, 2018).

Organizations, governments, and health institutions have taken advantage of the wide reach online platforms have to develop custom campaigns that reach specific audiences. As such, digital health interventions have become an effective method to reach more people at lower costs to promote health, prevent disease, and strengthen healthcare systems (Holst, Sukums, Ngowi, Diep, Kebede, Noll, & Winkler, 2021). Holst et al. also mention that using digital tools and technology is an important strategy to improve health literacy, defined as the outcome of patient education (2021).

Through artificial intelligence and algorithms, digital programs can be tailored to deliver information at an adequate time to specific people. This approach has shown to be successful when the target audience receives the information and can interact with it, rather than only being exposed to it. For health education, modern memory carriers, recorders, and electronic devices have replaced other teaching tools since they are what most people use and have spread throughout the world, and they have better quality and more longevity (Laaser, & Kovacic, 2007). Other digital public health interventions and activities are in the form of online support groups specific to a condition, where affected people and their families come together and share information and support for one another. On a recapitulation of reviews, it was shown that especially social media interventions have made a significant impact on all public, even on populations at risk of disadvantages such as youths, low-income populations, rural populations, and older adults (Welch, Petkovic, Pardo, Rader, & Tugwell, 2016).

Patient Education Strategies for Osteoporosis

Osteoporosis, as a chronic disease that affects millions of people worldwide and with no known cure, has been subject to various patient education interventions to prevent its development and improve its diagnosis and treatment. Osteoporosis management is often ineffective due to poor patient adherence, which may be associated with a lack of patient education regarding the disease, its preventive measures, and its consequences. Therefore, patient education programs, which have proven effective in other chronic conditions and osteoporosis in certain studies, are crucial for improving knowledge, health beliefs, and behavior among patients (Morfeld, Vennedey, Müller, Pieper, & Stock, 2017).

A study conducted by Park et al. (2017) was designed to evaluate whether an educational intervention program on osteoporosis could improve osteoporosis knowledge, self-efficacy awareness, and dietary habits and customs of a senior population in Korea. The intervention consisted of an individualized education program with materials distributed in print form and an exercise program composed primarily of stretch, balance, and impact training exercises. Their results showed an improvement in knowledge and self-efficacy, as well as changes in the patient's food intake patterns and habits, with an increase in dietary calcium and vitamin D consumption. The study concluded that educational measures are effective for the improvement of these parameters, which may help prevent the development of osteoporosis in the elderly population.

Another study, directed by Wang et al. (2016), proposed a new model of health education and management for osteoporosis prevention in China, in which an osteoporosis club was created and given various health education activities like lectures, exercise programs, and communication parties. The participants were already diagnosed with osteoporosis or osteopenia, and the intervention was focused on effective management and pathologic fracture prevention. Results showed increased osteoporosis knowledge and health belief levels compared with the control group, as well as a healthier lifestyle, increased medication compliance, increased bone mineral density, and decreased pain degree level. This suggests again that educational interventions improve disease knowledge and lifestyle habits to contribute to osteoporosis prevention and management.

An additional study specifically reviews the effects of patient education on osteoporosis prevention and treatment. The authors selected randomized controlled trials that included adults with or at risk of osteoporosis and assessed the interventions they received to prevent the disease. Patient education was observed to improve osteoporosis knowledge, osteoporosis management, and calcium and vitamin D intake in more than 50% of the analyzed trials. Pharmacological treatment, medication adherence, physical activity, fractures, and quality of life improved only in less than 50% of the trials. However, a significant association between characteristics of the intervention and improved results could be established, and the authors suggest further research to analyze the effectiveness of patient education programs for osteoporosis prevention and management (Morfeld, Vennedey, Müller, Pieper, & Stock, 2017).

As can be observed, there are no studies focused solely on digital interventions to improve patient education on osteoporosis knowledge. This new and modernized method to reach persons with or at risk of osteoporosis may prove to be effective given the communication system and information sources of today.

COVID-19 Pandemic's Urge to Change Patient Education Format

Telemedicine is a process that has been in development since the early twentieth century with telephonic medical consults and radio health promotion (Board on Health Care Services; Institute of Medicine, 2012), and in today's world, it shows a promise for the future of medical care and health. The technological advancements and integration of technology into the daily lives of millions of people have given health professionals a wide platform to reach into communities and provide relevant, truthful, and objective information as efficiently as possible to improve the public's health and quality of life. Since doctors and other medical professionals are still considered the most reliable source of medical information (Hesse W, 2005), it is important to have established plans of action to provide direct advice and health promotion information for the public. Governments and institutions have the challenge to deliver this information to people who would otherwise have a low probability of obtaining it, such as rural communities isolated from any medical center, and even to big cities where health services are constantly busy.

The COVID-19 pandemic accelerated the virtualization of health, making way for a growth spurt in many branches of science and medical services. During the pandemic, telemedicine was the primary mechanism to slow the spread of coronavirus. Many medical amenities were completely made digital, with health professionals providing their services by phone or videoconferencing, since social distancing was of primordial importance to lower new COVID-19 cases. One important application of telemedicine, besides helping enforce social distancing, is to distribute information rapidly and at low costs to a larger public. Because of this, it is widely available to be exploited in public health, helping inform and share prevention and clinical practices on different diseases and conditions (Vidal-Alaball, Acosta-Roja, Pastor, Sanchez, Morrison, Narejos, & Salvador, 2020). Ohannessian et al. (2020) mention that the COVID-19

pandemic guided the integration of telemedicine into the normal medical service, but that national and international guidelines and regulations are necessary for the future.

SOCIAL MEDIA CAMPAIGN AS A PATIENT EDUCATION TOOL

Digital Campaign Development

Given the need to deliver accurate medical information as well as health promotion for common diseases which may be preventable, the osteoporosis health campaign was created. Additionally, because of the COVID-19 pandemic, it was designed as a digital social media campaign to reach the public completely online. During the academic period, an endocrinology professor at the School of Medicine and Health Sciences of the Tecnologico de Monterrey, created a project where multiple teams were tasked to research a specific disease and design a campaign, with the intent of informing and creating awareness in the non-medical and medical population with the use of social media. A digital campaign was planned with the general objective of allowing young users to identify risk factors for osteoporosis and modify them. Specific objectives included promoting scientific and medical information about osteoporosis to the public and promoting the importance of disease prevention and ways to do so. In this case, the social media platform *Instagram* was chosen given the superior reach in quantity and specific profile of the determined audience.

Firstly, each group did their research to fully comprehend the disease and gain sufficient resources, which would be useful in creating media content to explain objectively and comprehensively to the public and ensuring the accessibility and understanding of this information to the audience regardless of their academic or social background. The authors selected key elements to deliver the information as efficiently as possible, considering as priority the understanding of the disease definition, etiology, classification, risk factors, pathogenesis, clinical manifestations, diagnosis, and treatment.

Once the authors had gathered enough information, the material was created for the *Instagram* campaign using the online tool *Canva*. The decision was made to target the young adult population of Monterrey, Mexico, who are the most active in social media and can modify certain risk factors with the most efficiency (Albergaria, Chalem, Clark, Messina, Pereira, & Vidal, 2018). Visual resources were used to draw in public. The aim was to provide small capsules with key information for the visualization and prevention of the disease. The authors named the campaign profile 'Cracky Bones' as a pun to attract users of the app and made public fixated posts with a distinctive aesthetic, as well as ephemeral Instagram stories. Another way of maintaining the attention of the public was the random questions based on the information posted, which were published the same day as the information on the same topic was published, and the participants were not able to see the results until they answered. Hours later, the correct answer was posted as a story and the public was invited to revise the posts again.

The campaign lasted 10 days, and when all the posts were published, the followers were contacted and asked to answer a small survey about the disease to test the osteoporosis knowledge they may have retained from the online social media campaign. The survey was composed of 12 questions and the total raw answers received were 191.

Figure 1. Statistics post. Translation: Statistics, most frequent metabolic bone disease.

Campaign Results

A survey was conducted to analyze the level of information retention of the target public after the osteoporosis campaign. The results are commented below and the survey, along with each questions' results, is available in *Appendix 1*.

The results showed that 70% of the people surveyed correctly answered all questions on osteoporosis; with the questions regarding the definition and epidemiology of osteoporosis having the highest percentage of correct answers in comparison to the questions about risk factors and etiology of the disease. The first question was an open question: "What is the disease osteoporosis? Please use your words." The authors consider this question reflected the population's comprehension of the disease since most of them were able to give a correct basic definition of the illness. 0.6% of participants answered either "I don't know" or an incorrect answer, which derives in 99.4% (n = 151) of the participants giving a correct answer as to the definition of osteoporosis.

The questions about risk factors, in general, were answered correctly by most participants. They were questioned specifically about gender, corticosteroids, alcohol or cigarette use, and vitamin D and calcium deficiency as risk factors. Overall, it was observed that the general population could recognize the actual risk factors from distractors. The most important risk and protective factors were included in the online campaign and were retained by the participants during the survey; for example, 73.4% of the population recognized smoking or alcohol use as risk factors and 66% recognized that cortisol represented a risk factor as well.

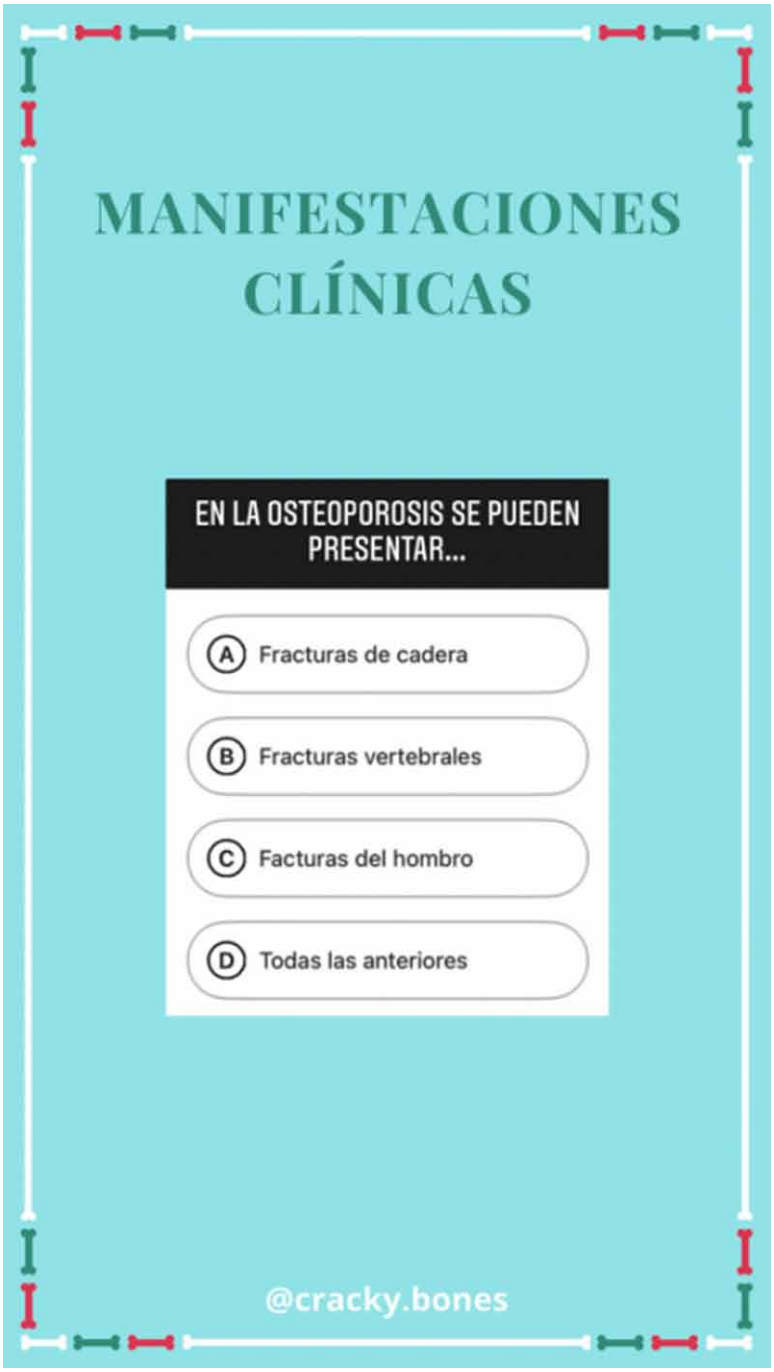
Figure 2. Second statistics post. Translation: Global Statistics, 30% white women and 8% of men older than 50 years, a total of 200 million people.

Instagram Post and Story Campaign Images

The authors used distinctive design resources such as *Canva*, relying on striking colors and fonts to transmit the information and attract attention. As mentioned before, the authors created posts, stories, and interactive quizzes. To better divulge the information, firstly an acceptable aesthetic was chosen to draw in the public, short messages were drafted, avoiding the use of specific medical jargon, and digestible capsules were created. All resources were based on reliable sources which were disclosed to the public. Below are some examples of the images created as Instagram posts and stories (*Figure 1, 2, 3, 4*), which were published during the social media campaign. The images are available in the Instagram account @craky.bones at any moment.

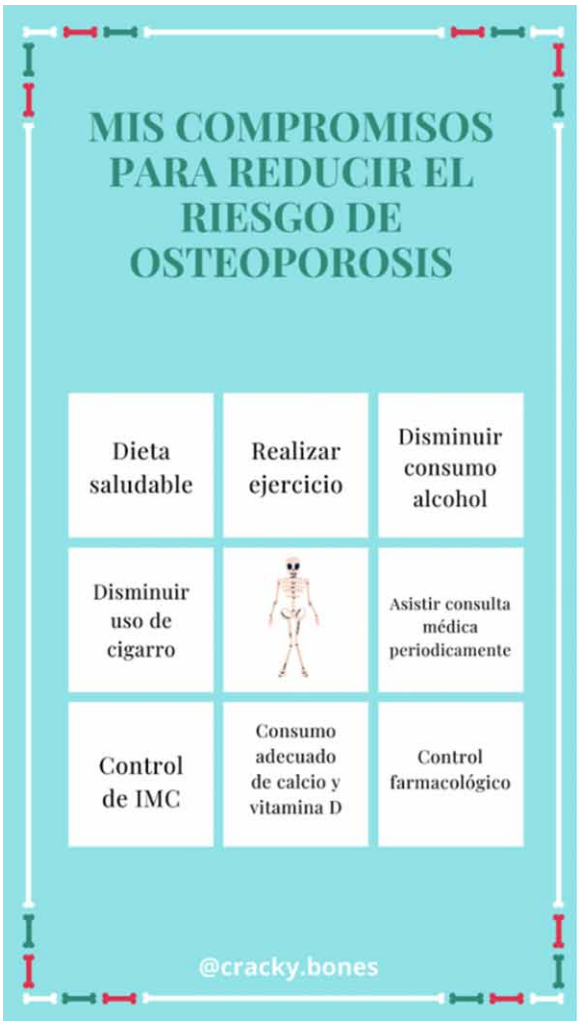
The path the account followers could go through was the next: primarily, participants would visualize the posts with specific information on osteoporosis, around 4 or 5 images per post, alike to the *Figures 1 and 2* presented. During the next few hours, the published images would appear on their feed and some stories would be uploaded with further information, along with a small quiz with two questions, like those that appear in *Figures 3 and 4*, with the intent to engage with the public through digital resources.

Figure 3. Question about symptoms. Translation: Clinical manifestations. In osteoporosis, you can present… A. hip bone fractures, B. vertebral fractures, C. shoulder fractures, D. all of the above.



The power of interactive resources is made clear with other studies such as the work of Crosby, Laird & Younie (2019), who made a digital campaign through a website to instruct young children about

Figure 4. Commitments endorsed for the public. Translation: My commitment to reducing my risk of osteoporosis. Healthy diet, exercising, lowering alcohol consumption, lowering cigarette use, assisting to regular checkups, BMI control, regular intake of vitamin D and calcium, pharmacological control if needed.



handwashing. They conclude that interactive materials are useful in learning abstract concepts and are well received by different populations.

Patient Education Through Social Media Campaigns

Being able to communicate to the public relevant basic information on any prevalent disease is just as important as knowing these facts as a health provider. Therefore, approaches like the one described, in the era of online communication, seem fit for doctors to use for reaching out to the population with quality information. An example of the drive to communicate this way is provided by the study conducted by Ruan, Raeside, Singleton, Redfern & Partridge (2021), a systematic review on websites available for

and directed to adolescents about health in general. They found that few resources were based on reliable sources, were interactive, or were written in a language comprehensible for children 13-15 years old. The present campaign was also focused on young adults, as mentioned, because, as Holland (2017) reports, engaging young people for education on osteoporosis encourages behavioral changes that help develop preventive measures. The authors consider that entering social media is the best way of connecting directly with young people to establish activities for healthcare and disease prevention, using interactive and quality material that ensures they learn and understand completely and adopt healthier lifestyles, the key to disease prevention.

As has been reported, increased health literacy may result from any number of different education programs (Holst, Sukums, Ngowi, Diep, Kebede, Noll, & Winkler, 2021), and the effectiveness of patient education can be seen with general campaigns specifically targeting osteoporosis, like the education campaigns conducted by Wang et al. or Park et al. A present-day and necessary approach to achieve this literacy is through digital campaigns, such as the one implemented by the authors, because of the means of communication and information obtention issued by technology's constant evolution and because of the current COVID-19 pandemic that forces public health activities to be online.

Livingston, Tugwell, Korf-Uzan, Cianfrone & Coniglio (2013) conducted a study about the attitude of young people towards mental health issues through an online campaign, where the results showed that people are more likely to talk about their problems and seek help if they have been previously exposed to a health campaign on the given topic. Young people also achieved more awareness by visiting a specific website the authors included as an extra resource for their users, which elevated this variable by 9.6%. Therefore, it can be observed yet again that being exposed to educational health campaigns and online information effectively leads to patient education. Though the authors of the osteoporosis campaign did not measure the initial knowledge the target public had, an astonishing approval rate was received, demonstrating the significant impact that can result directly from social media exposure. Another example of successful social media campaigns is the work of Mejova & Suarez-Lledó (2020), which raised awareness of different eating disorders in the Twitter app. They tracked the use of keywords in the app, and their results demonstrated the positive impact of their campaign on the general knowledge about eating disorders.

As suggested by Welch et al. (2016), public health interventions that use social media may experience higher use and accessibility rates than campaigns with different formats, given they already have a developed social network and millions of users. Furthermore, a study on the lessons obtained from different social media public health campaigns demonstrated that these campaigns hold promise to recruit participants to change behaviors and adopt small healthier actions through an inexpensive and targeted intervention (Freeman, Potente, Rock, & McIver, 2015). It may also be important to target specific audiences through different social media platforms; for example, *Facebook* is the most popular social network for older adults, while *Twitter* and *Instagram* tend to be more prevalent with adolescents and young adults.

Another use of social media to divulge public health information is by sharing individual evidence-based research, health consensus, journal articles, conferences, events, that otherwise would not be widely available and that do not necessarily have to form part of a health campaign. Thus, the platforms may also be used as blogs and information or update centers for the scientific community and the public to have easier and faster access to relevant scientific and medical information. This can help establish online networks where people, regardless of their academic and social background, can connect, share,

and learn about public health, disease prevention, and health promotion from professionals and each other (Gatewood, Monks, Singletary, Vidrascu, & Moore, 2020).

SOLUTIONS AND RECOMMENDATIONS

The posts were created based on the specific information regarding osteoporosis: definition, epidemiology, risk factors, pathophysiology, clinical manifestations, complications, screening resources, and treatment. The order of the information posted online was created in a way that people could learn first about the basic information and then gain more in-depth knowledge that could help in understanding the disease.

One of the main problems of this campaign was the reach achieved. The campaign was created only for one social media app, thus the only possible interaction with the target public was within the same platform. To ensure the promotion and delivery of the information to more people, it is important to use different social media platforms that may have a more diverse audience and may help reach people with osteoporosis or with an increased risk of developing osteoporosis. This way, the information provided may influence more people and help the audience promote and create new habits that will have a positive impact on their health.

To ensure the knowledge and participation of the public in the publications of the campaign, different quizzes were created and were published in the section of 'Instagram stories' where key information regarding the information that was being provided with the daily publications about the definition, etiology, pathogenesis, clinical manifestations, diagnosis, and treatment of osteoporosis was asked for participants to test themselves after having read the posts. However, with all the tools and content that social media has, it may be important to create more diverse activities to guarantee the comprehension of the information such as videos, polls, Q&A´s with experts, reels, or any other incentive for the population that may promote more participation and interest in the campaign to ensure patient education for disease prevention and health promotion. For further research, the authors of the osteoporosis campaign also endorse measuring the impact through other methods such as the number of shares or hashtag use.

FUTURE RESEARCH DIRECTIONS

With social media such as *Instagram* and *TikTok* rising in popularity every day and being predicted to increase engagement by 53.9% and 34.2%, respectively, in the following years (Williamson, D., 2021), they present the potential to become one of the main channels to transmit information to the public. The success of this social media intervention model, based on short videos and images posted online, can be observed in the work of influencers with medical-related content such as @doctorvic or @DGlaucomflecken, health professionals who create fun preventive medicine videos, engage users, and help them learn while impulsing informed health decision-making and divulging reliable and well-grounded information.

Despite the lack of exhaustive studies analyzing the issue, orthopedic patients seem to rely on social media as a source of information and entertainment. Curry, Li, Nguyen & Matzkin (2014) published a survey of 752 adult orthopedic patients, 51% of whom were avid social media users. This data highlights the opportunity and fervid demand of the population even in age groups that are not regularly thought of as enthusiastic about social media. As so, the authors suggest research studies focused on exploring

specifically orthopedic patients and at-risk people's use of social media as a source of medical information, and the degree of patient education that may be achieved through these types of interventions.

The future opportunities in this field are immense. Since the COVID-19 pandemic, the use of technological tools has skyrocketed. Technological advances are meeting quickly-evolving regulations, which has made it easier for healthcare providers to offer telehealth services faster. Preventive medicine or public health content in social media is a new field to explore. The population needs to be aware of the infodemic problem in social media platforms to be able to consume evidence-based and secure medicine channels. With the rising search for information online, the public requires reliable and easy-to-digest sources of information available. It is crucial to study the best online interventions to guarantee increased health literacy, which has been proven to be an effective preventative health measure.

CONCLUSION

Understanding osteoporosis is the first step for preventing and treating patients, and patient education plays an essential role in the outcome and evolution of this disease. During this chapter, the main aspects of osteoporosis and its importance in society were exposed as the basis for the relevance of the social media campaign that was executed and presented. In many diseases, including osteoporosis, an opportune diagnosis equals a better prognosis for the patients. Nonetheless, as mentioned several times during the chapter, it is not until pain or fractures become present that people search for medical services. Thus, prevention and early diagnosis were the central objectives of the educational campaign design due to the essential tool education represents to ensure the general population's knowledge, which can guide them to have healthier habits that can effectively prevent the development of distinct diseases.

During the progression of the osteoporosis campaign, several obstacles were presented. The COVID-19 pandemic and the technological advances of society forced the authors to design innovative and attractive digital content to reach their target public and have a successful campaign. Likewise, captivating the audience on a wide social network such as Instagram constituted one of the greatest challenges for the promotion and reach of the campaign. Due to the target audience of the campaign, the material was presented and explained in understandable terms for most of the public, along with visual support. As discussed, social media represents an important platform to connect with the public through low-cost and widely distributed public health interventions, and numerous studies have been performed to confirm their effectiveness as a preventative medicine tool.

By building this sort of content aligned with today's sources of information, free and trustworthy scientific and medical knowledge becomes a reality for anyone with internet access. Health promotion and disease prevention should stand as the key purpose of healthcare providers all around the world, and it is important to adapt to what the public most uses to provide better patient education and literacy, the most powerful weapon to improve the quality of life of the population by allowing them to become part of the solution.

ACKNOWLEDGMENT

The authors wish to express their appreciation to the School of Medicine and Health Sciences of the Monterrey Institute of Technology and Dr. Nancy Segura for their support, as well as their families and

friends for believing in them. This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

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KEY TERMS AND DEFINITIONS

Awareness: The state of being aware. Perception or knowledge that something exists.

Digitalization: The process of transforming something to digital.

Evidence-Based Medicine: Use of the best available documentation in decision-making about the care of a patient.

Health Promotion: The process in which individuals with health-related occupations share information with patients to influence their behaviors to ensure a healthier lifestyle and let them decide more consciously about their health.

Healthcare: An organized system that provides health services to an individual or a community and seeks to improve or maintain well-being.

Infodemic: Excessive amount of information, usually untrustworthy. Tends to spread fast, hindering reliable solutions.

Osteoporosis: A condition characterized by a decrease in bone density, producing porosity and fragility.

Preventive Medicine: The measures taken to ward off or halt a disease, preferably through education.

Public Health: The art and science of the health of the population. Branch of medicine dealing with epidemiology, hygiene, and preventive medicine.

Social Platforms: Electronic communication software programs used for social networking.

Telemedicine: The art and science of practicing medicine remotely with telecommunication technology.

APPENDIX

Post-Campaign Osteoporosis Knowledge Survey Results

Figure 5. El hueso se compone PRINCIPALMENTE de cuál de los siguientes minerales? Translation: Bones are composed primarily by which of the following minerals?

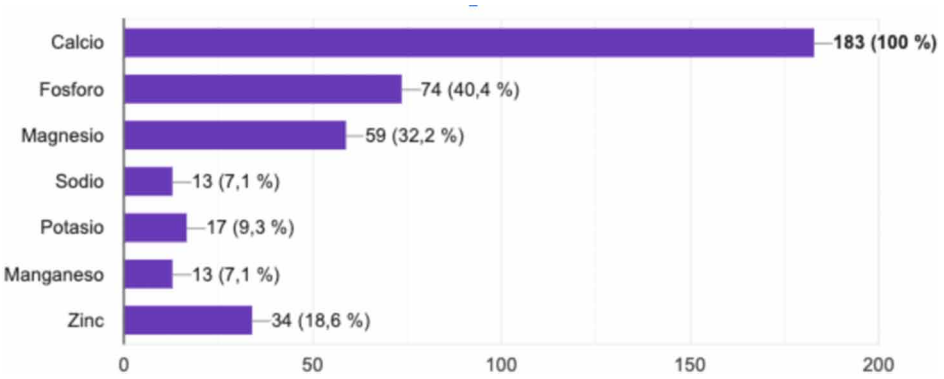

Figure 6. ¿La osteoporosis es más común en mujeres o en hombres? Translation: Is osteoporosis more common in women or men?

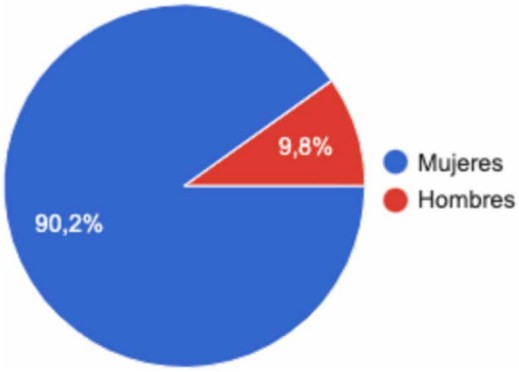

Figure 7. ¿A qué rango de edad afecta más la osteoporosis? Translation: Which age group is the most affected by osteoporosis?

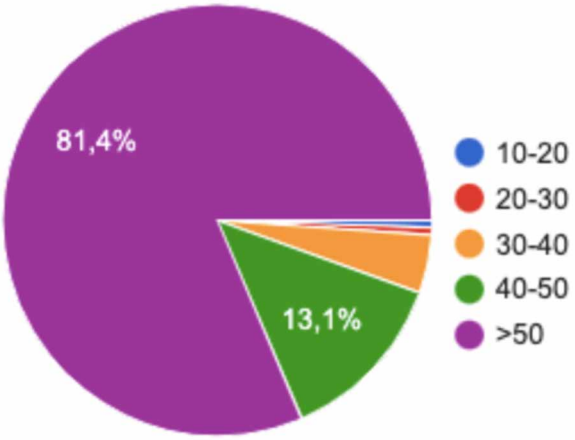

Figure 8. Marca los factores de riesgo para osteoporosis. Translation: Select the risk factors for osteoporosis.

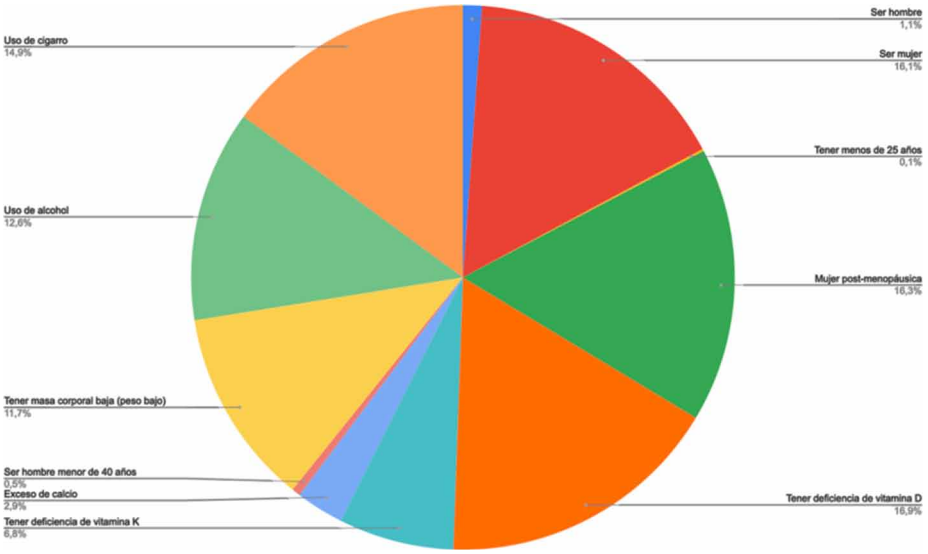

Figure 9. Las causas de osteoporosis que derivan de una afección del metabolismo del hueso directamente se les clasifica como. Tranlation: The causes of osteoporosis that arise from a problem within bone metabolism are classified as.

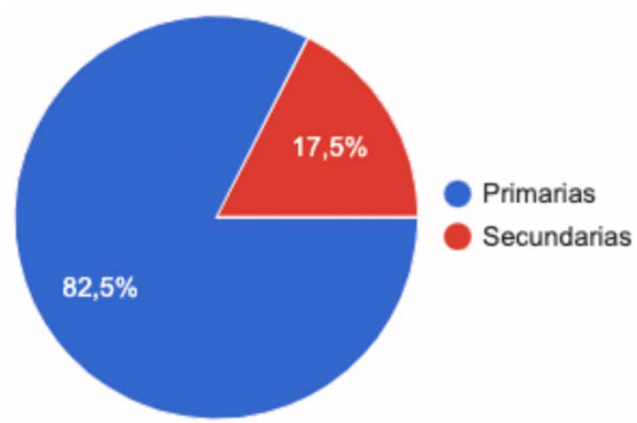

Figure 10. Lugares de fracturas más comunes en osteoporosis. Translation: Most common fracture location in osteoporosis.

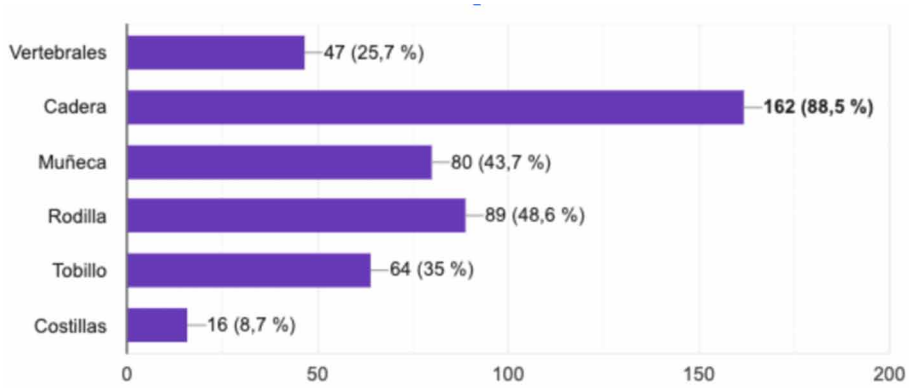

Figure 11. Los estrógenos confieren protección de la osteoporosis en mujeres. Translation: Estrogens provide protection from osteoporosis in women.

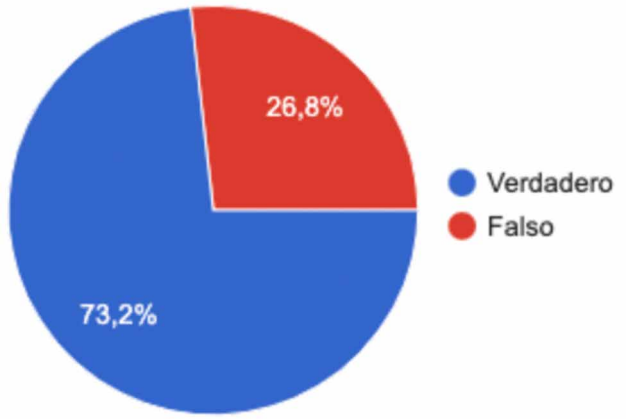

Figure 12. El cortisol (cortisona) confiere protección de la osteoporosis. Translation: Cortisol provides protection against osteoporosis.

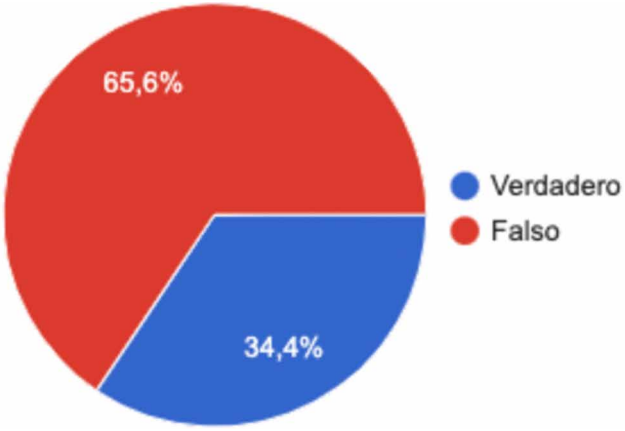

Figure 13. La osteoporosis está relacionada con el consumo de alcohol o fumar cigarrillos. Translation: Osteoporosis is associated with alcohol or tobacco use.

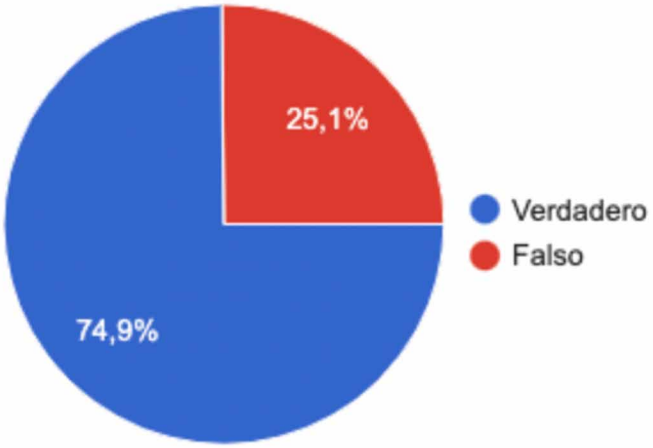

Figure 14. El tratamiento de la osteoporosis incluye. Translation: Treatment for osteoporosis includes.

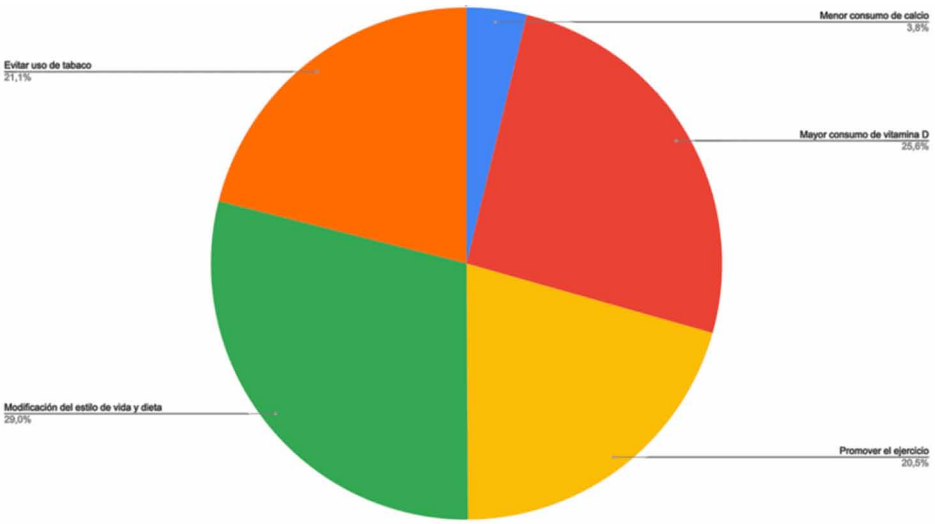

Figure 15. ¿Qué es la densidad mineral ósea? Translation: What is bone mineral density?

Section 2

Applications in Health Education

Chapter 11
The Revolution of Education Accelerated as a Consequence of the Pandemic

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ABSTRACT

Medical education has changed dramatically since its inception, from informal medical education without defined objectives or techniques to a formal medical education regulated by the government and academic groups. Now, a structured curriculum with well-defined goals and objectives, appropriate educational strategies, and the incorporation of digital tools will efficiently contribute to future health professionals facing their challenges in their practice. Surely the technological advancement that occurred due to the pandemic is here to stay. Although there are still challenges to be solved, the first steps are for them to be acknowledged and documented. This chapter's objective is to show how to structure an online theoretical course and its curriculum and discuss the implementation of hybrid models of education and virtual simulation in health programs.

INTRODUCTION

Changes in education are now part of the everyday routine. Since the medical field is constantly changing due to discoveries in approaches, diagnosis, and treatments, medical programs frequently need to update

DOI: 10.4018/978-1-7998-8783-6.ch011

their contents. Also, new trends in educational techniques force educators to make constant changes in their programs and methods for students to assimilate and take better advantage of the content.

Although lately, these changes have accelerated, certainly the COVID-19 pandemic has been crucial in this process. Change-resistant people are now forced to embrace it to maintain the educational process.

This chapter will discuss the adaptations that medical schools were forced to implement due to the restrictions of face-to-face activities, including the steps to create an online theoretical course and a curriculum, as well as teaching strategies that could remain inside the medical school as a consequence of the rise of technology implementation: virtual simulation and the hybrid model.

BACKGROUND

The education received during medical training in the past was very different from the one we know these days. There have been changes in teaching delivery, instructional technology, professionalism of teachers, student's role in the teaching-learning process, and curriculum content and length (Timperly H et al., 2007). Furthermore, historical and practical reasons determined the training length. Formal medical education began during the Middle Age in Northern Italy (Custers, 2018), and guilds guided the learners. Initially, there were two types of medical practitioners: academic doctors and practically trained surgeons. The former were trained exclusively theoretically and on a few skills for drug preparation. Generally, the learner's competency was assumed after completing a specific number of interventions during a flexible time range, rather than assessed.

Until the 19th century, people became concerned about the lack of performance requirements and learning objectives around medical education (ten Cate, 2014). As a result, the structure of a degree in medicine started being constructed. While shallow initially, physicians' competence and performance levels started to be a concern for the government. Therefore they established the approval of a practical examination to grant a license to practice medicine (Custers, 2018).

The Flexner Report in 1910 became a landmark for undergraduate medical education as it promoted a science-based form of academic education (Stahnisch and Verhoef, 2012). On postgraduate education, Osler established a structured postgraduate residency with a pyramidal structure: many students, few residents, and one chief resident (Custers, 2018). Nevertheless, until the 80s, when the Accreditation Council for Graduate Medical Education (ACGME) was established, the length and content of the different programs in postgraduate education in the U.S were regulated.

In addition, the World Federation for Medical Education, a non-governmental association established in 1972, sought to promote high-quality education. It publishes best practice global standards for quality improvement in undergraduate medical education, endorsed by recognized associations and organizations worldwide (WFME, 2020). Medical regulation, using these standards, provide the educational institutions with a framework for accreditation, self-analysis, and feedback for program improvement. In addition, it constitutes evidence for all stakeholders, students, faculty, community, government, health service providers, and foreign institutions that standards of competence are being met (Karle, 2006).

Quality assurance should constantly be sought, especially with the constant changes and challenges occurring in medical education. The shifts from teacher-centered to student-centered to include a patient-centered approach have made medical education more inclusive (Olivares et al., 2017). Teaching was based on lectures, now students' active participation is sought; content has shifted from microscopically focused to molecular, and new concepts around medicine are gaining importance for the training of future

professionals, such as telemedicine and virtuality (Carrion et al., 2021). Other challenges have arisen as globalization and technology are the norms in every aspect of our lives. In education, new ways of learning are being incorporated into the curricula of universities; courses can be taken in other platforms like Coursera. Open access online courses were available during the health emergency faced in 2020, and universities sought different ways to collaborate and contribute to the distant formation of students.

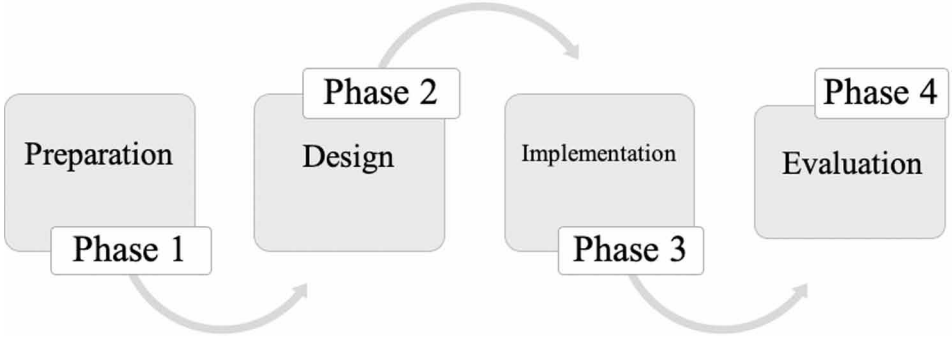
THE NEED FOR ACADEMIC CONTINUITY DESPITE THE PANDEMIC

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic, which causes coronavirus disease 19 (COVID-19), is an unprecedented health problem that has forced productive and educational detention at all levels. It is estimated that more than 1,500 million students attending schools and universities were affected by the closure in 188 countries in the first week of April 2020 (Sierra-Fernández et al., 2020).

Traditionally, universities worldwide offer medical education in face-to-face or practical sessions in simulation laboratories or hospitals. However, early in the pandemic, while scientists researched more about the virus, its transmission, and treatment, social distancing was the best prevention strategy. Consequently, the Association of American Medical Colleges (AAMC) recommended and pronounced the temporary suspension of clinical activities. The situation in hospitals became complex because of the uncertainty, the pressure in triage, lack of sufficient health care professionals, and the physical and mental exhaustion that making difficult decisions implies. Certainly, clinical students do not have the necessary skills to help the health professionals who participate in the COVID-19 infected patients' care, nor are they obligated to participate in their assessment or treatment, a lot less if they do not have the equipment needed for their protection. Medical students' not contributing in the early stages of the pandemic will prevent them from becoming vectors of the virus and transmit it inside and outside the clinical setting (Valdez-García et al., 2020).

After a few weeks and considering that the pandemic will last a while, to avoid the damage caused by the lack of academic sessions and clinical exposure of the students, all universities faced the challenge of changing their educational model from face-to-face to online (Nimavat et al., 2020; Sebbani et al., 2021). All the professionals involved in education worked and are working hard to maximize the benefit of online education. Although this adaptation process in every discipline is necessary, it is exceedingly complex in medical programs. In particular, for the clinical years, when students attend clinical scenarios to complete their training, traditionally face-to-face scenarios, challenging to adapt to an online environment. In these settings, students practice and apply the knowledge previously learned within classrooms (Lateef, 2010). The interview of the patient, performing physical exams, and other simple medical procedures are required for the completeness of health care professional programs. On-hand procedures on surgical rotations, diagnostic procedures, and other labors traditionally need their presence on the wards and face-to-face explanations (Valdez-Garcia et al., 2021). Also, the opportunity to learn from emergencies will not be possible at its fullest if they are not witnessed at the side of the patient's bed. Thus, the need to train physicians, specialists, and other health professionals, has never been more pressing than it is now in the context of the current global emergency. (Sánchez-Duque, 2020). The required criteria for graduation have not changed nor the abilities a physician will need to practice; instead, they are multiplying themselves and evolving, and students need to gain experience in performing these skills to master them.

Figure 1. Phases of the model for academic continuity in an online format (Lopez et al., 2021)



The First Steps in Online Theoretical Courses

Like all courses, online theoretical courses must have structure and a planned curriculum with clear objectives for a specific period (Samueli et al., 2020). The course designer must identify the problem to be addressed, perform an appropriate need assessment, have in mind the goals and objectives, identify the appropriate educational strategies, implement the course, and evaluate the curriculum's effectiveness (Kern, 2016). On the other hand, an online teacher requires pedagogical, course content, and technology knowledge (Nimavat et al., 2020). Likewise, students must have basic technology skills, equipment, and internet access to be trained by this method. Just as technology advances rapidly, education must follow it.

Other challenges those involved in online education may face are the lack of time management, lack of good communication, a negative attitude towards these courses, and students' limited involvement (O'Doherty et al., 2018).

Online education can be delivered through pre-recorded online classes, online simulations, live webcasts, and chat rooms. The ideal delivery option should be sought according to the learning objectives, and the educational techniques should be diverse so students of different learning styles can engage and learn. For a successful online program course, designers need to perform meticulous planning, checking, training the educators, and remembering "less is more" let us keep it simple for students (Curry and Smith, 2005). Also, one should consider that some live interaction is essential for students to feel connected to the course's goals (Vasavda et al., 2021).

In "A proposal for academic continuity and distance medical training due to the COVID-19 pandemic", Lopez et al. (2021) propose four steps to migrate medical education to an online format: preparation, design, implementation, and evaluation (figure 1).

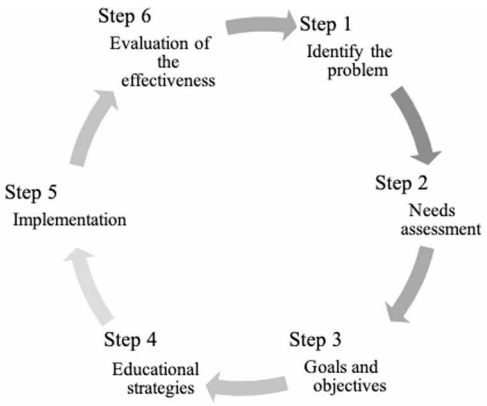
Phase 1: Preparation

The preparation phase emphasizes training educators to use the technological platforms available and update their devices before beginning an online course. In addition, the academic support team plays an essential role, as they are responsible for evaluating the technological resources and communicating with professors and students that need technical advisory.

Phase 2: Design

Part of the design process includes the search for educational resources. It must be guided by the educational needs previously identified by the educators' team. Resources should be easily accessible and downloadable prior to the course to prevent situations where there may be internet service trouble.

Figure 2. Six-step approach to curriculum development (Kern, 2016)



Phase 3: Implementation

The most difficult challenge in the implementation phase is to avoid inertia. Students must play an active role during the sessions. The interaction between them facilitates the learning process and promotes socialization, crucial to ensuring their professional identity. As most students take classes inside their room, sessions with a conference format should not be longer than 60 continuous minutes, with a 10-minute break (Lopez et al., 2021). It is also essential to know how to localize the academic support team to resolve technical difficulties.

Phase 4: Evaluation

The evaluation phase is complex. Regarding students' online assessments, concerns have been raised about the lack of honesty demonstrated by students while being assessed. While traditionally, most of the author's institution exams are essentially made of multiple-choice questions, Lopez et al. (2021) suggest implementing alternative strategies, like open-ended questions and a shorter time to answer a test to avoid copy or consultation. Other strategies include asking the student to turn on the camera and record the session. Students need to remember their part in the learning process, and they must commit to being honest.

Curriculum Development

Kranthi (2017) defines *curriculum development* as a "planned, purposeful, progressive, and systematic process to create positive improvements in the educational system". A curriculum, more than just a list of content, reflects an educational proposal: all the activities, experiences, and learning opportunities that an institution offers, as well as people's reactions and responses to the institutes' intentions (Coles, 2011). Its relevance is not limited to the schools, learners, or educators but the society in general because of its impact on future healthcare professionals (Kranthi, 2017).

Several methods have been described to facilitate adequate curriculum development. Kern's stepwise curriculum development approach was designed specifically for clinicians and scientists in the medical field. This method is composed of six steps (figure 2).

Step 1: Identify the problem and general needs assessment

It can be a specific health problem or a group of problems, as well as it can be related to the qualities of the physician or health care needs of the society in general. Therefore, we have to ask ourselves some questions about a health care problem: What does it affect? Whom does it affect? How important is it? Identifying the problem and analyzing and comparing the current approach versus the ideal approach are necessary elements that comprise the general needs assessment.

Schneiderhan, Guetterman, and Dobson (2019) suggest complementing this step with writing a rationale statement. These authors offer an example from their own experience to clarify this step: "During the review of residents' performance at a small residency program, it was noted that there was a slow rate of acquisition of communication skill milestones by a substantial number of learners, making it clear that the issue was less about the individual learners and more systemic in nature. On further reflection, it became clear there was not a specific educational strategy to teach this topic. This led to the formation of a working group to develop a curriculum to teach communication skills."

Step 2: Targeted needs assessment

During this step, it is essential to assess the environment. Identify the resources available, the needs and preferences of stakeholders, the barriers, and the enablers. Also, it is important to learn about the students' previous experiences, expectations, current proficiencies, attitudes, and preferred learning style, that is, the identification of the learners' preferences.

To gather all of this information, one should use different methodologies. Interviews or questionnaires are efficient ways to retrieve information. Discussions in large or small groups are favored because the learners and stakeholders feel part of the development as they are being heard. Direct observation in classrooms or clinical settings could help visualize the learners' real environment and the problems needed to solve.

Step 3: Goals and objectives

This step can be undervalued in the medical curriculum development, but it is crucial. Kranthi (2017) states that "as long as the goals and objectives of curriculum development are clear in the planner's mind, cutting-edge achievements in various concerns can be realized".

What are we planning to solve with this specific curriculum? Setting the goals and objectives will direct the curriculum content, the education methodologies used, and the ideal methodology for assessing students' content knowledge. A clear definition of the goals and objectives will drive the later evaluation of the effectiveness of the curriculum. Goals should be general and communicate the overall objective of the curriculum. On the other hand, objectives are refined, specific, and measurable; they should direct educational strategies and assessment methodologies (Schneiderhan, Guetterman, and Dobson, 2019).

Learning objectives communicate what skills or knowledge the student should acquire by the end of the session or course. They are outcome-based and learner-centered, help teachers plan a lesson easier, help write assessments, secure accreditation, and help academic advisors and advisees (Mahajan and Singh, 2017). Hence the importance of writing them correctly.

Bloom's taxonomy has been helpful in the process of writing a learning objective. It is an accepted classification of educational goals that was published in 1956. It is composed of three domains: cognitive, affective, and psychomotor. Bloom's cognitive taxonomy describes six types of processes in a hierarchical order, enlisted from the simplest to the most complex: knowledge, comprehension, application, analysis, synthesis, and evaluation (Bloom, 1956). Furthermore, a revised version was published in 2001 by Bloom's former student Lorin Anderson, who changed the major categories first described as nouns to verbs: remembering, understanding, applying, analyzing, evaluating, and creating. Once the

educator has placed its topic in one knowledge level, writing an educational objective is simplified with the structure of the taxonomy action verbs (table 1) (Forehand, 2010).

Table 1. Example of verbs related to Bloom's processes (Wilson, 2016)

Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
Know, identify, relate, list, define, recall, memorize, repeat, record, name, recognize, acquire.	Restate, locate, report, recognize, explain, express, identify, discuss, review, infer, illustrate, interpret, represent, differentiate, conclude.	Apply, relate, develop, translate, use, operate, organize, employ, restructure, interpret, illustrate, show, practice, calculate, exhibit, dramatize.	Analyze, compare, probe, inquire, examine, contrast, categorize, differentiate, contrast, investigate, detect, survey, classify, deduce, discover, inspect, dissect, discriminate, separate.	Compose, produce, design, assemble, create, prepare, predict, modify, tell, plan, invent, formulate, collect, generalize, document, combine, propose, develop, arrange, construct, organize, derive.	Judge, assess, compare, evaluate, conclude, measure, deduce, argue, decide, choose, rate, select, estimate, validate, consider, appraise, criticize, infer.

In order to write a correctly structured objective, the first step is to decide what is critical for the learners to take away from the exercise. Then, it is helpful to place that idea in Bloom's hierarchy according to the adequate depth of understanding that the educator is looking for the learner and choosing its measurable action word. Finally, to gather the information, the educator can use the formula *Who will be able to do how much (or how well) of what by when* (Webb et al., 2013), as illustrated in figure 3.

Figure 3. Formula for writing objectives with a correct structure

An example of the formula application will be: The student (who) will be able to identify (to do) the principal microscopic characteristics (how well) of the clear cell renal carcinoma (of what) by the end of the course (when).

Step 4: Educational strategies

Course contents and methods are elaborated to meet the intended objectives. The final result of this step is a schedule of the curriculum events, a list of curricular resources, and plans for the assessment. It is essential that consistency is maintained between objectives already established and the methods considered. Also, to maintain attention and prevent being monotonous, it is crucial to use various educational methods.

Not all methodologies suit every objective, and it is necessary to consider the appropriate one for each specific objective. For example, reading, projects, discussions, simulation, standardized patients, and real-life experiences are sound methodologies for cognitive goals. On the other hand, reflections,

role models, discussion, simulation, standardized patients, and real-life experiences are suitable for the affective objectives.

For psychomotor objectives, the best methodologies are: reflection on experiences, feedback on performance, role models, simulation, real-life experiences, and environmental interventions.

Step 5: Implementation

This step could be the most exhausting and difficult one. One should obtain administrative support for applying the developed curriculum so the resources needed are guaranteed and, therefore, it can be introduced to the learners safely. First implementations will never be perfect; they will have problems so that the norm is enhanced with continuous improvements, maintenance, and actualization for current needs and opportunity areas.

Step 6: Evaluation of the effectiveness

To complete this step, one should ask the learners how they felt about the methodologies used. Also, there is a need to determine if the goals were met and assess individual achievements.

An example of Kern's steps for the development of a curriculum on oncopathology for clinical students during the pandemic is presented next:

1. **Identify the problem and general needs assessment:** Generally, students do not do clinical clerkships in the pathology laboratory, so when they graduate, it is difficult for them to understand the basic terminology used in this field, as well as the procedures and processes needed for tissue examination.
2. **Targeted needs assessment:** With the COVID pandemic, there was a need to restrict face-to-face rotations to ensure students' safety. However, some resources could be used to target the identified problem as virtual meetings and online courses.
3. **Goal and objectives:**
    a. Goal: To incorporate a clinical rotation for medical students on pathology. After this course, students will know how a pathology laboratory works, when a tissue evaluation is needed, and what to expect on an issued diagnosis.
    b. Objectives:
        i. Clinical students (who) will be able to recognize (to do) easily (how well) how a pathology laboratory works (of what) by the end of this rotation (by when).
        ii. Clinical students (who) will be able to decide (to do) in general terms (how well) whether an intraoperative pathology consultation is needed or not (of what) by the end of this rotation (by when).
        iii. Clinical students (who) will be able to differentiate (to do) basic (how well) morphology characteristics between neoplastic and non-neoplastic lesions (of what) by the end of this rotation (by when).
        iv. Clinical students (who) will be able to use (to do) adequately (how well) the terminology used for the description of lesions (of what) by the end of this rotation (by when).
        v. Clinical students (who) will be able to identify (to do) the basic microscopic and macroscopic characteristics (how well) of the most common cancers (of what) by the end of this rotation (by when).

Notice that, in the example, the formula suggested to write objectives with a correct structure is being used (who + to do + how well/how much + of what + by when) (Figure 3), as well as the verbs related to the Bloom's processes (recognize, identify, decide, differentiate and use).

4. **Educational strategies:** A one-week clinical rotation was planned. Physical presence was required for macroscopic evaluation of specimens (one student per day with one or two residents), and virtual sessions were programmed for digital visualization of slides, mainly oncologic cases (2-3 students guided by one resident). Furthermore, students were also engaged in academic online sessions with residents and specialized doctors. There was an academic session where each clinical student presented an oncology case seen during the week. Also, during free time, students were required to choose between a set of online courses available in PathElective.com and submit the diplomas at the end of the rotation.

    a. Schedule: (see figure 4)

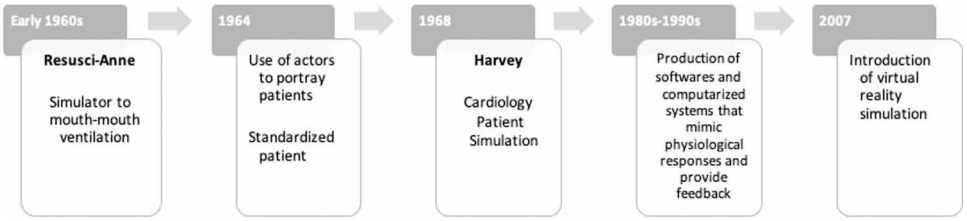
Figure 4. Clinical students' schedule during the pathology rotation

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
8 AM – 12 PM	Student #1 face-to-face rotation at Pathology Laboratory	Student #2 face-to-face rotation at Pathology Laboratory	Student #3 face-to-face rotation at Pathology Laboratory	Student #1 face-to-face rotation at Pathology Laboratory	Student #2 face-to-face rotation at Pathology Laboratory	Student #3 face-to-face rotation at Pathology Laboratory	PathElective diplomas' due date
1 PM – 3 PM	Online slide sessions						
4 PM – 5 PM	Theoretical online academic session #1	Bibliographic session	Theoretical online academic session #2	Students' cases online presentation			

b. Curricular resources
    i. Zoom platform
    ii. Microscope connected to a camera
    iii. Pathology Laboratory
    iv. Oncology slides and gross specimens
    v. PathElective
    vi. Residents
    vii. Specialized doctors
    viii. CAP protocols
    ix. histologyguide.com
    x. pathologyoutlines.com
    xi. NCCN guidelines

c. Assessment: Each student could get a maximum of 10 points. The rubric that will be used is:
    i. Attendance and good attitude in gross examinations (1 point)
    ii. Attendance and participation at online slide sessions (3 points)
    iii. Attendance and participation at online academic sessions (1 point)

Figure 5. Feature events in the history of virtual simulation



iv. Case presentation with general information about the patient, radiology, gross and microscopic images, diagnosis, normal histology of the involved organ, and general information about the disease (epidemiology, pathogenesis, gross, microscopic and molecular findings, treatment and prognosis) (3 points)
v. Path Elective course (1 point)

5. **Implementation:** Although we had all the support from the Clerkship organizer, the first weeks were a little chaotic primarily because of all the activities that were included in just one week; nevertheless, changes to the communication sent at the beginning of each week were done continuously as questions from the students were raised.
6. **Evaluation of the effectiveness:** At the end of each week, a questionnaire was sent to know if the students had learned and which activities they liked the most or which they did not.

Incorporating Virtual Simulation

Simulation is a technique that replaces and amplifies real experiences (So et al., 2019). Although this technology is increasingly used for the training of medical professionals, especially during the pandemic because of the forced cessation of face-to-face activities, its origins can be found in antiquity. It has been described that models of human patients were built in clay and stone to teach clinical features of some diseases and their effects on humans. Some of the key events representing the beginning of the modern era of medical simulation include the simulators Resusci-Anne and Harvey. Resusci-Anne is a realistic simulator designed by Ausmund Laerdal to teach mouth-to-mouth ventilation. Laerdal was encouraged by Peter Safar's work in the early 1960s (Grenvik & Schaefer, 2004).

Furthermore, in 1968, Dr. Michael Gordon presented Harvey, the Cardiology Patient Simulator, a mannequin that can reproduce several cardiac diseases by varying blood pressure, heart sounds, heart murmurs, pulses, and breathing (Gordon et al., 1980).

Recently, more realistic environments were developed, and virtual reality simulation was introduced (Jones, Passos-Neto, and Braghiroli, 2015). Modern simulation is not only based on mannequins; it also includes the use of actors to portray patients and, as technology improves, software and computerized systems that can mimic physiologic responses. These important events in the history of virtual simulation are represented in figure 5.

Healthcare simulation marks a change between the traditional educational philosophy of "see one, do one, teach one" developed by Dr. William Halsted in 1890, to "see one, simulate many deliberately, do one" principle of simulation-based training (Viglialoro et al., 2021). Several terms are relevant when

talking about a virtual simulation environment. *Virtual simulation* is defined as a simulation through the screen where graphics, sound, and navigation emphasize the 3D nature of the environment. Likewise, virtual reality refers to the use of highly visual 3D features to reproduce real-life situations; typically incorporates physical or other interfaces such as head-mounted display, motion sensors, or haptic devices in addition to computer keyboard, mouse, speech, and voice recognition. When discussing a virtual standardized patient, we refer to an avatar-based representation of standardized human patients who can converse with natural language learners. It is important to understand the totality of a virtual simulation environment as it is expected that simulation technologies become more relevant in medical education (McGrath et al., 2017).

Virtual simulation is a convenient tool for medical students in many aspects. Virtual reality makes accessing clinical experiences simple for learners; this flexibility allows integrating simulation-based education into everyday practice. Another advantage of this technology is the patient's safety, as virtual reality scenarios are repeatable, learners can make mistakes and learn how to improve their performance (Pottle, 2019). Students receive immediate feedback that helps them realize what they need to do better and encourages them to perform to their capacities until mastering a skill or task. Feedback intrinsically motivates them to keep striving to practice successfully (Ustun, Yilmaz, and Karaoğlan Yılmaz, 2020). It is known that virtual simulation, including virtual patients, is helpful in preclinical evaluation. It has been reported that virtual patients can more effectively improve medical students' skills and achieve at least the same degree of knowledge as traditional methods (Watari et al., 2020).

Virtual simulation is also a convenient tool from an institutional standpoint. This technology allows simulation to be delivered at reduced cost with fewer resources. It also frees up space, as it can deliver the clinical scenario in a small space with under 5 minutes of setup (Pottle, 2019). Faculty time is another crucial aspect to discuss. It has been found that virtual patient simulation software programs could help medical students improve their clinical decision making-skills with minimal supervision of lecturers (Watari et al., 2020). It is known that the assessment of clinical competence is one of the most challenging tasks in medical education, and it has been suggested that the simulation can be a valid and reliable method to assess the technical skills and to determine the skill level and the capability to practice safely (Viglialoro et al., 2021).

This tool has been widely used for the last two decades, and the pandemic marked an opportunity as well as a need to accelerate its implementation and evaluation. These implementations are well documented in the literature, for example, at Yale School of Medicine, they developed a curriculum with high-fidelity mannequins in a telesimulation format for a six-week elective (Ray et al., 2021). The communication skills required for these simulations are different from those needed in traditional scenarios; however, these techniques require further evaluation to understand their impact on learning.

Undoubtedly, the incorporation of virtual simulation in the training of health professionals will continue to rise.

Incorporating a Hybrid Model for Preclinical Students

Hybrid education, also known as blended education, refers to the joint use of activities within the classroom (face-to-face) and online (non-face-to-face or distance) (Mosa, 2014). This model is defined as the effective combination of different interaction models, teaching models, and styles that facilitate learning based on transparent communication between the parties involved in the course (Amato and

Novales-Castro, 2014). The hybrid model has been increasingly accepted over the years to promote student learning and engagement.

The average attention span of students in a classroom varies from 15 to 20 minutes, and the retention rate by the end of the session approximates 20%. Incorporating online lectures in the curriculum can help improve attention span and retention (Basheer, 2016). In addition, class size has been described as a variable that can negatively affect active participation and interaction. A pilot study conducted at West Chester University in Pennsylvania reported that students using the blended format in the human development unit learned the content and increased their engagement, preparation, participation, and interest (Kenney and Newcombe, 2011). Other advantages that the hybrid model has, compared to entirely face-to-face education, are the autonomous work of the student, the elimination of spatial barriers, and the temporal flexibility (Amato and Novales-Castro, 2014).

From the economic perspective, some authors state that the hybrid model is convenient as it reduces implementation costs (Amato and Novales-Castro, 2014). However, other analyses point that medical schools in developing countries might find the equipment costs and the staff expenses difficult. Another drawback is that this educational model relates to the educators' and students' computer skills, disparity among them can affect the learning process and the outcomes (Basheer, 2016).

The hybrid model can be applied in both the preclinical and clinical curriculum of medical education. However, most of the research related to this educational method has been developed in the preclinical context. Essential learning years, as the Association of American Medical Colleges states, the physicians must understand the scientific basis of medicine to apply them in clinical practice (Anderson et al., 1998; Corona and Fonseca, 2019). Therefore, the study of scientific literature plays a leading role in the training of a medical student. Knowledge of the structure and function of the body and its molecular, biochemical, and cellular mechanisms are essential to comprehend the disease and the diagnostic and therapeutic approach. In addition, the preclinical curriculum must cover the pathology and pathophysiology of diseases and the power that the scientific method has in establishing the causation of disease and therapies. A student will not be able to conduct an appropriate and direct interrogation if he/she does not know the symptoms, risk factors, or epidemiological elements related. If the student does not understand and integrate the pathogenesis of the disease and how it may manifest on the patient, he/she will be unable to perform a physical exam because he/she ignores what signs to look for in the patient.

Although the pandemic had a gentler impact on the day-to-day routine of the preclinical students compared to clinical students, basic clinical training experiences like a physical examination or history taking have been affected, creating concerns about their preparation to begin clinical rotations (Hilburg et al., 2020). Hence the importance of developing teaching strategies besides video conferencing lectures for them. Besides, a reduced interaction time between preclinical students negatively impacts their experience as it may cause frustration and a sense of isolation. To counteract, improving online peer interactions may be achieved by enhancing discussion board sites, wikis, and blogs (Venkatesh et al., 2019).

The incorporation of a hybrid model for preclinical students has shown its relevance internationally. In Mexico, the implementation of hybrid models for medical students studying the first four semesters of the degree has been studied and found to have good acceptance by students, concluding that this modality is useful for their learning (Amato and Novales-Castro, 2014). In Willemstad, Curazao, researchers implemented the hybrid model for clinical skills taught in the second semester. Their clinical skills course curriculum in the basic sciences utilizes a standard patient program. They found a significant improvement in students' feedback after implementing the hybrid model and a notable improvement in students' performance (Arja, Arja, and Fatteh, 2019).

Incorporating a Hybrid Model for Clinical Students

In the words of Corona and Fonseca: "The clinical method is how art, science, and values go hand in hand, embrace each other, and are integrated to carry out the medical assistance activity to individual patients. This harmonic integration results in professional practice that has excellence as a goal for the sake of our own patients."(Corona and Fonseca, 2019).

Traditional medical education requires on-site learning, with physical presence and interaction in clinics and hospitals with real-life patients, which generally occur during the last part of the training of medical students, specifically during the last two years of academic training in the author's institution. In this set of social learning, the relationships among physicians, patients, and colleagues are essential for the learning process of a medical student. Many medical schools, before the pandemic, incorporated different models of clinical education, either model with continuity or discipline-specific block clerkships. Continuity models include 6- to 12-month longitudinal experiences, such as following all the patient hospital stays from diagnosis to treatment, including experiences with interdisciplinary integration and increasing difficulty (Teherani, Irby and Loeser, 2013). Clinical rotations are valuable learning tools because it is where students learn to complete clinical histories and physical examinations and have the opportunity to participate in different procedures.

More recently, socioeconomic changes have increased the relevance of medical education in ambulatory settings; a need to adapt clinical teaching strategies designed initially within the hospital setting. To face this complex and highly technological era, Valdez (2021) proposes a learning model centered on the *patients' perspective*, defined as a didactic strategy in which learning and teaching organize towards the health needs and problems of real, simulated, or virtual patients with a focus on human, biomedical, management and entrepreneurship dimensions. The student-patient relationship increases if a good tutor-apprentice relationship was built.

Regardless of the clinical environment in which the student was developing, the COVID-19 pandemic forced the migration of traditional learning methods to an online format, as discussed previously in *The need for academic continuity despite the pandemic.* Changing a theoretical course to an online version is relatively easy, but a practical course requires innovative ideas. Grand rounds, lectures, journal clubs, academic lectures, simulated handoffs, imaging evaluation, radiological dictation, watching surgical videos, identifying key steps and anatomical landmarks, as well as writing postoperative notes are some examples of activities that require basic and clinical knowledge integration for their completeness.

Clinical medical skills can be complemented but not completely achieved through an online format. The situation caused a vital question among institutions: How to continue learning without patients and procedures? A worldwide challenge required an immediate solution; therefore, Hinojosa-Gonzalez et al. (2020) proposed a virtual hybrid program to counteract the loss of clinical exposure of medical students.

Before the COVID-19 pandemic, research-based in the hybrid program for clinical students was limited. Nevertheless, some studies described improved students' clinical competence, including clinical reasoning, self-efficacy, critical thinking, and clinical skills such as history taking, examination, reporting, documentation, and patient management (Rowe, Frantz and Bozalek, 2012). During this health emergency, hybrid intervention models were studied to train medical students to reintegrate safely into their clinical activities. Satisfactory results were observed in the correct use of the personal protection equipment and hand-washing technique, classifying patients with respiratory disease, and initial management of patients with suspected COVID-19 (Valdez-Garcia et al., 2021). Thus, hybrid interventions for clinical students in different medical curricula could also show positive results.

SOLUTIONS AND RECOMMENDATIONS

Although online learning is the future of education, it also has some difficulties that different strategies may diminish. For example, faculty may have struggles in migrating to the virtual platforms for lectures. Also, medical education is not just about theoretical information; students must get skills to interact, perform a physical exploration, and do medical procedures that are normally in-person learned, and while COVID-19 has forced these parts of the curriculum to move almost entirely to online platforms, eventually they will face real-life situations that can make them doubt because of the absence of these experiences.

Institutional infrastructure plays a major role in accomplishing an easy and steady transition. Of course, investment also plays a major role, but simple things such as protocols and guidelines for the teachers to take advantage of the tools are equally important.

Besides, schools worldwide have different financial statuses, and new content could be shared among every university, so students have access to high-quality learning material.

Also, engagement and responsibility from the learner and the teacher are essential to reaching the course's goals. Recently, it has been documented that incorporating learners in the curriculum design process is essential and beneficial for the teachers, themselves, and future students (Geraghty et al., 2019) Although while co-creating a curriculum has many challenges, there are ways to overcome them to pull out the best of the process (Könings et al., 2020).

Besides the curriculum design, commitment from both the learner and teacher can be achieved by always having at least some live sessions and not only pre-recorded lessons. One could argue that online learning permits larger groups of students per teacher; however, this could affect the dynamic interactions generated by small learning groups (Vasavda et al., 2021). Nonetheless, Breakout Rooms within the platform Zoom achieve this type of interaction, which helps even shyer students to interact more easily. This interactive learning method that is being proposed considers the characteristics of today's medical students: they have better assertiveness, self-linking, as well as higher expectations and stress and anxiety. They have little desire to read long texts and have long classes. It is important to point out these generational characteristics because they are already established when students enter medical school; they reflect societal changes and cultural shifts (Buja, 2019).

FUTURE RESEARCH DIRECTIONS

Although blended education has been previously described, this health emergency forced faculties and students to use technology. Schools that switched to a temporary online program were obligated to develop informatics skills, receive training and have a technical support group to contact in case of doubts. Both students and educators found ways to work more effectively from home through these months than the uncertainty that existed during the beginning of the online model implementation. The psychological factor is another important variable. Students' and educators' performance was compromised by the sudden change in the educational model and the high stress that impacted a personal, familial, social, economic, and cultural context. This technological adaptation and reducing stressors may improve the implementation outcomes of the hybrid model in medical school, both in preclinical and clinical education. As technology has taken a huge step into preparing future physicians, virtual simulation is another learning

strategy whose implementation will increase. Further research is needed to describe the results of the implementation of the hybrid model in medical schools outside the context of the COVID-19 pandemic.

CONCLUSION

Medical theory and practice are vast and frequently changing. Medical schools must be prepared for different challenges, such as the current pandemic, that will constantly force education to adapt its curriculum, objectives, and educational strategies. Educational revolution is guided by both the technological acceleration and the changes in the generational characteristics in personality that result from shifts in society and culture. The technological advancements incorporated into medical education resulting from social distancing open the door to developing new educational strategies. Hybrid education and virtual simulation have shown benefits before and during the COVID-19 pandemic. As medical schools have technologically improved, these methods will help educators and students reach their objectives more adequately and efficiently. Documentation of the new educational implementations is highly valued for continuing evolving medical education and offering the best quality formation to future health professionals.

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KEY TERMS AND DEFINITIONS

COVID-19 Pandemic: A worldwide common disease caused by SARS-CoV-2.

Educational Strategy: The type of learning technique used by teachers to achieve the set goals and objectives.

Hybrid Educational Model: A teaching program that combines face-to-face and online techniques to meet their objectives.

Medical Curriculum: Group of academic and non-academic objectives that will be achieved by medical students and with them become health care professionals.

On-Site Learning: Form of education in which the student must attend classrooms, laboratories, clinics, or hospitals to carry out activities related to the academic program.

Online Education: Form of learning in which the student does not have face-to-face interaction with the teacher nor the classmates.

Virtual Simulation: Learning technique in which a student, through a screen and 3D objects, can practice skills and knowledge in an artificial environment to reproduce real health care situations.

Chapter 12
Updating Training in the Medical Field:
The TARGET Model and Its Applications to Remote Learning

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ABSTRACT

This chapter briefly reviews the literature that explores the training technique of deliberate practice and the related constructs, training outcomes of achievement goal orientation, self-efficacy, perceived instrumentality, and reflective practice. This work explains how educators can use and measure these variables to enhance current training methodologies. As part of creating more effective training, the TARGET model, developed by Ames, will be utilized to discuss potential ways to enhance training outcomes in a post-COVID-19 world. Specifically, suggestions are offered for enhancing online training using deliberate practice combined with the TARGET model within a medical setting where there are limited resources.

INTRODUCTION

COVID-19 has changed the landscape in terms of patient care. The shift to virtual and remote environments took great adjustment, as many practitioners were not familiar with the technical and nontechnical skills needed to adjust to this new setting. Additionally, established skills or techniques that were effective in person had to be adjusted for working virtually or remotely. For educators, the shift to online or remote training also entailed difficulties in transitioning to not only training students in therapeutic skills virtually, but also evaluating students' skills in these techniques without seeing them perform the

DOI: 10.4018/978-1-7998-8783-6.ch012

skill in person. One model that could be helpful for addressing both of these concerns is the TARGET (task, authority, recognition, grouping, evaluation, and time) model by Ames (1992).

The TARGET model outlines a way to construct tasks in a training environment such that they will elicit more involvement by the student in their own learning. Tasks should be planned and developed in a manner that is relevant to students, is moderately challenging, and allows them to demonstrate their abilities through a variety of assessments. Authority in tasks should be set so that both instructors and students share responsibility for learning, and students can exercise autonomy through the learning process. It is important to recognize students' efforts privately to reduce competition and focus on students' effort and progress rather than provide feedback that references a group standard. Group collaborative assignments can decrease competition between students and can develop a sense of belonging within the program or profession, especially when focused on real-world applications. Evaluations should be focused on progress, improvement, and mastery, rather than being norm-referenced or solely based on outcomes. Finally, time should be as flexible as possible, as each task may vary in terms of the time needed for completion.

Although the TARGET model provides an idea of how to construct tasks, it does not address how to enact skill change from these tasks. One technique that does so is deliberate practice. Deliberate practice comes from the work of K. Anders Ericsson (1993)and focuses on the how to transform a student's performance on a task from novice to expert. Together, deliberate practice and the TARGET model can provide a framework for creating better practitioners in a remote environment.

The objectives of this chapter are to review the literature on deliberate practice and the related constructs of achievement goal orientation, self-efficacy, perceived instrumentality, and reflective practice. We also explore how these constructs combine to enable not only superior training, but also superior evaluation of students. The chapter discusses the TARGET model and how these constructs fit within it. Finally, the chapter provides suggestions for future research and means of applying TARGET to future technological interventions for training.

BACKGROUND

Ericsson derived the idea of deliberate practice from his work on expertise, or developing the characteristics, skills, and knowledge that distinguish experts from novices or less-experienced individuals (Ericsson, 2018) across a variety of domains, including music (Ericsson et al., 1993), sports (Shea & Paull, 1996), and medicine and surgery (Norman et al., 2018). Ericsson's research suggested that experts are made through hard work and diligent practice, rather than by innate talent. He defined the work needed to become an expert as deliberate practice, the individualized training activities designed to improve specific aspects of one's performance through repetition and successive refinement (Ericsson et al., 1993). By engaging in these effortful and relevant tasks, and by utilizing feedback from an instructor or coach, a student can incrementally increase their skills, which will eventually lead to superior performance (Ericsson et al., 1993).

In medicine and surgery, superior performance has been linked to deliberate practice (Duvivier et al., 2011; Issenberg et al., 2002; Wayne et al., 2006). One meta-analysis found that deliberate practice had a large effect on enhancing clinical skill acquisition when compared to standard medical education (McGaghie et al., 2011). However, an important caveat is that the outcomes of deliberate practice are related to the need to concentrate and focus on the improvement of the skill, rather than just the repeti-

tion of the skill over time (Ericsson, 2006; Miller et al., 2017). It is the effort involved, not the time spent, that matters. Specifically, many individuals will become routine experts when they can handle the typical difficulties that arise as part of their practice without an investment of cognitive resources (Ericsson, 2007). True experts, though, will arise when they exercise cognitive resources and attempt to develop a better understanding of the situation (Ericsson, 2007). As Tracey and colleagues (2014) attest, practitioners must constantly strive to improve themselves, reaching for goals just beyond their current ability if they wish to continue to improve.

The main takeaway from deliberate practice for future training is that, to aid students in becoming experts, conditions must be created so that they can practice tasks repeatedly. These tasks must be of moderate difficulty and be conducted such that the student can repeat the process, receive feedback, and then try again until they are performing the task at the standard needed.

Comparing someone's performance on a task to an objective standard is important, but not always the most feasible strategy, especially when operating remotely. In the latter scenario, gathering information from multiple sources will benefit not only students but also instructors in improving students' performance and learning. Constructs that can provide information on improving students' performance include achievement goal orientation, self-efficacy, perceived instrumentality, and reflective practice.

Achievement goals are cognitive representations focused on an end state involving an interpretation of one's competency (Hulleman et al., 2010). They are split between mastery and performance goals. Mastery goals focus on general self-improvement, developing competence, and achieving task mastery, whereas performance goals focus on demonstrating competence and outperforming one's peers (Ames, 1992; Korn & Elliot, 2016). The mixed effects of performance goals on outcomes led to the examination of the valence of performance goals. While performance goals were found to influence outcomes, performance approach at times acted similarly to mastery goals, while performance avoidance was found to be associated with more negative results (Elliot & Harackiewicz, 1996). Performance-approach goals focus on striving to do better than others; performance-avoidance goals represent striving to not do worse than others (Elliot & Harackiewicz, 1996). As more research was conducted, mastery goals were also divided into approach and avoidance, where the former focus on striving to attain mastery or improvement, and the latter focus on striving not to fall short of task mastery or not to lose one's skills, abilities, or knowledge (Elliot & Thrash, 2001).

A meta-analysis by Payne et al. (2007) found that three orientations—mastery approach, performance approach, and performance avoidance—were related to performance on the job after training. The mastery approach and performance approach were consistently found to be associated with more positive outcomes than performance avoidance, although these outcomes differed between mastery approach and performance approach. Self-efficacy, a variable strongly associated with training outcomes, has been found to be linked to stronger mastery approach and not associated with performance avoidance. Additionally, feedback, one of the critical features of deliberate practice, was sought in those with higher mastery approach, while those high in performance avoidance were less inclined to do so. Individuals high in performance approach would seek out feedback only when they thought they did well. Additionally, performance approach and performance avoidance were both more likely to have a higher state of anxiety, whereas mastery approach was found to have a lower state of anxiety. The overall findings suggest that mastery approach is the most helpful orientation for students to have, although performance approach can be beneficial as well. However, mastery approach was found to predict performance above and beyond other well-known antecedents, such as cognitive ability and the Big Five personality traits (i.e., agreeableness, conscientiousness, extraversion, emotional stability, and openness to experience)

(Digman, 1990), suggesting that those who have a mastery-approach orientation are likely to perform better on the job.

The fourth orientation, mastery avoidance, has not been as well studied (Huang, 2016) even though it is the second most-endorsed goal (Baranik et al., 2010). A recent meta-analysis by Baranik and colleagues (2010) examined mastery avoidance. They found that a mixture of positive and negative outcomes, such as competitiveness, need for achievement, negative affect, and interest, were positively related to mastery-avoidance goals, whereas cognitive ability was negatively related to mastery avoidance. In contrast, performance-approach goals were related to competitiveness, and negatively related to variables such as perceived competence, positive affect, help-seeking behavior, and performance. The analysis also suggested that older measures, such as the Achievement Goals Questionnaire (AGQ) and the Patterns of Adaptive Learning Scales, were not adequately capturing mastery-avoidance goals and differentiating them from PAV goals (Baranik et al., 2010; Huang, 2016). Therefore, updated measures (e.g., the Achievement Goals Questionnaire Revised, or AGQ-R) may more appropriately assess achievement goals because they gather information on all four orientations.

In addition to performance outcomes, training is also influenced by achievement goals. Mastery-approach goals are linked to strong positive influences on transfer, whereas performance-approach goals have a weak effect on transfer, and performance avoidance is negatively related to transfer (Laine & Gegenfurtner, 2013). Mastery-approach goals have been positively linked to self-efficacy (Huang, 2016), although performance approach is also positively related to self-efficacy, albeit to a lesser extent. Mastery-approach goals predicted the development of perceived psychosocial abilities, and higher levels of performance-avoidance goals inhibited the development of perceived psychosocial abilities (Madjar et al., 2015). Performance-approach goals have a positive effect, but less than that of mastery-approach goals, and are linked to other negative outcomes, such as negative responses to setbacks and immediate over long-term focus in terms of learning, which may lessen their desirability as an orientation within the training of healthcare professionals (Madjar et al., 2015; Midgley et al., 2001; Payne et al., 2007). Achievement goals can be modified by feedback such that positive feedback leads to a decrease in performance-avoidance goals, and negative feedback leads to a decrease in performance-approach goals, suggesting that performance orientations may be more malleable to change, whereas mastery-approach goals are more stable in comparison (Muis & Edwards, 2009). It is important to note that, while mastery-approach goals are the most stable, there are ways to enhance their development in students, such as the TARGET model (Ames, 1992; Madjar et al., 2015).

The main takeaway is that students will enter programs with different kinds of achievement goal orientations. These goals focus on an end state where their competency is evaluated. The most useful goal orientation for students and instructors is the mastery-approach orientation, as it is linked to the most positive outcomes in terms of performance, transfer, and its connection to other training variables. Mastery-approach goals are more stable than performance-approach goals and can be enhanced using the TARGET model. Mastery-approach goals are important to examine, but self-efficacy, another notable training outcome, can provide information about students' attitudes in addition to their behaviors, such as deliberate practice (Burke & Hutchins, 2007).

Self-efficacy is defined as beliefs regarding one's capabilities for a particular task or endeavor (Bandura et al., 1977), and it acts as the cornerstone for several contemporary theories regarding motivation (Locke & Latham, 1990; Schunk, 1989). Self-efficacy is positively related to a wide array of outcomes, such as persistence and performance in adversity (Schmidt & DeShon, 2010) and enhancing motivation and performance (Bandura & Locke, 2003). Students high in self-efficacy are more likely to engage in

more maintenance activities post-training (Stevens & Gist, 1997), are more likely to hold a mastery-approach orientation (Huang, 2016), and will expend greater effort and persevere longer (Bandura, 1986) than students who are low in self-efficacy. Likewise, those higher in self-efficacy will typically engage in more effort, persistence, and use more cognitive resources than those with lower self-efficacy (Greene et al., 2004).

Bandura (1982) hypothesized that enactive mastery experiences, vicarious experiences, and verbal persuasion could act as sources of self-efficacy, all factors that can occur during a graduate student's education. Enactive mastery experiences, the authentic successes a person experiences in dealing with a particular situation (Bandura, 1997), can be powerful for creating self-efficacy. Notably, to increase long-lasting self-efficacy, overcoming obstacles and difficult situations is necessary through the maintenance of effort and persistence (Bandura, 1997). Vicarious experience can also be a powerful factor. Early on, when self-efficacy is low, the vicarious experience can have a stronger effect than when existing self-efficacy is higher (Bandura, 1997). Students will often receive feedback or encouragement that they can perform a task (Schunk, 1983), which can act as verbal persuasion. Feedback is effective primarily when the person providing it is viewed as knowledgeable and reliable, and the feedback is realistic (Bong & Skaalvik, 2003). Bandura is careful to emphasize that self-efficacy does not directly arise from these three sources; rather, it occurs through the cognitive appraisal of the situations (Bandura, 1986; Bandura et al., 1977).

The construct of self-efficacy benefits training as well as academic outcomes because it is amenable to intervention as theorized above and verified through the empirical literature (Burke & Hutchins, 2007; Kraiger et al., 1993; Salas & Cannon-Bowers, 2001; Salas et al., 2012; Van Dinther et al., 2011). As proposed by Kragier et al. (1993), self-efficacy can moderate the relationship between knowledge acquisition and subsequent performance. Additionally, self-efficacy was suggested to be a useful predictor of long-term transfer of knowledge or skill maintenance (Blume et al., 2010; Harned et al., 2013; Kraiger et al., 1993).

The main takeaway from self-efficacy is that it is a malleable construct linked to positive outcomes in training, including performance, retention, and transfer. It is theorized to increase when students can engage in activities where they authentically succeed, see others perform the activity, or even when receiving feedback about their performance. The cognitive appraisals the student makes about these experiences lead to the formation of higher self-efficacy, which in turn lead to increased benefits in performance. One construct that measures these cognitive appraisals students make is perceived instrumentality, which focuses on the evaluations a student may make about the training and the effort they wish to employ in learning the material (Chiaburu & Lindsay, 2008).

Perceived instrumentality is a related motivational construct that touches on both achievement goal orientation and self-efficacy. Perceived instrumentality is the individual's belief that performing a specific behavior will lead to a desired outcome (Chiaburu & Lindsay, 2008). Instrumentality partially influences achievement goals via personally valued future goals, and how the training or intervention may impact the attainment of that goal (Greene et al., 2004). It also can influence the outcome of training through its impact on motivation to transfer, a related factor to motivation to learn, which in turn is influenced by self-efficacy (Chiaburu & Lindsay, 2008).

To tap into perceived instrumentality, it is important to evaluate what students are aiming to obtain from the training or course. Trying to convince students to adopt mastery-approach goals when they lack interest in the topic and do not see utility in the information is impossible. Instead, emphasis on future utility of the task, whether it be in the near or distant future, can aid in transfer of information

from training (Greene et al., 2004). Students, like employees, will make calculations about analyzing outcomes associated with training and determine whether or not the outcome is worth the effort involved (Quratulain et al., 2019). Therefore, ensuring that students see the benefits of the training for their future goals is an important component of any training.

The main takeaway about perceived instrumentality is that training must confirm that students see the utility of the training for their future roles or goals. Merely telling students that the training is important, or strongly encouraging them to take part for their "own knowledge," is insufficient to ensure transfer. Emphasizing the benefit for future outcomes—be it skills gained, knowledge to be used, or negative outcomes to be avoided—plays a role in promoting positive training outcomes (Chiaburu & Lindsay, 2008).

These factors all contribute significantly to the development of expertise. The mastery-approach orientation may influence the development of self-efficacy (Harackiewicz et al., 2008). Self-efficacy represents the beliefs that the expert has in their ability to accomplish their task, their willingness to continue engaging in the planning, and the self-analysis required to solve complex and difficult problems. Perceived instrumentality influences the likelihood that training will transfer after the student leaves. However, to get to the point of expertise, a key element is responding to feedback, whether in terms of performance in an academic setting (Alexander, 2004; Alexander et al., 2004) or through responses to treatment in a clinical setting (Ericsson, 2004, 2007, 2015; Norman et al., 2018). Using feedback, novices can make incremental progress toward a closer approximation of expert performance (Ericsson et al., 1993) and develop their expertise to a higher level. Although deliberate practice utilizes feedback to enhance specific behaviors, a construct that integrates feedback throughout the process is reflective practice (Cooper & Wieckowski, 2017).

Reflective practice refers to the act of reflecting on clinical experience, including personal reactions, attitudes, and beliefs (Bennett-Levy et al., 2009). Reflection requires intentionally focusing one's attention on a particular context, clarifying the focus, and using knowledge and other cognitive processes (e.g., self-questioning, logical analysis, and problem-solving) to make meaningful links (Bennett-Levy et al., 2009) that make meaning of all information obtained in a session. In essence, reflective practice can be viewed as a form of metacognition in that aspects of reflective practice involve reflecting on oneself reflecting (Mezirow, 1998), similar to the concept of metacognition, which focuses on the cognition of cognition (Flavell, 1979), as well as the monitoring and control of cognition (Efklides, 2008).

Reflection has its roots in Dewey's (1933)(1933) seminal work. Dewey conceptualized reflective thinking as a process that lies between recognizing the problem and the solution to the problem. His model focuses on combining observations of the surrounding conditions, knowledge of what has happened in similar situations in the past, and judgment that combines information from the observations and experience to decide in the moment. Importantly for clinical workers, Dewey believed that, although reflective practice was a rational activity, it also needed to incorporate emotions into the decision-making process.

Another influential work was Lewin's application of reflection in his model of action research (Lewin, 1951). Lewin emphasized that feedback is a vital part of the learning process, and that reacting to feedback and "unfreezing" one's belief system by re-examining assumptions helps enable change to occur. Kolb (2014) discusses how he uses Lewin's theory, as well as Dewey's work and Piaget's work to form his theory of experiential learning. Kolb's experiential-learning cycle focuses on having concrete experiences, reflecting on those experiences, creating conclusions and hypotheses based on those experiences, and actively experimenting to determine the validity of those hypotheses. Gibbs (1988) suggested a cycle of reflection that complements Kolb's learning cycle, where students are encouraged to reflect based on a multistage model, wherein reflections are incorporated into developing further changes in practice.

Gibbs's (1988) theory of the reflective cycle is based on six stages instead of four, focusing on describing the situation and the feelings involved, evaluating and analyzing the experience, and concluding what else could have been done before finally moving to an action plan. Overall, the central idea behind these theories of reflection is that learning is a process that requires students to reflect on their experience in order to translate the experience into further learning and the improvement of skills in practice or learning; this is similar to how deliberate practice utilizes feedback to increase practitioner skill (Cooper & Wieckowski, 2017; Ericsson, 2004; Mamede & Schmidt, 2004). Reflection is the "engine" of practice and guides practitioners to increase the skill even after departing from clinical training (Bennett-Levy et al., 2009). As for engaging in reflective practice in clinical work, Donald Schön specifically applies reflective practice in a model that focuses on what professionals do when reflecting upon their work (Schön, 1983; Schön, 1987).

Schön (1983) proposed a model that contained three conceptualizations of reflection: "knowing-in-action," "reflection-in-action," and "reflection-on-action." Knowing-in-action encapsulates the skills and knowledge that are used every day without conscious knowledge (Schön, 1983; Schön, 1987). It is the knowledge revealed by the spontaneous, skillful execution of the performance. Reflection is triggered when stimulated by surprise, either when something does not go according to plan, or when something interesting occurs (Schön, 1983). Reflection-in-action occurs while we are working, similar to the idea of thinking on our feet. It involves awareness in the moment of our experiences, feelings, and theoretical underpinnings, and how these connect to the problem at hand (Schön, 1983; Schön, 1987). Reflection-on-action is typically what occurs after the event. Through this process, the practitioner explores what happened and why they acted a certain way (e.g., their experiences, feelings, etc.), and develops a richer understanding from this reflection that can be used to alter their future actions.

Treatment manuals often integrate reflection as an important part of the process of learning how to be an effective clinician (Beck et al., 2015; Harris, 2013; Safran & Segal, 1996; Senediak, 2013). Reflection in these circumstances is often taught as a means of examining past experiences, theories, beliefs, and assumptions held by the clinician to help improve future interactions with patients (Park-Taylor et al., 2009). Reflective practice can be taught in groups (Knight et al., 2010; Park-Taylor et al., 2009), or it can be done individually when reflecting upon one's practice (Beck et al., 2015; Beck & Beck, 1995; Binks et al., 2013) or through the use of different role-plays, workshops, or supervision activities (Lavender, 2003).

The main takeaway about reflective practice is that it is the "engine" of ongoing improvements after clinical training. Mastery-approach goals, self-efficacy, perceived instrumentality, and deliberate practice are useful when engaging in training, but instructors will want to ensure that students will carry on focusing on their learning after the student has left their respective program. Reflective practice is a variable that could track this development, that works well with deliberate practice, and that enhances overall training outcomes.

APPLICATION OF TARGET TO TRAINING

Keeping these five factors—deliberate practice, achievement goal orientation, self-efficacy, perceived instrumentality, and reflective practice—in mind, one way that training can adapt to both in-person and remote environments is by utilizing the TARGET framework. As previously described, the TARGET model focuses on six areas to build students' feelings of mastery, and in turn build their self-efficacy as

Table 1. TARGET model (Ames 1992)

Task	• Relevant to students • Moderate challenge • Multiple sources of assessment
Authority	• Shared between instructor and student • Students encouraged to take on autonomy
Recognition	• Private • Focus on students' effort and progress rather than based on a group standard
Group	• Collaborative assignments • Oriented toward real-world examples
Evaluation	• Progress, improvement, and mastery • Not norm-referenced or solely based on outcomes
Time	• As flexible as possible for completion of tasks

well (see Table 1 for an outline of the TARGET model). Utilizing deliberate practice and incorporating reflective practice, students can enhance their outcomes gained from training, and sustain their motivation to transfer the material learned by emphasizing the perceived instrumentality of the learned material.

The following section demonstrates how the TARGET model could be applied to maximize mastery approach, self-efficacy, reflective practice, and deliberate practice within current models of training. After discussing how TARGET could be currently used, suggestions for modifying it for use online will be provided.

First, *tasks* focused on skill development should utilize clinical role-plays, tied in with a form of oral examination and a written portion that are equally weighted toward the student's progress through their training. Doing so will allow multiple avenues of information gathering by the instructor, while giving the student practice not only on the clinical skill, but also on related professional skills the student will utilize in the future (e.g., clinical case presentations, writing skills, oral presentation skills). When first learning the skill, instructors should model the skill for the students, as this will enhance self-efficacy via vicarious learning and provide a mental model for the student to reflect on and compare against when rehearsing independently. Then, running students through rapid role-plays focused on just one part of the skill (e.g., providing education on a treatment option) with short feedback sessions after each run, would moderately challenge the student while slowly exposing them to experiences where they demonstrate mastery of the topic. Feedback should be aimed at not only correcting the student's execution of the skill, but also helping the student begin to reflect on what they missed and how they can improve in the future. These mini-feedback sessions will enhance reflection-on-action while providing scaffolding for reflection-in-action as the student demonstrates improvement. An important note is that these rapid practice sessions can be completed in as little as 20–30 minutes depending on the complexity of the skill practiced. The frequent feedback will enhance reflective practice while also giving the student a benchmark to aim for when practicing the skill on their own. Creating tasks specifically aimed at eliciting reflection may also benefit the student's learning. Emphasis on how these scenarios will benefit the student may also be useful. Finally, providing examples of how mistakes can be made without the knowledge or skill from the training can enhance students' perceived instrumentality of the training and provide a means of giving feedback about the scenario in question.

Authority for the tasks then can be shared between the student and instructor by giving the student an opportunity to set their own goals for improvement by the following session. Doing so allows the student

to demonstrate their desire to improve, encourages them by indicating that the instructor trusts that they will improve, and allows the instructor to assess the student's willingness to learn on their own time. Over time, the instructor can begin working with the student to allow the student increasing autonomy in choosing the cases they see, the specific interventions suggested, the resources consulted, as well as slowly taking the lead in difficult situations with patients. The focus is on shifting authority from the instructor, who traditionally has held most of the decision power, to students, who traditionally have not had the opportunity to demonstrate a desire for mastery in a formal way. Many supervisors may already practice these techniques informally but creating a formal expectation may aid in students taking on these responsibilities earlier, which may enhance mastery and self-efficacy. Relatedly, encouraging students to form study groups or other practice groups where they are in charge of the practice can shift authority from the instructor to the student (Pires et al., 2020). An emphasis on students practicing reflection and taking ownership for mastering reflection outside of work with the supervisor in these groups can also be beneficial (Yusuff, 2015).

Recognition for students' accomplishments can be focused on their growing skills, progress toward their self-identified goals, and reactions to feedback from their supervisor rather than a description of their progress compared to other students in the program. This last part may be more difficult as many supervision groups may have older students who take part in supervision with younger students. However, a focus on inner growth rather than growth as compared to outside entities may help inspire a mastery-approach mindset. As part of this process, crafting assignments or practicums where students can evaluate each other on their genuineness or growth in reflection could be helpful. Creating the expectation that students will enhance themselves through reflection, and creating an environment where recognition is based on improvement rather than comparison to others, will foster a mastery-approach orientation.

Many medical settings will have some form of *group* supervision or group work oriented toward patient care. Shifting the focus toward collaboration, with praise, rewards, and incentives focused on how well students collaborate on patient care, could enhance already positive outcomes. Reminding students about the real-world applications of group work may also address concerns they express about working in a group. Noting the importance of communication across professions in many medical settings and practicing this during a student's training may also boost the effectiveness of group work. Creating reflection groups, where the focus is not necessarily on patient outcomes but on the student's takeaways from sessions, and how the student can continue to improve their technique, could be helpful here. The focus should be on achieving mastery through authentic experiences, reflection on interactions with patients, and providing actionable feedback for the student to utilize in their sessions going forward.

Evaluation, related to *recognition*, would focus as much as possible on individual student progress toward their mastery of clinical skills, rather than on norm-referenced evaluations. The goal of creating a growth mindset, where mistakes (when possible) are understood as acceptable learning opportunities, and then providing additional chances for the student to demonstrate changed behavior should be the focus of evaluation. Comparisons to a norm or standard will have to occur (e.g., surgery, reduction of suicide risk), but in other less black-and-white realms, when possible, evaluation should focus on growth and increasing mastery. Doing so by combining evaluations from peers, observations, and performance on clinical role-plays as well as interactions with patients may allow for a more nuanced evaluation of the student.

Finally, where possible, allow students to take the *time* they need to succeed on the task or suggest their timeline. This dimension may be more appropriate with younger students who are first learning about clinical skills in a nonclinical context (e.g., the classroom). As the student shifts toward clinical

work, they will have to increase the speed that they learn material and implement it with their patients. As much flexibility as possible regarding the timing of seeing patients, the type of treatments, or the deadlines for learning techniques would aid this dimension (see Table 2 for a summary of suggestions).

Table 2. TARGET model with suggestions for enhancing training

Task	• Model skill to enhance vicarious learning • Conduct rapid role-plays on the same scenario with specific feedback to improve technique • Provide examples of how knowledge or skill from task will prevent future mistakes (and then demonstrate those mistakes)
Authority	• Allow students to set own goals where appropriate • Allow students to increase autonomy as skills and confidence increase • Encourage students to practice reflection outside of supervision and take ownership for mastering reflection
Recognition	• Focus on progress toward self-identified goals and reaction to feedback • Focus on inner growth and increasing reflection skill • Utilize peer evaluations focused on students' reflections
Group	• Connect group work to real-world examples or situations • Create reflection groups with students • Foster a group environment where feedback to improve is valued
Evaluation	• Praise individual progress toward mastery rather than comparing against a norm or standard • Combine evaluations from peers (on reflection skill), as well as observations, performance, and improvement
Time	• Allow students to suggest their own timeline (where appropriate) • Maintain flexibility regarding timing of seeing patients, types of treatments, or deadlines for learning techniques

APPLICATION OF TARGET TO REMOTE LEARNING

With these suggestions in mind, it is important to discuss how these ideas can be adapted for a virtual or remote learning context. *Tasks* can be adapted for online environments with relative ease. Clinical role-plays can be conducted in a virtual environment utilizing videoconferencing software, as might be done in a health care setting (Gifford et al., 2012). Instructions can be modified to focus the students' attention on the more relevant stimuli (e.g., facial expressions, voice modulations) and emphasize the differences between conducting treatments in an environment where you can only see half of the patient's body. Practicing scenarios where the student will have to not only tackle health-care-related issues, but also technical difficulties (e.g., intermittent connection, poor audio) is also warranted. Focusing on scenarios where the worst case may occur (e.g., suicide intervention is necessary) and using deliberate practice to hone a student's skill and confidence in handling these situations will be useful. Creativity in designing tasks can also be valuable. For example, one benefit of online sessions is that practitioners can see the environment a patient may be experiencing and can tailor their interventions to be more personalized using that information at hand. Practicing scenarios where students are encouraged to be inventive in their solutions and embrace the possibilities of remote learning and service provision will be helpful for enhancing self-efficacy, as well as fostering a desire for mastery of this new method of providing treatment. Emphasizing the future applicability of the tasks and how these additional training scenarios may aid the student in their future profession may also enhance the transfer of training by the student (Greene et al., 2004).

Alongside the creation of tasks is encouraging students to take more *authority* in not only the design of clinical tasks, but also their education. Part of this shift will be encouraging students to take the lead in introducing new difficulties they may have experienced since the last supervision, either during in person patient encounters, or during remote service provision. Then, students may begin brainstorming ways to address these difficulties, with the supervisor standing in as a consultant to evaluate the acceptability of the solution regarding overall policy. By doing so, students can not only begin to engage more actively with their learning in a way that is related to their future practice, but also demonstrate that they are able to problem-solve even "novel" problems.

Recognition and *evaluation* may need little to no adjustment for a virtual environment, as they both focus on acknowledgment of a person's progress and provide opportunities for improving upon mistakes. These opportunities should not necessarily change during a shift to remote learning, and any errors on the student's part due to technical difficulties can and should be used as opportunities for the student to learn, and reference in the future if their patients experience similar difficulties. A focus on the adaption of the student to new circumstances may be a better evaluation for remote circumstances.

In terms of the *group*, a remote environment can be both beneficial and detrimental. One recommendation is that instructors will need to familiarize themselves with the technology they will be using in remote learning (Wang et al., 2014). Being effective at using tools such as breakout rooms, text chat, camera and microphone adjustments, as well as common technical problem-solving skills will be necessary. Setting standards for communication preferences during different activities (e.g., utilizing voice to interrupt during a skills demonstration, or only using text during a skills demonstration for questions), as well as overall etiquette will be required. Framing each group discussion with a specific goal and ensuring that all communication leads to that goal will be helpful. Creating structured rules around private communication between group participants during group activities may be necessary, as it is much easier to become distracted with those private communications in a virtual environment. Relatedly, creating rules around multitasking during groups, and working hard within the group to share authority about maximizing the learning of each student, is needed. Multitasking is possible in groups held online and creating rules and checks for multitasking may be needed to ensure student focus (Wang et al., 2014). One other important consideration is that, when creating these groups, it may take additional time for students to grow comfortable with discussion in an online format compared to an in-person format. Keeping these factors in mind may help ease students into their groups and enhance their overall participation as a whole.

Finally, *time* may need little to no adjustment for a virtual environment. Providing additional time, where possible, when the student is initially learning to apply both the information learned, as well as navigating a technical interface, will be necessary (see Table 3 for a summary of suggestions).

FUTURE RESEARCH DIRECTIONS

The TARGET model and the suggestions provided are just one avenue of changing the approach to educating new healthcare professionals. The proposed clinical tasks involve role-plays with fellow students, supervisors, or even trained actors, but there is significant potential in the next few years for alternative means of training future practitioners using technology (Beidas et al., 2014). Virtual reality and artificial intelligence both offer promising avenues for future training, with the ability to create standardized "actors" with whom students can practice refining their skills on their own time. Virtual

Table 3. TARGET model with suggestions for remote learning

Task	• Utilize video conferencing software comparable to what is used in future placements • Practice handling technical difficulties (e.g., slow connection, poor audio) • Emphasize future applicability of conducting remote sessions with patients
Authority	• Ask students to take the lead in bringing technological, procedural, or clinical concerns to the instructor's attention • Collaborate in addressing difficulties to maximize students' self-efficacy for handling future difficulties
Recognition	• Should not need a shift; focus should be on the student's adaption to the new medium
Group	• Familiarize instructor with technology (e.g., breakout rooms, camera and microphone adjustments) • Set standards for communication preferences • Set ground rules for multitasking
Evaluation	• Should not need a shift; focus should be on the student's adaption to the new medium
Time	• Should not need a shift other than providing additional time to focus on technical difficulties and adjustment to a new medium

avatars could provide a means for students to refine their craft through deliberate practice, without creating worries about taking time away from other students or from their supervisor. The avatars can also work to provide "feedback" depending on the student's success in role-playing with the avatar, helping to incrementally increase the student's skill as they work to obtain the "standard" that their supervisor can demonstrate to them.

Another related consideration is that, with the increase in online or remote learning, students may benefit from the ability to utilize asynchronous resources during their training. As other authors have noted, training offered online has numerous benefits, including convenience for the user, ease of logistical concerns (e.g., travel, lodging), and reusability if the student requires additional time with the training or missed one part of it. Depending on how remote learning is conducted, the repeated use of similar training across years could aid in standardization and reduce the time taken by instructors to review basic material. Resources could be reallocated to more complex scenarios that may benefit more from individualized attention.

CONCLUSION

In conclusion, this chapter has reviewed the literature on deliberate practice and the related constructs of achievement goal orientation, self-efficacy, perceived instrumentality, and reflective practice. Deliberate practice, when combined with the TARGET model, can act as a means of enhancing training outcomes in a remote or virtual learning environment and can be adapted for both in-person and virtual learning.

ACKNOWLEDGMENT

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

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ADDITIONAL READING

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KEY TERMS AND DEFINITIONS

Achievement Goal Orientation: Cognitive representations of an end state involving an interpretation of one's competence with a specific task.

Deliberate Practice: The measured and focused repetition of a task paired with feedback from a standard aimed at improving one's performance.

Mastery-Approach Orientation: An end state focusing on general self-improvement, developing competence, and achieving task mastery.

Perceived Instrumentality: A perception of the usefulness of a given task/training toward the user's future goals.

Reflective Practice: Reflecting on clinical experience with the intention to utilize knowledge, cognitive skills, emotional reactions, attitudes, or beliefs to make meaning of information obtained in a session.

Remote Learning: Learning taking place in any format where the learner is not in person with the instructor.

Self-Efficacy: Beliefs regarding one's capability for a particular task or endeavor.

Chapter 13
Teaching Clinical Skills During Pandemic Times: Online Clinical Simulation

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ABSTRACT

Clinical simulation is a teaching strategy that replicates medical situations in controlled environments. The COVID-19 pandemic created disruptions for healthcare simulation centers. As a response, the Universidad Anáhuac designed online clinical simulation practices and assessments. The pre-intervention survey showed skeptical medical students (59.15%) to continue this learning format. The intervention included neurology, cardiology, and gynecology topics supported by five faculty members and staff. Instruments were examination checklists to evaluate the clinical competence based on a 100 score and the Debriefing Assessment for Simulation in Healthcare (DASH) with a 1 (extremely ineffective) to 7 (extremely effective) score. Students received individual training by Zoom, including simulation practices, debriefing, and assessment. Even though it seemed impossible to address clinical skills by distance, simulation practices continued with online resources. Collaborative participation between faculty, students, and staff facilitated learning during the COVID-19 conditions.

DOI: 10.4018/978-1-7998-8783-6.ch013

INTRODUCTION

In November 2019, the Chinese government alerted the world about a new virus called SARS-Cov-2 that originated in the province of Wuhan, affecting the population by COVID-19 disease. With its virulence capacity, uncertain evolution, and high mortality rates, the world's governments implemented immediate epidemiological strategies to stop the spread and collapse of the world's health care systems. Therefore, in Mexico, in March 2020, the federal government began with protocols to reduce all non-essential activities and events with crowds of people, causing the suspension of many jobs and schools at all educational levels.

In medical schools, hospital rotations were suspended to prevent health risks. As a result, approximately 150 students interrupted the last semesters of their medical program, where most of the clinical competence is acquired or reinforced. In addition, the lockdown impacted the closing of several facilities transforming face-to-face education into screens with emergency remote education. Besides the hospital settings, clinical simulation sessions were also canceled, removing opportunities for medical learning. The unusual circumstances led to the project to experiment with innovative approaches considering distance learning as part of the social responsibility of the university and the medical school.

The purpose of the chapter is to describe an intervention project at the School of Medicine of the Universidad Anáhuac (Querétaro campus), to introduce Online Clinical Simulation to address the continuity of the academic medical program.

The objectives of the chapter are:

- **Readiness for online simulation practices:** Provide evidence of students' skepticism to apply online simulation practices and assessment.
- **Framework for online simulation practices:** Describe a conceptual framework to implement online simulation practices for the topics of neurology, cardiology, and gynecology.
- **Assessment instruments:** Introduce instruments to assess online simulation practices for clinical competence and debriefing as part of the educational intervention.
- **Discussion and recommendations:** Explain and contrast results of the clinical competence for the intervention applying online clinical simulation.

The authors of the present chapter invite leaders, faculty members, students, and staff to learn from the presented methods and experiences to reproduce online-based simulation activities in their contexts.

BACKGROUND

Distance Learning in Medical Education

A medical program with classroom traditional classes belongs to the past century. The era of digital information provides opportunities to improve teaching methods without the barriers of distance and time. According to Pei and Wu (2019), preparing qualified doctors for today's environment requires reconsidering teaching methods and other training efforts to introduce ubiquitous digital information.

Distance learning has been practiced for decades, even by correspondence. However, the Internet expanded its reach and the opportunity for distance learning that leads to new definitions such as online

Table 1. Online offline and blended learning

	Online learning	Offline learning	Blended learning
Other concepts	• Online learning • Web-based learning • Internet-based learning • E-learning • Distance learning by video.	• Offline learning • Face-to-face teaching in a classroom • Watching video lectures together in the classroom • Reading paper text-based documents or books	• Blended learning • Hybrid learning • Flex courses
Characteristics	• No barriers of time and space • Education is remote	• Specific synchronous time or physical space	• Mixed formats take advantage of both environments

learning or learning strategy as e-learning, which refers to the use of the Internet for education (Ellaway & Masters, 2009). Even that technology was already available for several decades, until the year 2020, the entire educational system had the emergency to address a remote format for teaching. There is no consensus about the concept or definition for learning that is not completely in person. Table 1 presents three concepts to compare different approaches.

Pei and Wu (2019) developed a meta-analysis to compare the efficiency of online education vs. offline learning. The authors identified 16 articles that met the criteria selection for pre-test and post-test that were stratified in two groups a) seven articles with no significant difference between the two teaching methods, and nine articles with significant improvement in the online learning groups.

Until recently, distance learning meant little more than the ability to transmit "prepackaged" or "canned" information to a broader audience. However, the power of online learning derives from its ability to foster interaction. Teachers became tutors on the sidelines of learning, but now they are not completely absent. Any course employing e-learning run exclusively online, or it could be a combination of online and face-to-face activities (combining activities like this is generally referred to as "blended learning"). Students may be at a distance or traditional campus-based universities, accessing their online learning environment from computer labs, lecture halls, cafeterias, or anywhere else. The classroom then becomes any location with the Internet. From this perspective, all medical students are remote learners because they study at home or while traveling to hospitals for clinical rotations (Ellaway & Masters, 2009).

Online education in Medicine has different advantages as accessibility, scalability, customization, and efficiency. Dennis & Wolbrink, (2019) collected data from pediatricians using the worldwide website of "OPENPediatrics Annual User Survey" of 2017. They asked about a site, when it was accessed, where they accessed it most, and through which devices they accessed it. The authors found that most participants used the three modalities of education (courses, simulators, and shared practice forums). Authors conclude that users prefer the combination of the three modalities for deep and well-founded knowledge.

In the last ten years, online learning has had a great boom in medical schools, using different teaching methods, thus eliminating an important barrier in traditional education. Through online tutorials, collaborative learning, and simulations, teachers facilitate learning through activities for students to achieve the objectives, thus breaking some barriers of traditional education. The Educase report from 2012 (Johnson *et al.*, 2012) predicted that:

- **Education paradigms are shifting to include online learning, hybrid learning and collaborative models**. Students already spend much of their free time on the Internet, learning and exchang-

Table 2. Online educational resources

	Learning Management Systems	Educational Software and IA	Multimedia and realities
Purpose	• Facilitate teaching-learning process varying levels of support provided to staff and students	• Facilitate the teaching-learning process through computer programs or applications. • Artificial Intelligence	• It promotes interaction with a greater sense of realism due to the incorporation of audio, video, images fixed or animated, even in the third dimension. • Realities include Virtual Reality or Augmented Reality

ing new information often via their social networks. Institutions that embrace face-to face/online hybrid learning models can leverage the online skills learners.

- **People expect to be able to work, learn, and study whenever and wherever they want to**. Learners must balance demands from home, work, school, and family. People want easy and timely access to the information on the network and tools, resources, and up-to-the-moment analysis and commentary.

Almost ten years later, the 2021 edition (Pelletier *et al.*, 2021) reports that the COVID pandemic delivered a seismic jolt that significantly accelerated the evolution of blended and hybrid course models. As a result, higher education institutions were forced to become inventive and creative to introduce an array of new course models to cope with the emergency of the situation. The terminology and trends include Artificial Intelligence(AI), flex courses, digital education, learning analytics, and open educational resources.

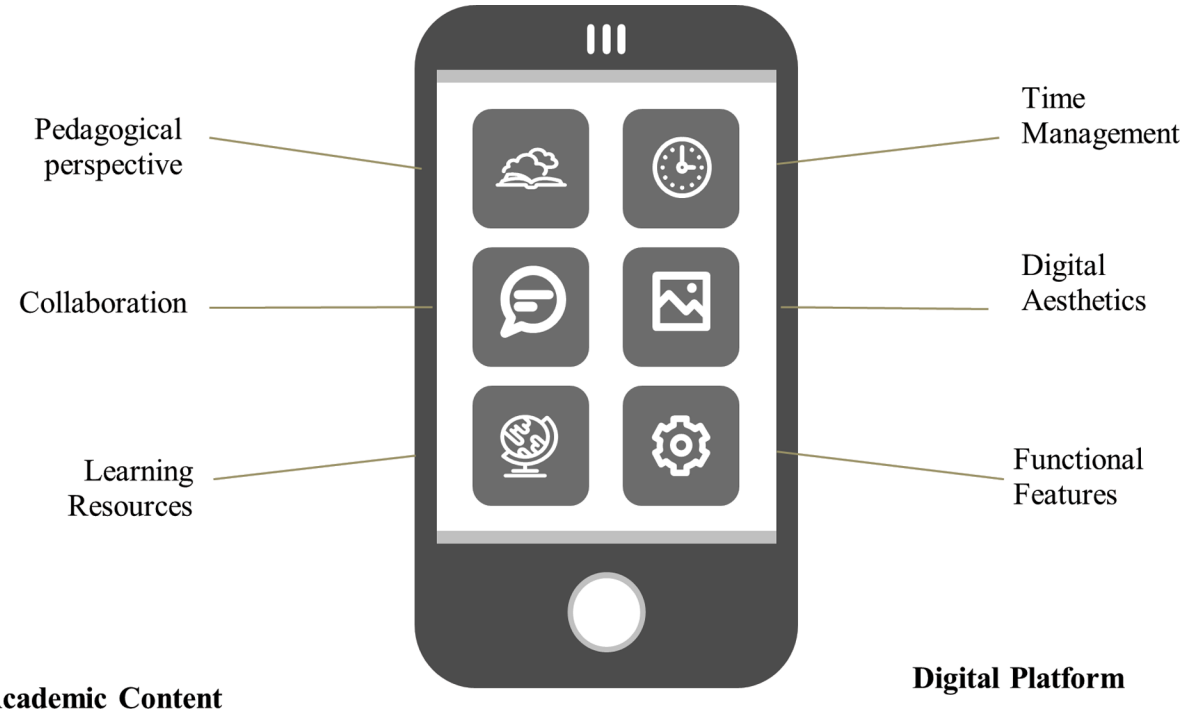
Information and communication technologies are still in constant development and widespread application in Medical education. The teaching-learning process in Medicine is enriched with Learning Management Systems, educational software, and Multimedia. (Pérez Martinot, 2017) (Table 2).

Learning Management Systems include digital materials that facilitate medical educations, especially if they are designed for discipline-specific purposes Pérez Martinot (2017) argues that digital materials should be updated on a regular basis considering new knowledge and technologies. The author recommends deciding digital materials based on:

1. **Culture:** consider that culture is broad and complex, with multiple interactions between subjects, and is transmitted from one generation to another
2. **Selection:** faculty must know what they want to teach to choose the contents of the program appropriately.
3. **Structure**: the preparation of the curriculum saves a close relationship with the content of the program.
4. **Methodology**: consider the most appropriate for transmitting the concepts to the student.
5. **Evaluation**: Assessment of the quality and efficiency of educational products.

Regarding educational software, it can be stratified into adaptive or non-adaptive learning. Adaptive learning is a methodology that allows the software to identify the level of students' knowledge and learning styles to transform materials, tasks, and delivery methods according to the needs of learning process participants (Morze *et al.*, 2020). Some elements that educational software may include:

Figure 1. Quality dimensions for online platforms (Olivares Olivares et al., 2021)



1. **Tutorials:** Encourage dialogue and allow particularizing learning according to the student's level.
2. **Intelligent tutors:** Mimic mental capacity and make judgments that facilitate diagnosis.
3. **Simulations:** Create micro-worlds where students can interact with physical and biological processes.
4. **Hypertexts and hypermedia:** It organizes data so that large banks of information can be consulted.

On the other hand, non-adaptive learning by software programming allows the student to decide the order of the modules, management of time, and depth of the inquiry. MOOCs offer education with high-quality standards to a large number of participants around the world who have internet access at little or no cost. These courses have the potential to offer better educational experiences within learning communities where students and teachers from multiple institutions and geographic locations participate remotely.

Olivares Olivares *et al.* (2021) provided a quality model for self-directed online learning platforms. The model classified the quality dimension into two groups, as shown in figure 1. Academic content involves the process of learning competencies, both generic and disciplinary. Generic competencies promoted are creativity, critical thinking, self-direction, collaboration, and inquiry through learning resources. Digital platform refers to media production and preparation to enhance the learning experience, with an online well-designed, and friendly environment customized to the participant's schedule and context. Designing online practices considering those quality dimensions could improve the medical students' content learning, interaction, and motivation.

About Multimedia, it consists of the use of various media (voice, text, animation, videos, graphics, data, etc.) to present and transmit information that can be reproduced on a computer with adequate hard-

ware (for example, sound and video cards, monitors) (Pérez Martinot, 2017). Multimedia is an excellent complement to distance learning courses. Current applications include virtual Reality.

Even that Multimedia usually considers a 2D format. Alternative realities have introduced 3D immersive experiences for learning that usually require more devices than the computer. (Kaplan *et al.*, 2021). Virtual Reality (VR) has a 3D computer-generated environment, updated in real-time. It allows humans to disconnect the real world for full immersion and interaction through various input/output devices. Augmented Reality (AR) combines elements from the real world with graphics that display on top of the real environment. The tasks that might be performed with alternate realities are (Kaplan *et al.,* 2021):

1. **Cognitive tasks.:** Cognitive tasks relate to situations in which participants learn information that they later had to remember or apply into a specific context.
2. **Physical tasks:** Involves bodily training or psychomotor skill assimilation.
3. **Mixed tasks:** Combination of both physical and cognitive requirements

In medical education, physical and mixed tasks are part of clinical competence. Clinical simulation has been widely applied for medical training.

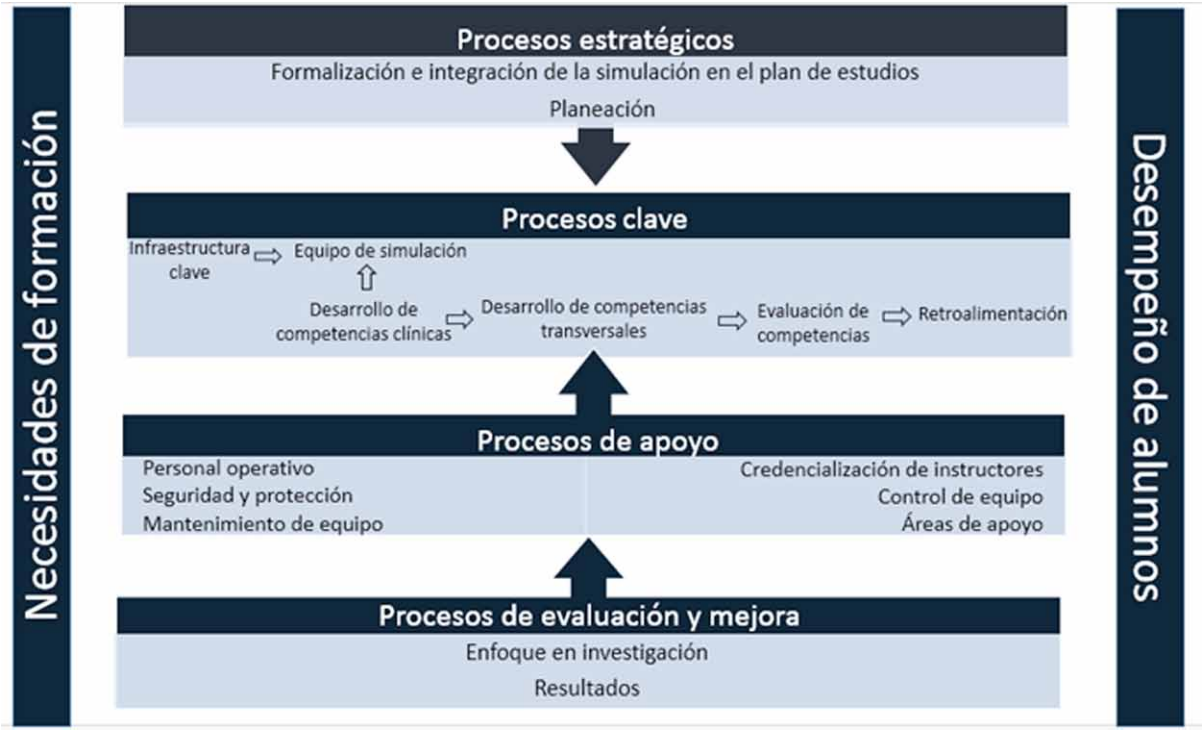
Clinical Simulation: An Innovative Concept Adopted from the Ancient Era

Clinical simulation is not a new concept. Early conceptualizations dated since the Chinese dynasty in the years 967-1067 BC used life-sized bronze statues to teach acupuncture puncture site techniques (Owen, 2012). Five hundred years later, smaller simulators began to be used after Humanis Corporis Fabrica de Vesalio promoted teaching with anatomical models, followed by wax life-size musculoskeletal simulators. By the 18th century, obstetric simulators with amniotic fluid filtration were introduced, and by the 17th century, the first surgical simulators developed hybrid simulation. One of its most important characteristics is its exponential evolution, leading it to seek new ways to use it to the maximum in any educational context (Caballero, 2017).

Today, clinical simulation is defined as a technique, not a technology, that replaces or amplifies real experiences with guided experiences, often immersive, that evoke or replicate substantial aspects of the authentic world in a fully interactive way (Gaba, 2004). Nevertheless, this didactic strategy has been applied in Mexico since the 1980's at different educational levels and specifically for undergraduate medical programs (Dávila-Cervantes, 2014). It has the potential for clinical skills training, formative and summative evaluation, and feedback for students in schools, colleges, and hospitals. Several simulation centers have been introduced as part of the medical curriculum, growing the type of practices exponentially, leading to seek new ways to maximize their capacities for any educational context (Caballero, 2017). For example, the National Institute of Medical Sciences and Nutrition "Salvador Zubirán," the Center for Teaching and Certification of Medical Aptitudes (CECAM by its acronym in Spanish) of the National Autonomous University of Mexico and other private hospitals such as Hospital Medica Sur or the ABC Medical Center, as well as other public and private universities like the School of Medicine and Health Sciences at Tecnologico de Monterrey. The equipment, size, and services vary from each institution (Serna *et al*., 2012).

Turrubiates (2016) provided a quality model for Simulation Centers. The quality model was developed based on the recommendations of specialized institutions in the field of simulation: Society for Simulation in Healthcare (SSH), American College of Surgeons (ACS) and Royal College of Physicians and

Figure 2. Quality model of Simulation Centers (2016)



Surgeons of Canada (RCPSC), as well as contributions from expert authors on the subject. The model includes the elements of the Educational process, Profile of instructors, Infrastructure and equipment, and Management. As shown in figure 1 the quality model was developed like a processes map because according to Hernandez *et al.* (2009) it allows the visualization and appreciation of the interrelationships between the processes.

With the continuous increase of hospital restrictions, patient safety protocols, and confidentiality of data, the clinical simulation became part of the medical curriculum. However, with the COVID pandemic, simulation practices with equipment, direct supervision, and other resources remained unclear as part of the simulation center activities.

FROM FACE-TO-FACE TO ONLINE SIMULATION

The described educational intervention to save the continuity of education was located at Querétaro, Mexico, where two medical schools and three simulation centers provide training services for undergraduate medical programs, including technical and non-technical skills for different topics. The presented intervention project was developed in a private educational context, in the Medical Surgeon degree, at a university in central Mexico that is part of a Network of Universities in various states of the Mexican Republic. Participants were faculty members and students from the fifth to the eighth semester of their medical program. Those last semesters are part of the clinical clerkships from their Bachelor's Degree.

Since the face-to-face practices were impossible to achieve, the main question was, Is it possible to train clinical skills remotely? With which learning results?

Online Simulation. Is that Even Possible?

Considering that not all skills are acquired in the classroom, it is a fact that students who actively participate in simulation scenarios improve clinical judgment, protocol alignment, motivation, diagnostic confidence, and in turn, patient safety (Deslile et al. 2019; O'Donell et al. 2011). Unfortunately, due to the COVID lockdown, students in the clinical clerkships of the medical program were not able to go to a hospital nor the facilities of a simulation center. Thus, due to the implication that simulation has directly in the student's teaching-learning process, finding a way to continue the students' learning training in clinical skills was imperative, even when they could not physically attend a simulation center.

The first step was to survey faculty members and students via Google forms to gather their opinion about the feasibility of online simulation to develop technical skills. The results obtained from these instruments showed that out of 71 participating students, 40.85% considered it possible to learn clinical skills at a distance, while 59.15% were skeptical. On behalf of teachers, it was found that, of the 16 participants, 68.75% were convinced that it was possible to develop clinical skills at a distance, while 31.25% did not share this opinion.

In addition to these surveys, a SWOT analysis was performed to deepen the context, as presented in Table 3.

Thus, the results obtained from this diagnosis showed that distance clinical simulation could be used as a didactic tool, so it was imperative to formulate a proposal for a learning experience that would provide continuity to the student's personal and professional development. The online simulation learning experience had to be adapted considering different medical student profiles and attributes. Motivation, interaction and, special needs are also elements to include in the design

Framework for Online Simulation Practices

The general objective of this project was the application of online clinical simulation through distance practices. Online clinical simulation is a guided teaching strategy that replicates health care situations with home props to learn without risks. The purpose was to continue the teaching-learning process to develop clinical skills in students during their clerkships. Several phases were included to address e the implementation of this proposal. Simulation-based education (SBE) has been proposed as an additional educational strategy. SBE attempts to replicate real-life experiences through simulated scenarios, environments, or patients, creating a safe environment where confidence and clinical competence can be developed.

The first phase was to train a group of medical interns in simulation and debriefing to adapt and implement a series of online simulation practices as Leopold maneuvers, cardiovascular physical examination, and neurological examination. Then, as a second phase, the selected practices were implemented with students during their clinical clerkships, including their debriefing sessions and application of evaluation instruments. Finally, the last step consisted of carrying out the evaluation process of achieving the clinical competencies and the analysis of the results (Figure 3).

Table 3. SWOT analysis regarding online clinical simulation

SWOT	Students	Faculty
Strenghts	• The students who considered that it is possible to do internships online are open to knowledge. • The students who did not consider the online type of learning to be appropriate are because they are unfamiliar with the subject or have had no experience. • The potential topics to address online simulation were Pediatrics, Gynecology, Ophthalmology, Cardiology, Urology, Neurology, Orthopedics, and Emergency.	• Teachers were open to the possibility of teaching clinical skills online.
Opportunities	• Understand online simulation as a new didactic strategy for students who can apply simulation practices for clinical skills.	• There is an opportunity to trigger the development of practices and the design of online simulation. • As part of the results of the surveys, examples of online clinical skills practices were mentioned, such as video tutorials on physical examination maneuvers, deep learning and artificial intelligence and, clinical case resolution, among others.
Weakness	• Lack of training, lack of skills, knowledge to perform the activity remotely. • A lot of skepticism that clinical skills can be performed differently than face-to-face. • Lack of real-time feedback from both the team (students present in practice) and the teacher and interaction with them.	• Lack of training in digital platforms and technological tools. • The surveys helped to detect limitations in the examples obtained in terms of "simulation practice examples." E.g., "online practices only in dermatological lesions."
Threads	• The materials and instruments are in the university facilities. • It is impractical since it depends on the type of learning of the student. • They recognize that teamwork in real-time is invaluable. • They consider that it will be a theoretical activity, not a practical one.	• Five teachers considered that clinical skills could not be learned online, including interaction and physical examination of the patient and the handling of materials by the students.

Figure 3. Framework for online simulation training

Online Simulation Instructors Training

Although faculty development is not new, the increased demand for faculty to teach with technology is relatively new (Belt & Lowenthal, 2020). For SBE to be effective, teachers must understand learning theories and have their learning objectives identified and well established in order to identify how people learn. This process is divided into four fundamental parts: a) observation of simulated behaviors, b) retention, c) practice, and d) motivation. Some SBE practices are implemented through observation, since not everyone can access simulators as active participants. Regarding simulation, it is essential in the curriculum for the following reasons (Harden & Laidlaw, 2017):

1. **Patients.:** Real patients may not always be available for clinical teaching.
2. **Time**: Training could be available at the proper time and space.
3. **Standard learning**: Every student receive the same training and assessment
4. **Mastery learning**: Students may repeat the exercise until they achieve the expected performance.
5. **Safe rehearse**: Students learn in a safe environment both for the student and the patient.
6. **Collaboration:** Improve interprofessional skills and decision-making with different roles and ranks.

The COVID emergency pushed teachers to learn several digital technologies. The advances in technology create new challenges for faculty developers across all educational institutions and organizations. According to Belt and Lowental (2020), the preferred method for faculty to learn is in person. However, since the lockdown of the pandemic, faculty all around the world have had to learn new ways of learning and working from online platforms (Pelletier *et al.*, 2021).

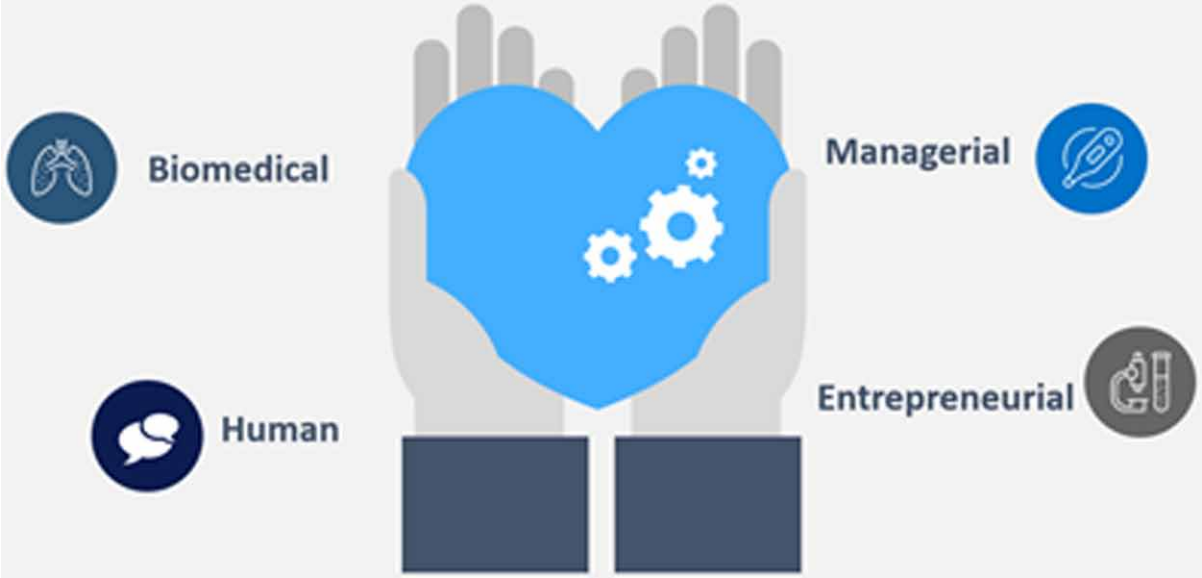
Simulation practices needed to be transformed into distance training. Telesimulation possibilities intend to offer a new opportunity to learn through distance platforms (Deslile *et al.*, 2019). Telesimulation is defined as a "process by which telecommunication and simulation resources are utilized to provide education, training, or assessment to learners at an off-site location (McCoy *et al*., 2017, p. 2). This concept of "tele" was earlier applied in health. Telemedicine was originally used to denote the provision of medical services across distance (Fatehi & Wootton, 2012). According to Fatehi and Wootton, the term 'telehealth' was introduced to reflect a broader scope of interprofessional functions from several roles of the healthcare team.

Patient Centered Learning

Patient Centered Learning (PCL) refers to patient care as a person who collaborates with the health team to decide every clinical intervention, considering integral quality healthcare services aligned with patient preferences in every phase of clinical care: patient knowledge, diagnosis, intervention, and monitoring/ follow up. The Patient Centered Learning (PCL, Figure 4) is oriented to enhance patient participation in their clinical care considering four perspectives a) human, to understand the patient as a person, b) biomedical, for evidence and knowledge, c) management, for quality and safety, and d) entrepreneurial to innovate on health care needs (Olivares Olivares & Valdez García, 2017).

The human perspective considers the patient as a whole human being with emotions, context, and health requirements. In the clinical simulation, it is possible to address this perspective with simulated patients. Shen *et al*. (2017) present optimal results in the use of simulations in a new suture mold with pigskin attached to the patient to simulate the wound and in the clinical setting for suturing examination. This

Figure 4. Patient Centered Learning



cast gives the impression that students are suturing real patients training communication skills between the student and the standardized patient expressing variable emotions during the suturing procedure. Díaz y Ruiz (2019) agrees with this premise, stating that there must be authenticy in the simulated scenario with respect to real-life situations where subjects develop physically, conceptually, and psychologically. The student should express emotions generated during the simulation, and it is recommended to reconstruct the situation from the perspective of those who experienced it. However, in online simulation, communication and emotions require an understanding of relationships through screens.

The biomedical perspective is also learned by clinical simulation. Sideris *et al.* (2017) developed a study of 292 students at the University of Leeds. Introducing students to basic training simulations created an interest in the surgical field. The study results highlighted the need for better teaching of final year students in the operating room. It also suggests that students benefit from a senior-led teaching model in highly technical subjects, whereas junior doctors better teach practical skills. The intervention in the present study had the collaboration of the staff of the Simulation Center of the School of Medicine of the Universidad Anáhuac (Querétaro campus) as presented in Table 4.

In the clinical simulation, there are several strategies to address safety and resources. The managerial perspective seeks efficiency in personnel, time, materials, cost, and infrastructure, maximizing safety and quality of care, and compliance with the corresponding regulations (Olivares Olivares & Valdez García, 2017). The risk factor is reduced for both patients and students, and trainees can acquire certain skills before direct contact with patients. Some resources to manage during SBE observed by Serna *et al.* (2012 are:

1. **Information.:** There is a high volume of variables and information.
2. **Contents**: Students become the managers of their knowledge, which could be available through databases, books, or other material.

Table 4. The staff of the Simulation Center of the School of Medicine of the Universidad Anáhuac (Querétaro campus)

Position	Role	Responsibility for online practices
Coordinator	• Lead online simulation practices	• Coordinate debriefing • Assess instructors performance
Instructors (3 Senior Studens)	• Educate students by online simulation practices	• Participate in the faculty training • Design the rubrics to assess the clinical competence • Assess students performance • Self-assess performance
Faculty. Specialist MD and Posgraduate Dr.	• Tutoring or guiding team of the participating students	• Expert for reviewing assessment checklists
Students in clerkships	• Learning clinical competence 10 students in the cardiovascular examination practice 24 students in the Leopold maneuvers practice and 4 students in the neurological examination practice	• Execute practices • Assess instructor performance • Self assess performance

3. **Scenarios authenticity:** Multiples possibilities of settings as consultation, emergency room, hospital, operating room, etc.
4. **Time for trial and error:** The time for experimentation might be costly considering equipment and technology.

The COVID-19 demanded the Self-protection and Self-care of the health care professional as a new competence (Abreu-Hernández *et al.,* 2020).The lockdown of the simulation center to protect faculty and students demanded a different approach for learning. Telesimulation requires resources that include but are not limited to telecommunication equipment that allows the capture and transmission of audio/visual data, an Internet connection, software that has teleconferencing capabilities, and simulation equipment (McCoy, Sayegh, Alrabah, & Yarris, 2017). The costs vary from free/low-cost options to high sophisticated audio/visual equipment within simulation centers. The online clinical simulation in the present study required the management of resources off-site location, including Zoom and MS teams.

Medical education benefits from information technologies, predominantly when specific pedagogical strategies guide them. There are multiple advantages and disadvantages to using them. However, the benefits are most notable, especially in creating skills in students that would require many hours of practice and possible risk to patient safety. The debate and research results could open up areas of opportunity to improve and enhance the use of clinical simulation practices in the creation of better students with a punctual balance between their emotions, theories, and knowledge to be applied. The entrepreneurial perspective in PCL allows the understanding of the context in which the individual is immersed to understand the social determinants of health and extend the solutions for achieving a social transformation (Olivares Olivares & Valdez García, 2017). For the purpose of the intervention in the present study, instructors had to create practices from the distance to ensure the continuitiy of the education. The content of the course to introduce instructors to online simulation was based on PCL fundamentals, as presented in Table 5.

Table 5. Course contents for online simulation instructors

PCL perspective	Objective	Content
Human	• Assimilate the role of the instructor as a facilitator. • Apply communication skills.	• Distance communication • Feedback
Biomedical	• Comprehend the importance of the clinical simulation to introduce biomedical knowledge	• Characteristics of the clinical simulation • Types of clinical simulation
Managerial	• Understand the use of videoconference platforms	• Zoom platform and its features • MS teams platform and its features
Entrepreneurial	• Transform in-person simulation practices into online practices	• Clinical simulation instructional design • Assessment instruments • DASH instrument

Implementation of the Intervention

In addition to faculty training, Diaz and Ruiz (2019) recommend including disciplinary knowledge and non-technical skills (asking for help, leadership, role-taking, closed-loop communication, resource mobilization, situational awareness, etc.) for SBE curriculum design. With SBE, Hough *et al.* (2019) also found significant improvements in students' self-efficacy in different health areas. Some examples are assessment and physical therapy, management of pediatric patients, increased confidence in clinical skills, more appropriate clinical decisions, better treatment development, preparation and planning, enhanced communication skills, and interprofessional practice. Trainees who have not had many opportunities to practice their clinical decision-making showed lower initial levels of confidence. In contrast, students with SBE were most confident in their communication and interprofessional skills.

Simulator-based education reproduces real clinical scenarios. Its methodological processes activate learning and teaching and develop disciplinary and transversal competencies. Generic competencies are associated with specific knowledge and skills related to a particular professional role, and transversal learning integrates knowledge and skills from multiple disciplines (Díaz Barriga, 2006).

The ideal is to work with small groups so that they can enhance the experience. According to Harden and Laidlaw (2017), in small group teaching, learners work together in a group, interacting to achieve common learning goals. The simulators allow students to self-evaluate and learn about their progress and mistakes. Students can apply theories and concepts learned in simulators. Simulation practices reduce the learning curve and create an environment for building confidence and professional identity (Serna & Martínez, 2018). Professional identity is the dynamic evolution of the self as a person who is part of social and academic groups with a role within professional contexts to generate a conscious change (Olivares *et al*., 2020).

Dávila-Cervantes (2014) describes different learning strategies, including the standardized patient, the human simulator, the hybrid patient, the virtual simulator, and the skills simulators. Each one promotes critical post-practice analysis. By simulating risk situations, the level of mastery achieved by learners can be measured. The level of fidelity to the real experience should be used according to the knowledge and skills to be taught. In Table 7, are presented different levels of fidelity are grouped together and what is relevant is not that they look of the highest quality, but that each practice has its own needs. This reinforces the idea that educational technologies solve educational problems. Therefore, educational

Table 6. Types of simulation strategies (Serna & Martínez, 2018)

Strategy	Description	Impact
Hybrid simulation	• It is a combination of simulators with real patients to recreate a clinical scenario.	• Acquisition of individual competencies in clinical skills
Simulation of a new case	• Design of a clinical case of a patient with a rare disease, which may include several events	• Development of critical thinking skills that enhance the competencies associated with the educational objectives of the clinical area.
Simulation on standardized patients	• Real actors participate to represent specific clinical cases. They can be used to evaluate the elaboration of the clinical history, communication with the patient and how the physical examination is performed.	• Acquisition of communication, psychomotor and teamwork skills.
In-situ Simulation	• Design of an on-site scenario to care for a patient.	• Development of critical thinking skills that enhance the competencies associated with the educational objectives of the clinical area.
Virtual simulation	• It is carried out with computer-simulated scenarios; several students can be present simultaneously.	• Acquisition of individual competencies in clinical skills
Simulation of complex tasks	• It is used to develop manual skills such as surgical techniques.	• Acquisition of individual competencies in manual skills
Full patient simulation	• Use of life-size mannequins with complex clinical situations that need to be solved as a team.	• Acquisition of individual competencies in clinical skills

strategies should not be adapted to the fidelity or virtuality of technology but rather to enhance the spaces where students can improve their skills.

Table 7. Levels of simulation fidelity (Dávila-Cervantes, 2014).

Simulation type	Characteristics
1. Low fidelity	• Simulators of an anatomical segment, in which specific procedures and some invasive and non-invasive maneuvers are performed. Some examples are practices such as gynecological exploration, intramuscular or intravenous injections, or blood pressure measurement.
2. Intermediate fidelity	• It is defined by the combination of the use of an anatomical part with computers managing clinical variables.
3. High fidelity	• It refers to the integration of multiple physiological variables, managed by computers using advanced hardware and software technology to increase the realism of the simulation. Some examples are practices of complex clinical situations such as euthyroid or complicated delivery, endotracheal intubation, cardiopulmonary resuscitation in children and adults, recognition of cardiac diseases, and emergency care in intensive care.

Debriefing

Debriefing is defined as a facilitated conversation after critical events or simulations in which participants analyze their actions, thought processes, emotional states, and other information to improve performance in future situations. It incorporates three important aspects of the experiential nature of adult learning: reflection, feedback, and future experimentation (Brett-Fleegler *et al.*, 2012). Debriefing of simulated

clinical experiences is increasingly seen as a crucial step in clarifying and consolidating the insights and lessons gained through simulation. The Debriefing Evaluation for Simulation in Healthcare (DASH) is designed to help assess and develop debriefing skills. The DASH assesses the strategies and techniques used to conduct debriefings through an evaluation of specific behaviors. It is based on evidence and theory about how people learn and change in an experiential context. The DASH is designed to allow the assessment of debriefings from a variety of disciplines and courses, with different numbers of participants, a wide range of educational objectives, and varied physical and time constraints (Breet-Fleeger *et al.*, 2012).

Some studies have addressed advantages from debriefing. Rubio *et al.* (2020) comment that clinical reasoning is a thought process for exploring experiences and systematizing thoughts. The process of arriving at reasonable conclusions occurs by gathering and analyzing data logically through the discussion process. The authors conducted two debriefings with students. The first group participated in simulating a patient's care with COVID-19, and the other just observed. In their results, they noted that those who used the simulation felt fear and confusion. However, upon completion, they experienced pride, confidence, and enthusiasm. Feelings are embedded in the anchor of education. Including emotions in learning experiences produces more meaningful educational experiences.

Bae *et al.* (2019) found with their study that debriefing in simulation is one of the most effective teaching methods for fostering relevant competencies in learners in the health sciences. Their study developed a debriefing protocol to improve clinical reasoning in undergraduate students. Clinical reasoning is required as a core competency of medical professionals. Every day clinical diagnoses are becoming more complicated; consequently, patients' diseases are more diversified. It would be challenging to have students experience all possible conditions in clinical practice. Simulations help learners to diversify their experience with environments, circumstances, and contexts that are not easy to deal with in daily practice. Students' clinical reasoning process should be enhanced even with a health problem that has not been experienced before. Feedback is essential for medical education with simulation.

The implementation of the present study considered virtual simulation (Table 6) of low fidelity (Table 7). There were included three different practices performed individually by each student: Cardiovascular exploration, Neurological examination, and Leopold Maneuvers.

Every session had the following activities:

1. The instructor connected with students by a Zoom link
2. The instructor explained the online simulation practice
3. Each student had a turn for training
4. Debriefing and assessment.

Assessment Instruments for Online Clinical Simulation

The online simulation practices and instructors were evaluated using the DASH (Debriefing Assessment for Simulation in Health) instrument (Center for Medical Simulation, 2021). The DASH aims to assess those instructor behaviors that evidence and theory indicate facilitate learning and change in experimental contexts (Brett-Fleegler, y otros, 2012). There are three versions of the DASH:

1. **DASH Rater Version:** Designed for trained raters to rate instructors (Simon, Raemer, & Rudolph, 2018).

2. **DASH Student Version:** Designed for students to rate their instructors (Simon, Raemer, & Rudolph, 2010).
3. **DASH Instructor Version.** Designed for instructors to rate themselves (Simon, Raemer, & Rudolph, 2012).

DASH has a 1-7 Likert Scale (Raemer &Rudolph, 2010)

1. Extremely ineffective/abysmal
2. Consistently ineffective/very poor
3. Mostly ineffective/poor
4. Somewhat effective/average
5. Mostly effective/good
6. Consistently effective/very good
7. Extremely effective/outstanding

The coordinator of the Simulation Center led the process for DASH. The three versions were applied in their extended version for the present study to obtain as much information as possible. The elements to assess are:

1. **Element 1:** Establishes an engaging learning experience
2. **Element 2**: Maintains an engaging learning environment.
3. **Element 3:** Structures debriefing in an organized way
4. **Element 4:** Generates stimulating discussions.
5. **Element 5:** Identifies and explores knowledge gaps.
6. **Element 6:** Helps participants achieve or maintain good performance for the future.

The instructors designed checklists to assess the clinical competence for Cardiovascular exploration, Neurological examination, and Leopold Maneuvers. The scale was dichotomic (Correctly performed or Incorrectly performed).

Results

DASH results

The three instructors were assessed with the three versions of DASH instructor 1" referring to the cardiology instructor, "instructor 2" to the neurology instructor, and "instructor 3" to the Leopold maneuvers instructor. Average results are presented in Table 8.

Instructor one and two had consistently effective scores in all the elements. Instructor 3 had lower scores in two aspects. At the end of the practices, a feedback session between the coordinator and instructor 3 addressed opportunity areas. It was emphasized that the instructor should go deeper to generate more discussion participants about what happened during the practice and customize the feedback to identify the gaps in knowledge.

Table 8. DASH evaluation by each instructor

Element	Instructor 1	Instructor 2	Instructor 3
Engaging learning experience	6.41	6.66	6.30
The engaging context for learning	6.33	6.66	6.55
Structure the debriefing in an organized way	6.33	6.83	6.25
Generates stimulating discussions	6.25	6.50	5.90
Identifies and explores performance gaps	6.33	6.16	4.95
Helps participants achieve or maintain good performance in the future	6.75	6.83	6.00

Clinical Competence Results

The results of the cardiovascular checklists are presented in Table 9

Table 9. Results by subcompetence of the cardiovascular screening checklist

Subcompetence	Percentage of students who achieved the subcompetence	Percentage of students who did not achieve the subcompetence
Verify that the heart rate is normal	60%	40%
Places stethoscope over carotid sinus for murmurs	0%	100%
Check carotid pulse	10%	90%
Check pulse in both extremities	10%	90%
Place the stethoscope in aortic focus in second right intercostal space in line to sternal	90%	10%
Place the stethoscope in pulmonary focus in second left intercostal space in line for sternal	90%	10%
Place the stethoscope in tricuspid focus in the fourth intercostal space in the left parasternal line.	100%	0%
Place the stethoscope in mitral focus in fifth intercostal space midclavicular line.	80%	20%
Precordial impulse palpation	30%	70%
Checks for immediate capillary filling in extremities	0%	100%

During the debriefing, students were asked the reason for not palpating the pulses in the extremities or carotid murmur. They biased by the name cardiovascular name of the practice. In their words, “there was confusion since it was cardiology practice, we focused only on the thorax and yes, checking pulses is essential.”Only one student checked pulses in the extremities who also explored for carotid murmurs”. The process of debriefing helped students to realize the importance of details. The Patient Centered Learning approach is oriented to visualize the patient as a complete human being instead of isolated organs.

The results of the neurological exploration checklists are presented in Table 10

Table 10. Results by subcompetence of the neurological exploration checklist

Subcompetence	Percentage of students who achieved the subcompetence	Percentage of students who did not achieve the subcompetence
Performs an inspection and palpation of the right parietal area corresponding to the area of trauma	0%	100%
Evaluates mental functions through the use of questions and requesting the execution of orders to rule out alterations (Mini-mental)	90%	10%
Explore Cranial Pair I	100%	0%
Explores pupillary reflexes bilaterally and extrinsic eye muscles Cranial pair III	100%	0%
Place an object in front of the patient and ask him to follow it with his eyes and draw an H as well as an X (cranial pair III, IV and VI)	100%	0%
Explore Cranial Pair V	100%	0%
Ask the patient to raise eyebrows, wrinkle nose, smile, inflate mouth (Cranial Pair VII)	100%	0%
Clicks close to the external ear and asks if it is able to hear it (cranial pair VIII)	100%	0%
Explore Cranial Pair XI	100%	0%
Evaluates Cranial Pair XII	100%	0%
Evaluates muscle groups by palpating their consistency and asks the patient to perform active movements first against gravity and then against resistance imposed by the physician	50%	50%
Explores muscle reflexes by asking the patient to position the area to be evaluated in a relaxed manner (motor)	90%	10%
Explores thoracic and pelvic limb sensitivity by asking the patient to close his eyes and mention the sensations when stimulated (sensitivity)	0%	100%
Evaluates cerebellar function	10%	90%
Ataxic (frontal release) and abnormal movements	0%	100%
Assessment of meningeal signs	100%	0%

With respect to the neurological examination skill, it can be observed that a large percentage of students were able to perform some subcompetences correctly, but others were underperformed. During the debriefing, the instructor emphasized the importance of inspecting a cranioencephalic trauma. Several students said that they had noticed it, but since the patient was still responding, they "assumed" that it was not a serious injury; besides, they had already finished their turn and could not return. The need for order in the physical examination was mentioned.

It is recommended to apply further lectures and reading with distance learning. The teacher in the process of implementing the technology would increase the motivation and its scope to address missing elements. Also in another study it was shown´ that the addition of a virtual classroom with interaction through virtual conferencing and online assignments significantly improved student learning. (Cook & Steinert, 2013).The results of the Leopold maneuvers checklists are presented in Table 11

Table 11. Results by subcompetence of the Leopold maneuvers checklist

Subcompetence	Percentage of students who achieved the subcompetence	Percentage of students who did not achieve the subcompetence
Verify that the fetal heart rate is present and in normal range	12%	87.5%
Performs Leopold maneuvers (at least 3 of the 4 maneuvers)	100%	0%
Places her hands palpating the uterine fundus: allows the identification of the fetal pole (cephalic or breech) in the uterine fundus	100%	0%
Places his hands on the lateral sides of the uterus: allows the identification of the fetal orientation (anterior, transverse or posterior)	100%	0%
It performs a balling and wedging movement of the fetal head above the symphysis pubis	100%	0%
Places his two hands in the upper pelvic narrowing: allows the identification of the descent of the fetus	100%	0%
Adequately describes the fetal situation and presentation, after performing the Leopold maneuvers	25%	75%

Regarding the Leopold maneuvers, it was observed that most of the students developed 5 of the 7 subcompetencies that comprise the Leopold maneuvers. In two subcompetencies they had a low performance. At the end of the practice in the debriefing, the instructor asked, "How did you feel about the practice? What would you change, or what would you improve?" Most of the students answered, "assess the fetus first", "missed taking the fetal heart rate..." etc.. The instructor mentioned that only three people asked about the fetal heart rate and reiterated the importance before starting the physical examination on the woman's abdomen.

The students mentioned why it is important to perform specific maneuvers that they did not realize before by memorizing them and ensuring consolidation of learning from the theoretical class to practice. Feedback is what the students found effective in consolidating learning when performing an exercise to practice the skill since the students mentioned: "I prefer to make a mistake when palpating the pillow and have someone correct me than to make a mistake and hurt a pregnant woman and her baby."

Most of the students showed great enthusiasm and interest in doing the gynecology practicum, as they told us that they felt "anxious" due to the lack of practice during these months. Emotions are an essential part of any teaching. Fear and lack of confidence are factors present in medical education. Lozaya *et al.* (2019) describe the use of simulations in medical psychology as a holistic experience where ethical, moral, emotional, and interpersonal aspects are integrated. Learning with virtual materials creates a specific experience that allows linking the student's confidence and security with their knowledge. At the same time, it enables relating empathy with realism, as they are acceptable and interactive situations. The practice helps to reduce the usual anxiety that students suffer during their medical careers.

One of the students mentioned, " Earlier, I have had not to find sense in this online practice, since if I've watched videos of exploration in class." The instructor began the debriefing by asking the team, "What do you think is the difference between the two activities? The majority answered, "someone is evaluating and accompanying us in real-time." They reflected that a good debriefing discussion promotes learning, even in a distance mode.

SOLUTIONS AND RECOMMENDATIONS

During the implementation of each practice, an open communication channel was maintained in case of doubts or complications that might arise in the process. In addition, each teacher had at their disposal the institutional platforms such as MS Teams, Brightspace, institutional social networks, and Zoom. In summary, Table 12 shows the results of the three practices

Table 12. Results by subcompetence of the three online simulation practices

Practice	Minimum score	Maximum score	Media	Standard deviation
Cardiovascular	40	70	47.0	12.5
Neurological	50	75	65.5	12.0
Leopold maneuvers	80	100	84.4	6.5

The results of the global evaluation of the achievement of the clinical competencies show that the students had passing results in the neurological examination competency and the Leopold maneuvers. However, the cardiovascular examination competency had negative results. The contrast does not mean that the online simulation practice in cardiovascular exploration was not effective, since DASH results were "consistently effective." Furthermore, according to the results in Table 12, it can be observed that there were students who managed to develop the three competencies in a distance modality, although in the diagnostic survey of the intervention, 59.15% of them stated that clinical skills could not be learned at a distance.

Therefore, the objectives of the intervention were achieved by applying clinical simulation in distance practices, developing specific technical, clinical skills. According to the results obtained, debriefing played the most important role in achieving effective learning of technical skills. From the beginning, the instructor should ensure clear instructions, the participation roles are assigned, and all doubts appropriately are resolved.

Important recommendations regarding online simulation practices include planning the intervention considering goals, resources, and training. There is also important to consider adequate didactic planning, well-established learning objectives, and expert support to create the evaluation instruments, including validation and application. Based on the results of the present study, online simulation practices might replace or complement face-to-face practices in specific contexts considering the Figure 3 framework.

Therefore, integrating a structured, organized, and appropriate debriefing to the students, as well as accompanying the instructor throughout the process of implementing new technology or learning strategy, allows the achievement of the expected learning outcomes when using distance simulation for teaching clinical skills during pandemic (Cook & Steinert, 2013).

FUTURE RESEARCH DIRECTIONS

As education advances with new platforms and technology applications, the culture and trust for online simulation practices will increase. Further research should include detailed elements to address not only technical skills but several Patient Centered Learning perspectives.

CONCLUSION

Online education has increased exponentially at all educational levels for several disciplines. In Medicine, learning technological advances have changed teaching and learning to provide new and powerful tools to promote student motivation and engagement. Learning as a medical student is based on self-directed learning for complex environments (Dennis & Wolbrink, 2019). Recently, video conferencing software, virtual platforms, multimedia, social networks, and MOOCs provide alternatives for self-paced and remote learning. Virtual Reality and Augmented Reality are also giving immersive experiences for learning. The 2020 pandemic expanded the use of digital skills to avoid direct contact between teacher-student.

The present study was conducted for the continuity of education during the lockdown. It changed the skepticism to address training of complex technical skills with low cost by online simulation practices. Even that distance learning and telesimulation had been applied before, training. Psychomotor skills are traditionally learned in on-site simulation centers. After the experience presented here, arise important reflections about the mandatory training and assessment of skills that were never trained by distance.

ACKNOWLEDGMENT

The chapter presented here is the Thesis to obtain the Master's Degree in Educational Technology at Tecnologico de Monterrey. Furthermore, this master's degree was financed 50% with a scholarship from Tecnologico de Monterrey, and the remaining 50% was funded by "Programa Nacional de Posgrados de Calidad (PNPC)" scholarship from the governmental organization CONACyT.

The School of Medicine of the Universidad Anáhuac (Querétaro campus) accepted participating in the study. The institution provided permission to teachers to participate in the schedules and programs of the three subjects and the participation of human and technological resources from the simulation center of the School of Medicine.

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KEY TERMS AND DEFINITIONS

Clinical Simulation: Is a teaching strategy that replicates medical situations in controlled environments, promoting learning without risks.

Distance Learning: Is a method to study remotely from the educational setting, either online or offline.

Online Clinical Simulation: Is a guided teaching strategy that replicates health care situations with home props to learn without risks.

Online Learning: Is an educational approach that requires the Internet to address learning content.

Patient-Centered Learning: Patient-centered learning (PCL) refers to patient care as a person who collaborates with the health team to decide every clinical intervention, considering integral quality healthcare services aligned with patient preferences in every phase of clinical care: patient knowledge, diagnosis, intervention, and monitoring/follow up.

Telesimulation: Is a process by which telecommunication and simulation resources provide education, training, or assessment to learners at an off-site location.

Chapter 14
Undergraduate Medical Training in Communication Skills: From Face-to-Face to Virtual Environments

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ABSTRACT

Communication skills are important for physicians, as they are continuously in contact with human beings—patients, families, or members of healthcare teams—in various circumstances. At Universidad de los Andes' School of Medicine, these skills are a fundamental part of the curriculum and the subject of two undergraduate concentration courses. The purpose of this chapter is to present the experience of transitioning one of these courses, Communication Skills II, from face-to-face to a virtual learning environment as a response to the COVID-19 pandemic. It describes the rationale behind teaching communication skills, illustrates how the course was developed and taught face-to-face, presents the challenges posed the COVID-19 pandemic, explains the transition of the course to a virtual learning environment, and concludes by offering an overview of the evaluations and perceptions of the course, as taught in the virtual environment, by those involved in it.

DOI: 10.4018/978-1-7998-8783-6.ch014

INTRODUCTION

The School of Medicine at Universidad de los Andes (Bogotá, Colombia) considers communication skills essential in the development of all medical competencies proposed in the curriculum, and consequently in the training of undergraduate and postgraduate students. Teachers must therefore rise to the challenge to help students develop and improve their communication skills, to become efficient and effective professionals, and, above all, to be more humane, understanding and compassionate.

The importance of teaching about communication and how to communicate to those who will ultimately perform activities to care for the health and wellbeing of others is closely related to the importance of communication itself. "Communication is a process present in physicians' everyday labor, not only in the context of relationships with patients, families, and communities, but also when participating in team work related to administrative and educational activities, which is why the development of communication competencies is imperative in medical education" (Trujillo & Suárez, 2019). According to Bennett & Lyons, communication that is effective and adequate is a very important aspect of providing quality care, and the skills related to it have been linked to better results such as "accurate identification of patients [*sic*] problems; greater job satisfaction and less work stress for doctors; increased patient satisfaction, compliance and adherence with treatment; and reduced patient distress" (2011, p. 46).

In order to approach this educational challenge at the university, two undergraduate and two postgraduate concentration courses on communication skills are taught, among other strategies. In this way, the School of Medicine aims for students to gradually acquire communication competencies transversally throughout the curriculum in different moments and scenarios that are part of medical education, such as classrooms, simulation laboratories, community spaces, teaching hospitals, and out-patient centers (Trujillo & Suárez, 2019).

Regarding the curricular and pedagogical principles considered in the design and development of the concentration courses, they rely firstly on competency-based medical education (CBME) – a model adopted by the School of Medicine at Universidad de los Andes – which has been defined as "education for the medical professional that is targeted at a necessary level of ability in one or more medical competencies" (Carraccio et al., 2016, p. 645). Even though it is a challenging concept, it has been embraced by institutions and associations worldwide in an attempt to educate the best possible medical professionals who are adequately trained to work harmoniously, respectfully, and productively as members and leaders of inter-professional teams that provide the safest and most complex care available (Carraccio et al., 2016). Trujillo, Gómez, Cardozo, Moreno, & Gamba further state that CBME "promotes both individual and collaborative knowledge creation, allowing students to integrate information that will be used in different contexts and to experience learning as meaningful" (2016, p. 2).

The competencies related to interpersonal and communication skills to be developed in these courses are adapted following the Core Entrustable Professional Activities from the Association of American Medical Colleges (2014). The aims for students are to:

1. Communicate effectively with patients and their families, with colleagues, and with the public in different socio-economic and cultural settings.
2. Work effectively in a team, either as a member or as a leader.
3. Act as a support for other health professionals.
4. Keep patients' medical records updated, comprehensive and complete.
5. Show sensitivity, honesty, and compassion in difficult conversations and situations.

6. Demonstrate insight and understanding about emotions and human responses to emotions.

These competencies allow students to approach their patients comprehensively and to interact in a therapeutic manner, while also understanding the aspects related to disease prevention and health promotion following the person-centered approach model. During the concentration courses, different theories and communication strategies are presented emphasizing empathy, active listening, the management of verbal and non-verbal communication, as well as other useful interviewing techniques. Furthermore, students learn how to recognize communicative barriers and difficult contexts and to apply strategies to manage these situations, always recognizing, understanding and adapting to ethical and professional values.

The pedagogical principles that are central to the concentration courses on communication skills are as follows (Vigotsky 1979; Ordóñez 2004; Ordóñez 2006; and Brown, Collins, & Duquid, 1989 in Trujillo & Suárez, 2019):

- Understanding learning as a process in which the individual actively builds knowledge.
- All prior learning is essential in order to make connections with new knowledge.
- Tasks and assessments are designed so that there is no difference between knowing and doing.
- Comprehension is sought not by way of transmitting information, but through the development of abilities for inquiring and meaningfully connecting.
- Error is used in a constructive manner.

This chapter focuses on the second undergraduate concentration course taught in the fifth year (ninth semester) of medical education, which is called Communication Skills II. The objective is to present the experience of transitioning this course from face-to-face to a virtual learning environment as a response to the COVID-19 pandemic.

COMMUNICATION SKILLS II TAUGHT FACE-TO-FACE

Medical students must develop skills to communicate in order not only to obtain relevant clinical information from a patient, but to be able to understand people's various sociocultural contexts, and their perspectives, beliefs, and emotional responses to disease. In doing so, as professionals they will have the capabilities to make accurate diagnoses and to propose management plans that respect the autonomy and personal values of their patients, while providing ethical and compassionate care (Trujillo & Suárez, 2019). Considering this, Communication Skills II is the second mandatory concentration course on the topic taught to all undergraduate medical students at Universidad de los Andes. Both, when it was taught face-to-face and online, it has an average length of twenty weeks, with three hours of in-person teaching per week.

The specific competencies to be developed by students in the course include being able: to communicate adequately with patients in out-patient clinical scenarios within the framework of person-centered care; to show sensitivity, honesty, and compassion in difficult conversations and situations (i.e., end-of-life dilemmas, adverse events regarding medications and medical procedures, bad news, among others); to apply the motivational interviewing model in clinical contexts in order to understand and promote behavioral change; to demonstrate compassion, integrity, and respect for others; to show sensitivity

toward the privacy and autonomy of patients, while respecting beliefs and diversity; and to behave in a way that offers confidence to patients and their families (Trujillo, 2019).

The course involves four groups of participants: the students who take the course; the tutors; the teachers, including a head coordinator; and the professional actors and/or patients with actual health conditions who perform the standardized patients' roles. At Universidad de los Andes, tutors are current undergraduate students from more advanced semesters who have previously taken the course they are supporting. They volunteer themselves for the role and are selected by teachers based on their academic performance as students and on their interpersonal skills.

The Communication Skills II course, it is organized in four consecutive modules: 1) person-centered care in ambulatory clinical settings and communication skills; 2) strategies for handling difficult situations and bad news; 3) applying motivational interviewing; and 4) an integrative module. In this section, the modules are described as they used to be, when taught face-to-face, before the COVID-19 pandemic.

During the first module, students reviewed literature and videos related to the person-centered care model (Gluyas, 2015), participated in workshops of clinical cases based on frequent primary care diseases in order to apply this model, and remembered, complemented, strengthened, and deepened essential communication principles and abilities learned during their first concentration course in communication skills. In the second module, they acquired skills to perform what are considered 'complex tasks' by Aspergen & Lønberg-Madsen (2005), which are related to the communication of bad news and the handling of difficult situations by reviewing relevant literature, analyzing videos and films that promote reflection on these subjects, participating in workshops of clinical cases, and practicing with standardized patients. During the third module, related to the transtheoretical model of change (Prochaska & DiClemente, 1982) and motivational interviewing (Rollnick, Butler, Kinnersley, Gregory, & Mash, 2010), students reviewed relevant literature, observed and analyzed videos that demonstrated the techniques of this kind of interviewing, and did role-playing activities. The purpose of the final module was to integrate and apply what had been learnt in the previous three, and the pedagogical strategy used was to practice in simulations with standardized patients (either trained professional actors or patients with actual health conditions, both of whom had been previously instructed by the head coordinator of the course on how to participate in the simulations).

Regarding evaluation, the feedback provided throughout the course – formative and summative – was based on assessment rubrics that were previously known by the students, tutors, teachers, and those performing the simulated patients' roles. These rubrics included all criteria to be evaluated and a description of the expected performance in each of them. Since 2018, the rubrics have taken the form of a modified mini clinical evaluation exercise (MiniCEX). Cccording to Holmboe, Yepes, Williams, & Hout "because [MiniCEX] involves the direct observation of […] skills, faculty have a significant opportunity to provide meaningful real time feedback to trainees". (2004, p. 558). Such exercises also and allow for the use of a common and clear language among all participants. Feedback was given to the students by their peers, the tutors, the people who performed the simulated patient roles, and the teachers.

Finally, it is important to mention that at Universidad de los Andes, all courses were supported by a Learning Management System LMS already before the pandemic and most of the material used by students to prepare for the upcoming lectures and activities was already available online. Furthermore, since its inception, the Communication Skills II course has been subjected to constant reflection practices and was open to change as needed based on the feedback given and suggestions made by all those involved in it, including the students themselves. In this sense, the course is considered to be 'alive'.

THE PANDEMIC CRISIS

In March 2020, Colombia – as many other countries – entered a new reality as a result of the measures taken by the government in order to face the COVID-19 pandemic. Lockdowns and restrictions affecting all citizens were established and, within a week, decisions about the courses taught at the university had to be made while keeping in mind that these would have deep consequences for all aspects of the professional exercise of current students in the future (Tolsgaard, Cleland, Wilkinson, & Ellaway, 2020). The questions that guided the reflection process of transformation and adjustment of the Communication Skills II course were: What could be done? How to teach online? How to redesign pedagogical strategies and evaluation processes? And how to train students, tutors, teachers, and professional actors to go on in an unfamiliar virtual learning environment?

To answer these questions, focus was placed on the students as the center of the learning process, as well as on the competencies to be pursued by them (as mentioned earlier in this chapter). These questions were challenging and pressing, because all of those involved in the course had to learn, adapt, transform, and innovate simultaneously and within a very restricted time framework. To master this task, a team of teachers, academic leaders from other scientific fields, tutors, professional actors, and students was involved.

Another essential element taken into consideration in this adaptation process and that will continue to be an important part of clinical and educational practices henceforth is the use of technology, including telemedicine, telehealth, and tele-education. Telehealth is defined as "the use of technology to deliver health care at a distance" (Association of American Medical Colleges, 2021), while the concept of telemedicine has been found to have over 104 peer-reviewed definitions (Sood et al., 2007 in World Health Organization, 2009), which is why the World Health Organization has broadly described it as "the delivery of health care services, where distance is a critical factor, by health care professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of diseases and injuries, research and evaluation […] all in the interest of advancing the health of individuals and their communities" (2009, p. 9). However, it is not uncommon to find that telemedicine and telehealth are used interchangeably (World Health Organization, 2009; El-Miedany, 2017). Lastly, tele-education is "the application of information and communication technologies in the delivery of distance learning" (Curran, 2006).

The spirit that surrounded the response of the authors to this unexpected course of events can be summarized using the words of Wijesooriya, Mishra, Brand, & Rubin, who state that "telehealth [and] online education […] should not be simply a new way to do traditional jobs but rather, an opportunity to take advantage of how technology can best be used to develop new and better ways to provide care [and] educate health care providers" (2020, p. 38).

COMMUNICATION SKILLS II TAUGHT IN A VIRTUAL ENVIRONMENT

Design

The journey of adapting and transforming Communication Skills II, in order for the course to be taught in a virtual environment, began with its group of teachers, who selected the pedagogical strategies and evaluation processes to be applied in the online course. Fortunately, many of the teachers involved in

the course had previous experience in blended learning. Finding compassionate new ways to motivate students, tutors, and professional actors was also a key part of this adaptation in order to make a successful entrance to tele-education and to the virtual environment.

Regarding pedagogical strategies, a series of agreements and adjustments were made and included: the reduction of the number of interactive lecture sessions, as they were going to take place through a cloud-based software platform; the use of interactive technologies that allow teachers to relate with their students, such as Padlet, Mentimeter, Kahoot, and others; an increase in the number of small group sessions, in order to ensure that students are guided more closely and received frequent feedback on their communication skills from their peers, teachers, and tutors; the use of videos made by the students, recording themselves while performing simulated clinical interviews with a person from their familial environment, followed by self-evaluation, peer evaluation, and evaluation by a teacher. Students are also asked to write reflections about their learning process and adjustments have been made to the evaluation categories for each of the activities performed by the students, stressing the importance of the observable components of the virtual interaction.

Another action taken in relation to pedagogical strategies was to adapt the clinical cases that would be used for the simulated patient sessions and other interactions with the professional actors in the virtual classrooms. Moreover, the final evaluation process, which accounts for the progress made by students throughout the course, was reduced from two sessions with each student – one for the student to conduct an interview with a standardized patient and a second for the student to conduct a self-evaluation and be provided with feedback – to performing a single evaluation session that would include the interview, the self-evaluation, and the provision of feedback; this new single-session approach has an improved effect, because the immediate provision of feedback is easier for the student to interiorize.

In relation to the tutors, the process of adaptation involved strengthening their role to function as liaisons between students and all teachers (not only the course head coordinator). They were introduced to the new design of the course and started learning how to use new tools for virtual learning in order to provide support regarding both technology and course content. The guiding aspects of the process with the tutors included: training in the use of technological and interactive tools; intensifying their role as a communication bridge between students and all teachers; and establishing the importance of close follow-up of students by tutors in order to detect special needs arising from the pandemic.

Accommodating Communication Skills II to the virtual environment also meant working with the professional actors. They had to be familiarized with the main changes to the course and to learn how to use the new tools in order to continue supporting the course in its new environment. They participated in the process of redesigning the clinical cases and adjusting the simulation sessions with standardized patients. Here the guiding principles were: training them in the use of technological tools; meeting stakeholders to adapt the clinical cases to be used; and redesigning the simulation sessions with standardized patients.

Although the aforementioned process involved many participants, the most important part of redesigning Communication Skills II was making students believe in and adapt to a new and unfamiliar way of learning, while understanding the importance of collaborative work and mutual support. This was especially relevant, as all those involved in the course – teachers, tutors, professional actors, and students – were simultaneously going through dramatic changes in their own personal lives outside the School of Medicine. In the authors' experience, the students accomplished this progressively throughout the duration of the course, which is consistent with findings from other medical schools going through similar transitions (Binks et al., 2021).

Implementation

Most of the competencies expected to be developed by the students and the modular organization of Communication Skills II, as well as its contents, remained the same. However, aspects related to one of the competencies, the design of the clinical cases used, the delivery of the contents, evaluation processes, and to the interaction with the students did change.

The competency linked to communicating adequately with patients in out-patient clinical scenarios within the framework of person-centered care was modified to specifically include the component of performing this competency in a telemedicine environment instead rather than a face-to-face setting (Trujillo, E.M., 2021). In the same sense, the clinical cases that would be used in the virtual environment were redesigned to reflect situations that take place in telemedicine; for example, instead of using only first-time visit situations for each and every workshop and interaction between students and standardized patients, the clinical cases now include a combination of first-time and follow-up visits, in which students are faced with either a first-time complete clinical interview or they must work with previously known information about the clinical situation. The tasks and assessments are now designed in such a way that there is no difference between knowing and doing, with students encouraged to seek comprehension through the development of abilities for inquiring and meaningfully connecting. This is highly relevant because health care workers in many scenarios and many countries are being asked to care for patients through telemedicine in response to the new realities brought about by the COVID-19 pandemic; this is therefore something that students must learn.

Furthermore, the few lectures that used to take place in modules 1 and 2 with the student group as a whole during face-to-face teaching, which were delivered by a single teacher, have been transformed into online live small group sessions (average 8-15 students), each led by one of the teachers and delivered via cloud-based software platforms relying on the use of interactive technologies to connect with students.

In order to allow students to develop and practice various skills, modules 1 and 3 now also currently include an activity in which each student records themselves while performing a simulated clinical consultation – either in-person or online – with a person within their familial environment (i.e., relatives or friends). The resulting video is then submitted via the institutional LMS along with a completed self-evaluation MiniCEX format and a reflective writing paragraph. During the following live small group sessions, the videos are played and formative and summative feedback on the interaction is provided by peers, tutors, and teachers.

Standardized patient sessions – exclusively with professional actors – also now take place in all modules. Live meetings involving teachers, tutors, and professional actors are held to carefully prepare the particular clinical situations to be presented to the students. A summary of the clinical case along with related guiding questions to be prepared are then provided to the students through the LMS before the live small group sessions take place. During these live sessions, teachers and tutors begin by establishing the ground rules and providing context for what will happen – usually three to four interactions – and they address any questions the students may have before starting the standardized patient activity. Each interaction takes an average of 40 minutes. In the first 20 minutes, one student exercises the role of physician by performing a medical interview and communicating an action plan, as in a telemedicine consultation. The remaining 20 minutes are used for two purposes: formative feedback about the witnessed interaction is provided by peers, tutors, professional actors, and teachers; and a summative evaluation is done by the teachers. A similar approach to using virtual standardized patient sessions in a medical

Table 1. Summary of changes in the Communication Skills II as a result of the transition to a virtual environment

Face-to-face setting	Virtual environment
Modules 1 and 2 were taught to the complete student group together.	All four modules are taught in small groups.
Standardized patient activities took place only in modules 2 and 4.	Standardized patient activities take place in all modules.
Students performed only face-to-face interactions with standardized patients.	Students record and analyze videos of themselves interacting with familial simulated patients (i.e., relatives or friends) and perform on-line interactions with standardized patients.
There was a single evaluation rubric designed for face-to-face interactions in all modules.	There is now one evaluation rubric for each module, adjusted to the virtual learning environment, that includes elements of telemedicine.
Final evaluation consisted of two separate parts for each student.	Final evaluation in a single session.
Students had a passive attitude and acted as receivers of information.	Students are active learners engaged in the construction of their own knowledge and skills.

school, with the purpose of teaching communication skills, has also been reported in the United Arab Emirates (Sudhir, Mascarenhas, Isaac, Alfroukh, & Rahuman, 2020).

The assessment rubrics used for formative and summative evaluation were also adapted to the transition to the virtual environment. Previously, a single evaluation rubric that was designed for face-to-face interactions was used in all four modules. Now, particular rubrics that take the form of an adjusted MiniCEX have been designed for each of the modules and they incorporate components to assess elements that are unique to each module (i.e., the use of tools suggested by the literature for motivational interviewing) as well as aspects to be mindful of in telemedicine (i.e., eye contact with the camera and facial expression; Iancu et al., 2020). The rubrics continue to be known beforehand by all those involved in the evaluation processes, including the students.

A summary of the changes to the course can be found in Table 1.

The implementation process has not come without difficulties for all groups involved. Many of these relate to access to resources such as devices (i.e., functional up-to-date computers) and high-speed internet, and others to social and personal circumstances such as having an adequate, quiet space for learning/teaching or preoccupations about privacy (i.e., having other people virtually 'walking in' and gaining insight into one's private life) (Binks et al., 2021). Nevertheless, student support services and other instances at Universidad de los Andes timely developed and implemented additional specific strategies for students, tutors, and teachers deigned to address mental health and well-being needs arising due to the pandemic (Universidad de los Andes, 2020).

EVALUATION SURVEYS OF THE VIRTUAL LEARNING ENVIRONMENT

At the end of each semester, students at Universidad de los Andes complete a survey of the courses they have taken, which includes 31 multiple choice questions clustered in 7 categories: coherence; presentation skills of the teachers; materials used; self-perception of learning; feedback, monitoring and assessment criteria; treatment of students; evaluation of the virtual environment (since 2020); and a general appraisal of the course. Additionally, it includes 6 open questions about the course itself, the

teachers involved, and comments regarding the virtual environment (since 2020). It is worth mentioning that these surveys are voluntary and only a small percentage of students answer them Nevertheless, for Communication Skills II the transition to a virtual environment increased the number of students who have responded to these surveys, as they have come to acknowledge the importance of learning communication skills, of providing feedback to their teachers, and because, so far, it is the only course that has included a specific component on telemedicine. In this section, student responses obtained in the last 18 months are presented.

Regarding coherence, answers show that most of the students who participated in the surveys perceive that the activities that are carried out and the materials used in Communication Skills II allow them to prepare for summative evaluations, and also that these materials are interesting to them. In relation to the presentation skills of the teachers, students agree that the content and learning objectives of the activities are clearly communicated and that teachers succeed in capturing their attention. Concerning the students' self-perception of learning, they manifest that the course promotes their interest in learning, that it contributes to their professional and personal development, that the level of learning they obtain is satisfactory, and that what they learn can be applied in other courses. With respect to feedback, monitoring, and assessment criteria, most students replied that the course allows space for reflection and to discuss their performance in activities, and that feedback is provided in a timely fashion. About the treatment of students, answers reveal the perception that teachers treat all students equally without discrimination, that the relationships between teachers and students are respectful, that no sexist or discriminatory comments are made. The overall appraisal of the course shows that around 87% of the students who answered the surveys would recommend the Communication Skills II course to others.

The answers to questions aimed at evaluating the virtual environment show that students believe that the activities performed throughout the course and the study materials used contribute to the achievement of the proposed learning objectives; furthermore, they perceive that these objectives are fully accomplished and assessed. The answers also show that students feel motivated throughout the course, that the interaction with peers supports their learning process, and that the activities performed during live sessions allow them to be focused or involved through active participation. In relation to the virtual environment, students also manifest that the course promotes their capacity to work autonomously to achieve learning objectives and that this environment provides adequate space to ask questions and receive answers. Moreover, students express that the changes in the evaluated activities encourage more individual and autonomous working. Nevertheless, students also perceive the workload associated with Communications Skills II to be excessive and the live sessions to be too long, and they noted that difficulties related especially to internet access (i.e., unstable connections or cloud-based software platforms that require greater bandwidth) affect the virtual interactions within the course.

In the answers to the open questions included in the surveys, students highlight the usefulness of feedback that is provided constantly, that is complete and detailed, and delivered in a timely fashion. Moreover, they state that they learn skills to handle difficult situations, to support and motivate patients, and that they acquire specific abilities to conduct interviews through telemedicine. Likewise, working in small groups reduces the stress and pressure related to performing an interview in front of many spectators. Other important comments include the fact that teachers are more aware of the progress made by students in terms of the content and competencies of the course, but also in terms of the needs and difficulties that students face in transitioning to a virtual environment (i.e., internet access, up-to-date devices), as well as the challenges brought about the pandemic itself, and make an effort to accommodate this as much as possible.

Considering students' answers to these surveys, it can be stated that the transition of Communications Skills II into a virtual environment has been well received and that the efforts made by the course's head coordinator, teachers, tutors and the university as a whole have been recognized and accepted. Furthermore, it can be said that the changes made have helped students to acquire the competencies sought by the course, which will contribute to their professional performance and to the wellbeing of their patients.

PERCEPTIONS OF STUDENTS, TUTORS, PROFESSIONAL ACTORS, AND TEACHERS

The personal perceptions of students, tutors, professional actors, and teachers related to their experiences of participating in the Communication Skills II course taught in a virtual environment are now presented, with the aim of enriching and expanding the student surveys outlined in the previous section. In order to gather these perceptions, the authors used purposive sampling; respondents were contacted via email and asked to respond outlining what they consider to be the positive and negative aspects of taking part in the course in a virtual environment. Their replies are summarized below.

Students' perceptions of the redesigned course include the fact that small groups make it easier to relate to others, to observe more closely, and to create an atmosphere of trust; that the feedback provided by teachers, professional actors, tutors, and peers is more constructive; and that the more personal follow-up by the teachers helps them to see their personal progress and that of their peers, which creates a more diligent, coherent, and steady learning process. Further positive aspects include the following: students consider that they have acquired the competencies sought by the course; they had more opportunities to interact with simulated patients; they came into contact with telemedicine scenarios that prepared them to do this kind of work (which is also likely to increase in the future); that flexibility in terms of time was augmented, as they did not have to spend time in commuting to a classroom; and, in the context of the pandemic, that the virtual interaction acted as a measure of biosecurity. Some negative perceptions of the students associated with the virtual environment are that the live sessions are lengthy – on occasions without enough time for a break – and that they require a quiet and calm space with reliable and stable internet access.

Tutors involved in the course as taught in a virtual environment identify that it favors the processes of giving and receiving feedback among students and that the opportunity to closely observe others while conducting simulated clinical interviews is more engaging for them, as well as for the students. Working in small groups makes it easier to interact with the students who are taking the course and to provide them with specific guidance related to their questions and needs. Working virtually also facilitates coordination with the teachers.

The professional actors who support Communication Skills II perceive the virtual environment as a new experience that has asked them to adapt and transform, though it has also allowed them to learn, create, and acquire new perspectives. They mention that the advantages of working virtually are that it shortens time and distance, reduces the resources needed for transportation (i.e., time and money), facilitates the use of written material in the simulations (i.e., information sent via cloud-based platforms and chats), which makes the experience more organized for them and for the students, and also that, in relation to the pandemic, they can reduce their exposure to COVID-19. Some disadvantages they mention are the need for a silent and tranquil space to work in (which is not always possible), a lack of experience using internet-based resources (i.e., cloud-based platforms), and lack of access to continuous and

reliable internet connections. While some of the professional actors think that working virtually hinders students' achievement of the course's competencies and see it only as an alternative imposed by the circumstances, others believe that medical education regarding communication skills should continue to include virtual experiences along with face-to-face ones, once it becomes possible and safe to do so.

The teachers who are part of Communication Skills II recount that they are able to perceive changes in their students' communication processes throughout the course more evidently in the virtual learning environment; for example, regarding how students are better prepared to respond adequately to difficult situations and how they understand and demonstrate skills related to person-centered care. Furthermore, by working in small groups, they note that their students are more relaxed and subjected to less group pressure when performing simulated clinical interviews, and also that they can concentrate better during live activities because there are fewer external distractions. Moreover, they feel that students are becoming increasingly aware of the importance of self-learning activities and more empowered to perform them as they realize that the responsibility of the learning process is shared between them and their teachers.

The teachers also express the opinion that the virtual environment enhances adaptive education, which "implies offering learning experiences that are customized, as much as possible, in response to each learner's evolving characteristics and needs" (Jason & Westberg, 2018, p. 829). This is because the virtual environment allows for the provision of different kinds of material for individual use by each student. In this vein, particularly the number of readings has been decreased, while use of instructional videos has increased, and videos recorded by the teachers themselves have been added to demonstrate the interviewing models expected. Working in small groups also allows the teachers to better gauge students' progression, to provide feedback that is more personal and specific, to gain a greater understanding of each student's characteristics, and to early identify early students with additional needs so that they can be supported. A policy of "reasonable adjustments and difficult moments" (Universidad de los Andes, 2020) implemented by Universidad de los Andes in response to the COVID-19 pandemic has assisted teachers greatly in adapting to the particular needs of some students. The activities of reflexive writing that are now included as part of the course in modules 1 and 3 help students to think critically about their own learning process and to identify the competencies that they have developed and those skills in which they need further work and reinforcement. Furthermore, additional opportunities to repeat activities that receive summative evaluation – including the final evaluation – are now provided for students, so that they can fully demonstrate the competencies they have acquired (previously, students had only one opportunity for assessment and grading).

An overall perception shared by students, teachers, tutors, and professional actors regarding working virtually is that it is more difficult to learn, demonstrate, and assess components related to non-verbal language – a paramount aspect of communication – given the reduced information that can be accessed through a camera (frequently only the face and neck of the person can be seen). However, many of those involved recounted trying to use other resources like hand gesturing and facial expressions to compensate.

CONCLUSION

Communication skills are an essential part of the curriculum at Universidad de los Andes' School of Medicine, as these are very important and highly valuable for physicians. The experience of transforming a concentration course on communication skills from a face-to-face setting to a virtual environment in response to the COVID-19 pandemic was challenging. However, this difficulty helped all those involved

to innovate, and the Communication Skills II course taught online is better designed to help students achieve the competencies it seeks. The authors think that the course is more successful now because all the learning activities and evaluations are planned more carefully in close alignment with both, the expected competencies and the new realities brought about by the COVID-19 pandemic.

Regarding additional actions currently underway to further improve the communication skills of medical students at the university, intercultural competencies, which "in essence are about improving human interactions across difference, whether within a society (differences due to age, gender, religion, socio-economic status, political affiliation, ethnicity and so on) or across borders" (Deardorff, 2020, p.5) are gradually being included into the content and evaluation rubrics of Communication Skills II. This receives particular focus since the head coordinator and teachers consider such competencies to be both valuable in terms of reinforcing the other competencies sought by the course, as well as necessary, both for themselves and their students, in order to be more sensitive, humane, and compassionate toward others.

In closing, the authors would like to mention that, as expressed by Tolsgaard et al., medical education around the world was forced by the COVID-19 pandemic to make "strategic decisions that addressed short-term needs and uncertainties in ways that avoided or mitigated longer-term negative impacts" (2020, p. 741-742). Indeed, the challenge presented by the pandemic forced many, including medical schools, to learn, adapt, transform, and innovate, as well as to continue their work as educators while finding new ways to allow students at the School of Medicine to acquire communication skills. Developing a more team-based design of the course was an unexpected – yet very welcome – outcome of this transformation process, demonstrating the importance of communication skills also in academic emergencies.

ACKNOWLEDGMENT

This research was supported by Universidad de los Andes, Colombia.

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

The authors would like to thank the students, tutors, teachers, and professional actors who outlined their perceptions about the Communication Skills II course and authorized their inclusion in this chapter.

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Chapter 15
The Role of Telemedicine and Globalization in Medical Education

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ABSTRACT

This chapter aims to bring to the fore cutting-edge research on how globalization is changing medical education by e-learning, remote simulation, and new emerging technologies. In particular, the authors wish to contribute to critical thinking about the conceptualization, investigation, and theorization of how medical education is changing and how medical schools and residency programs in different countries are being transformed according to health and educational needs. In this chapter, the authors reviewed telemedicine and remote simulation and how globalization plays an essential role in it.

INTRODUCTION

The current pandemic generated many effects on medical education and training. One of the most important effects was incorporating virtual learning to maintain academic activities while avoiding large gatherings. Telemedicine played a vital role in this situation by offering online courses and online clinical simulation activities. (Gonzalez-Urquijo et al., 2021)

The pandemic also affected how postgraduate students from medical residencies were trained, as clinics and hospitals were closed. Intervention or surgical procedures were reprogrammed, involving the skills and knowledge directly for trainees among their fields. Furthermore, most residents were part of

DOI: 10.4018/978-1-7998-8783-6.ch015

the task force in the fight COVID-19. During this time, the use of telemedicine was crucial, and thanks to new technologies, medical students and residents stayed on board with their academic curriculums.

Higher-learning institutions have implemented virtual learning into their curriculum since it is cost-effective, accessible, and flexible in terms of time and location. The main interest in virtual education is the interactive communication it permits. (Dawd, 2016) Furthermore, another benefit of virtual learning is that medical students and residents can engage with renowned physicians from other counties, with larger pools of experienced tutors and geographic flexibility, as geographic influence has been shown to affect how physicians' approach common problems; therefore, taking education into a more technical and globalized level. (Porpiglia et al., 2020)

Globalization is the process by which ideas, goods, and services spread throughout the world. It is now accepted that this force is essential for the contemporary continents. (Prideaux, 2019) Medical education has not been immune from the pressures of globalization. In the past, the model used for training was the "Apprenticeship Model." Medical education evolved by implementing the process and product-based models, transforming these models into outcome-based or competency-based models. (Gondal, 2019) Nowadays, there is a paradigm shift in medical education due to technological advances, such as the adoption of online learning. Given the accessibility of these new technologies and the lack of academics with high-level expertise in some fields, in many countries, we need to explore how best to use our scarce resources to have the most significant possible impact regarding the preparation of health professionals such that they can make the best possible use of available informatics technologies to gain knowledge from renown experts in the field. (Hovenga, 2004)

Global challenges include diverse undergraduate and postgraduate education standards, varied clinical practice contexts, variation in disease patterns, various ethnic, cultural, and social backgrounds, and language barriers. (Gondal, 2019)

This chapter aims to bring to the fore cutting-edge research on how globalization is changing medical education by e-learning, remote simulation, and new emerging technologies. In particular, the authors wish to contribute to critical thinking about the conceptualization, investigation, and theorization of how medical education is changing and how medical schools and residency programs in different countries are being transformed according to health and educational needs. In this chapter, we reviewed telemedicine and remote simulation and how globalization plays an essential role on it.

GLOBALIZATION GROUPS

There is currently a model shift in higher education due to technological advances, the adoption of e-learning, and greater participation in e-commerce by higher education providers. Interuniversity work must be essential to achieve a globalized education. For example, Hovenga (Hovenga, 2004) described a worldwide universities network. This is an international coalition of research guided by universities of international standing, established to create worldwide research and graduate education organizations. It has a well-known International Academic Development Board, which advices on the execution of its research-led mission; furthermore, it oversees the development of outlines for recognition of quality assurance and accreditation processes. Their initial programs include informatics, biomedical informatics, mobile devices, wireless communications, and more. This initiative began with establishing partnerships between four English universities and four American universities in early 2000. Now it is composed of more than 13 universities working for this purpose. Another organization following the same goals is

the International Association of Universities, a worldwide association of universities from 150 countries recognized to reflect and act on everyday affairs. Its purpose is to give expression to the obligation of universities as asocial institutions to promote, through teaching and research, the principles of freedom and justice, human dignity, contributing to the development of moral assistance for the strengthening of higher education. (UNESCO, 2003) Another approach to globalization in higher education is the global academic faculty development. This free, open-source software has been adopted by 118 countries, where lectures, textbooks, and articles are shared all over the internet. This project is led by the Disease Monitoring and Telecommunications at the WHO collaborating Center, Graduate School of Public Health, University of Pittsburgh, Unites States. (LaPorte, n.d.)

Another group that offers a link between internalization and outcome-based education is the MedBiquitous working group, which mission is to develop standards and supporting guidelines for competency data to enable educational resources and activities to be tied to a competency framework. (Https://Www.Medbiq.Org, 2020)

Medical schools must help health professionals to develop skills in medical education. The provision of different programs to offer these skills must cover an international spectrum, such as enrolling medical students into global programs in other parts of the world to exchange views and live different ways medicine is practiced across the globe. Another essential point for achieving a globalized education is by developing programs that target teachers in low-income countries particularly, intending to strengthen teachers career development in their countries; an example of this is The Foundation for Advancement of International Medical Education and Research, which goal is to help increase production of physicians in countries where there is an undersupply. (Harden, 2006)

THE ROLE OF MEDICAL STUDENTS IN GLOBALIZATION

One feature of modernization is the determination to develop and apply scientific knowledge for human enhancement, improved health, and poverty reduction. To this end, medical students are a tactical group in meeting the expectations and visions in health care for many countries worldwide. (Stevens & Goulbourne, 2012) Professionalism in medical students has been emphasized strongly in medical education in the past several decades. According to Wilkinson et al. (Wilkinson et al., 2009), professionalism is defined into five key aspects, which involves 1) ethical practice principles, 2) effective interactions with patients, 3) interactions within the health system, 4) reliability, which is the quality of being trustworthy or of performing consistently well, and 5) commitment to the amendment of competence in oneself, others, and systems. The medical student must be formed during his career to be ready to go out to a globalized world, where they can adapt without problem in any part of the world, applying the principles of professionalism learned in medical school. Modern medicine is global; doctors worldwide contribute to the quality of global health, and other nations benefit from doctors trained elsewhere. (Findyartini, 2019) Regardless of the domestic culture, international medical graduates had to make two significant changes: professional socialization and acculturation, whenever they commit to working in diverse health systems in other countries. (McKimm & Wilkinson, 2015) Professional identity formation is a very active process given the changes of professional expectations and standards over time and transformative development within each individual. While a medical student or medical graduate is having professional socialization when entering the profession itself, they have to learn how professionalism is expected differently in different contexts when deciding to practice in other institutions or countries.

The element of cultural competence is essential in this process. The double shift of acculturating to a new society and a new professional culture means that an individual's social and professional identity becomes redefined. (Cruess et al., 2014)

GLOBALIZATION AND TELEMEDICINE

Telemedicine is defined by the World Health Organization as the delivery of health care services at a distance using electronic means for "the diagnosis of treatment, and prevention of disease and injuries, research and evaluation, education of health care providers" to improve health. (Serper & Volk, 2018) The telecommunications revolution is opening vast perspectives for improving access to care by underserved populations. Telemedicine brings way to a future when physical distance may no longer be a significant impediment to health care. When referring to telemedicine, globalization plays an essential role by converting knowledge into an international public good that can then be brought to the center of the national policy agenda to address a local problem. A significant challenge for telemedicine will be to make sure that a new digital separation does not simply replace the old distance separation and that innovative technologies do not generate new forms of social exclusion. (Frenk, 2005) This becomes defined when we realize that 80% of the human population living in developing countries represents less than 10% of internet users. (*United Nations Development Programme. Human Development Report. New York: Oxford University Press for the United Nations Development Programme*, 1999) As you all know, Canada, the United States, and Sweden rank among the most wired nations, with 40% of their population regularly connected to cyberspace. Contrary to a large number of African countries, which count just a few hundred active internet users. The 1.2 billion people who survive on one dollar per day are a reminder of all of the massive gaps that must still be overcome within and between countries around the globe. (*United Nations Population Fund State of the World Population 2002. People, Poverty and Possibilities: Making Development Work for the Poor. New York: United Nations Population Fund*, 2002) Frenk. (Frenk, 2005) states that health remains one of the true universal ambitions in a world full of problems and disparities, offering a solid opportunity to reconcile domestic self-interest with global mutual interest.

TELEMEDICINE AND PANDEMIC COVID 19

Prior to the pandemic, telemedicine was seen as very useful for use in remote places where health care was difficult to access. At a global level through the World Health Organization, governments and personnel committed to health goals establish strategies and reports on how it was used under an eHealth concept. (Ryu, 2012) The Pandemic COVID-19 forced to use innovatively and abruptly all the knowledge and tools available for telemedicine. This achieved exponential and efficient growth to maintain health since the distancing between peers was prohibited for avoiding the contagion of the virus. (Escudero et al., 2020)

Thanks to the fact that many people had access to at least one smartphone or a computer to be able to provide health, adjustments were made in a strategic and accelerated way using telecommunications technology to continue maintaining health throughout the world, from consulting, educate and research, to sharing knowledge, resulting in an increase in globalization applied to all the aforementioned areas. The information was shared between health personnel in different countries of the world regardless of

distance and patients. (Chick et al., 2020; Dedeilia et al., 2020) Furthermore, it was noted that most people have access to technology (directly or indirectly as a family member) to maintain up-to-date status efficiently. The clinics and hospitals that closed because of the pandemic had to rethink how to actively back and establish specific processes. They focus on having the least number of patients present and more patients at home utilizing telemedicine. The processes and health systems changed radically, and after the pandemic is over, this way of practicing medicine must be adapted to the new normality, for avoiding long distances transportation of patients, which sometimes involves a companion, being a challenging event going to the hospital or the ambulatory consult with a physician. It is essential to constantly analyze which diseases can be treated in telemedicine and which ones not.

After reviewing publications from medicine programs and medical specialties where they share their experiences on how they adapt their educational and operational processes in their area, the use of telemedicine and remote simulation has become more valuable. We need more time to conclude more concise results, but the effectiveness of the remote consultation to the live consultation can be judged or guided from a phone call. (Almazroa, 2021)

During the pandemic, many international congresses, instead of canceling, had to abruptly innovate to continue spreading new knowledge and academic updates by carrying out the meetings via webinars. As a result, more people had access to these meetings since the prices to have access drop significantly. (Porpiglia et al., 2020)

Surgical training programs also were affected. In a questionnaire-based review of ophthalmology programs in Egypt, 86% of medical participants and students agreed that surgical skills were the most affected. Knowledge acquired in the clinic and surgery appreciatively dropped to 56% of normal, while the central rescue resource was based on online courses and webinars by 90% on average. (Mishra et al., 2020) On the authors' university surgical program, a survey composed of 15 questions about the perceived quality and utility of the virtual sessions during the pandemic was developed. Over half of residents (n= 17, 56.7%) felt similar academic performance during online sessions compared to the older model. Perceptions of the level of organization of academic sessions increased during the online model (n= 20, 66.7%). Twenty (66.7%) residents agreed it was easier to attend sessions during the online model. Fourteen (46.7%) residents reported their attendance to the sessions increased, and 14 (46.7%) residents would prefer this modality after the pandemic is over, with 8 (26.7%) being neutral about it. Concluding that the effectiveness of the transition from face-to-face academic activities to virtual activities it's a feasible tool for graduate medical education programs to adjust to a virtual model. (Gonzalez-Urquijo et al., 2021)

EMERGING GLOBALIZATION TECHNOLOGIES IN MEDICAL EDUCATION

Technological globalization occurs when there is a cooperative development of emergent technologies for being used anywhere globally, achieving a great exchange of goods and services between countries and knowledge. In medical education, the competencies continue to be clinical and theoretical, the latter platforms such as zoom meetings, webinars, or programs of live transmission, have allowed accelerated globalization in the acquisition and updating of knowledge, current topics, clinical cases, journal clubs, and the participation of international congresses, becoming more accessible for everyone. Furthermore, there is also the possibility to take online exams or evaluations while being supervised. (Rizwan et al., 2018)

Thanks to new technologies, the students get to know each other by forming study groups on social networks. Social networks are reuniting physicians from different parts of the world for sharing knowledge, especially when there is an emergent disease, with little information such as the current pandemic COVID-19. During the pandemic, doctors who were in stretch contact with COVID-19 patients share knowledge and passed tips about the handling and using the equipment, the virus lethality, among other many things. Furthermore, groups are being created beyond the University, such as Facebook groups of students with shared academic interests.

Another field where technology is emerging in medical education is clinical simulation. This practice can be carried out in wet or dry lab models and e-learning. Digital simulators for surgical procedures can use digital pressure sensors, including artificial intelligence that detects the practitioner's movements during the operation providing feedback to the user at the same time. (Lee et al., 2020)

CONCLUSION

Globalization of medical education requires cultural reflection to ensure its success in different environments and among different groups. Medical education calls upon modernization for economic growth, marketability, equity, and the connection to the transformation of the world by technology. To provide high-quality globalized medical education, standardized quality innovative medical schools and training programs are paramount for the future.

The wealth of conceptual, practical, and regulatory aspects of medical education must continue to be studied to better understand the importance of achieving a globalized education using the most advanced technology available, without differences of borders or countries.

Conflicts of Interest: The Author(s) declare(s) that there is no conflict of interest.

Funding: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sector.

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KEY TERMS AND DEFINITIONS

E-Learning: The process of learning using the internet, computers or any other type of electronic devices.

Globalization: Is the process of interaction, sharing or exchanges of services among countries and continents, by crossing borders.

Medical Education: The education needed to learn the knowledge and skills for becoming a health professional.

Remote Learning: Is when there is distance learning, such that students and teachers are not physically in the same place.

Technology: The process of applying scientific knowledge for a practical purpose.

Telemedicine: The practice of medicine in a remote way, when the health worker and the patient are not physically on the same place.

Chapter 16
Telesimulation and Academic Continuity of Health Professions Education

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ABSTRACT

Telesimulation, specifically in health areas, is an educational technique that combines clinical simulation and communication technologies. This definition has been constantly modified, but today more than ever it represents a valuable resource to provide academic continuity. The purpose of this chapter is to present the basic concepts of this strategy while reviewing its antecedents/history in the pre-COVID era, the experience with this technique in health sciences, as well as the processes and resources essential to carry it out with an analysis of the potential limitations that may entail. Likewise, concrete examples of telesimulation in various subjects will be shared, leaving readers the challenge of constant innovation in this field.

INTRODUCTION

The term telesimulation has historically changed and been shaped along with technological advances. However, and despite the differences cited by various authors, its essence is based on the combined use of simulation and communication technologies to provide distance education. It is used in many areas of professional training and health sciences are not the exception, specifically employing clinical simulation.

DOI: 10.4018/978-1-7998-8783-6.ch016

Several universities, simulation centers and even hospitals have acquired a lot of experience in this educational technique, through time and with the diversity of resources that each user has, can provide teaching despite certain adverse situations such as the current COVID-19 pandemic.

Virtual teaching spaces have certain general characteristics, however this chapter will talk about specific processes and resources that must be taken into account to achieve a useful telesimulation.

The objectives of the chapter are to show to the reader the historical experience of telesimulation in health sciences, how it has modified its definition and how to distinguish it from other concepts, its processes and essential resources, when it is advisable to use it and share some examples that the authors have been carried out in our educational institution.

BACKGROUND

Defining Telesimulation

The term telesimulation has historically changed and been shaped along with advances in simulation, communication technologies, and educational techniques, until it is embodied in the way we define it now. Several authors related to the area of health simulation, gave their definition of telesimulation influenced to a large extent by the technology available at the time. In this way, we can list some of the most representative authors who have worked with telesimulation and see the way they understood this concept.

1. von Lubitz et al. (2003, p. 379) gave the name of "Simulation-based distance training" to describe a distance training process (USA, France and Italy) using two SimMan Human Patient Simulators and to the communications hub at the MedSMART facility in Ann Arbor. "It proved to be a highly effective tool in improving emergency medical skills of junior physician trainees and, despite initial reservations, neither distance nor language and cultural differences posed significant obstacles." (von Lubitz et al., 2003, p. 384).
2. Okrainec et al. (2010) commented in their study using telesimulation to determine its effectiveness for teaching Fundamentals of Laparoscopy Surgery (FLS) skills in Botswana, Africa that "Telesimulation uses the internet to link simulators between an instructor and a trainee in different locations. Using two simulators, multiple computers, a series of webcams, and basic video conferencing software, the instructor and trainee can speak to each other and see themselves as well as see the simulation training that is occurring in each other´s FLS simulator". (Okrainec et al., 2010, p. 418).
3. Mikrogianakis et al. (2011) defined telesimulation similar to Okrainec et al, while describing the use of telesimulation as an effective tool for teaching intraosseous insertion techniques between Toronto, Canada and Gaborone, Botswana.
4. Hayden et al. (2012) understood telesimulation as a tool that uses "Web-conferenced (WC) instruction, where the debriefing instructor of a cognitive or team-training scenario is remote from the actual simulation but can give real-time feedback and discussion on the performance of a group of simulation participants."(Hayden et al.,2012, p. 525). Using telesimulation, they compared the impact of simulation sessions facilitated by in-person faculty versus those supervised remotely using Web-conferencing software.

5. Deepak et al. (2014) published their experience using telesimulation to provide continuing education in neonatal resuscitation to health care professionals in rural areas "Combining telehealth capabilities and simulation technologies in what can be termed telesimulation". (Deepak et al., 2014, p.516).
6. McCoy et al. (2017) defined telesimulation as "a process by which telecommunication and simulation resources are utilized to provide education, training, and/or assessment to learners at an off-site location. Off-site location refers to a distant site that would preclude the education, training, and/or assessment without the use of telecommunication resources". (McCoy et al., 2017, p.133).

As we have observed, the definition of telesimulation has evolved and yet it contains constant concepts in its structure. It is important to mention that there are some terms that can be used synonymously with telesimulation such as distance simulation and remote simulation. Also, there are terms that are easily confused but different from telesimulation such as telehealth and telemedicine, which will be defined next.

The World Health Organization (WHO, 2010) define telemedicine as "The delivery of health care services, where distance is a critical factor, by all health care professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers, all in the interests of advancing the health of individuals and their communities". (World Health Organization, 2010, p. 9). In their report, the World Health Organization mentioned that "telemedicine and telehealth are synonymous and used interchangeably". (World Health Organization, 2010, p. 9).

The next example brings up a distinction between telemedicine and telehealth. It is found in a brief article by the New England Journal of Medicine Catalyst (2018), which mentions that although they are frequently used as synonyms, "*telehealth* has evolved to encapsulate a broader array of digital healthcare activities and services. Where telemedicine refers specifically to the practice of medicine via remote means, telehealth is a blanket term that covers all components and activities of healthcare and the healthcare system that are conducted through telecommunications technology." (New England Journal of Medicine Catalyst, 2018).

Finally, it is important to note that it is highly probable that as we have more information obtained from studies carried out in the area of telesimulation as well as significant advances in information and communication technologies, the definition will undergo further modifications. An example that we can provide for the formulation of this new definition is that telesimulation does not necessarily require a mannequin to carry it out, since it can be performed with standardized patients, videos, 3D printed models, vital signs monitors and cellphone apps according to the objective for which we are designing a telesimulation.

EXPERIENCE OF TELESIMULATION IN HEALTH SCIENCE EDUCATION

Every day new scientific papers are added showing the experience with telesimulation in different areas of the health sciences. Several universities showed us how they use telesimulation to continue complying with educational competencies, many hospital centers share their telesimulation procedures to continue providing care to their patients despite being immersed in a pandemic and even companies related to the field of health see telesimulation as an opportunity to create and innovate new products. Here we

will mention concrete examples of how telesimulation has been used specifically to meet educational objectives and bring academic continuity of health professionals in the pre and COVID-19 pandemic era.

PRE COVID-19 ERA

The use of telesimulation to meet educational goals in various health-related areas dates back many years prior to the current COVID-19 pandemic and largely laid the foundation for the work currently being used to provide academic continuity to the health professionals worldwide. Some examples of the use of telesimulation in the pre-COVID-19 era will be briefly described next.

Navarro et al. (2003) worked on a series of projects to provide ophthalmic surgical training to physicians located in remote locations, using telesimulation. Later, Suzuki et. al (2005) showed a distance training program to perform robotic laparoscopic surgery with DaVinci ™, combining a PHANToM ™ soft tissue model and the internet, coupled with broadband communication. Then, Okrainec et al. (2010) showed their experience using telesimulation to teach fundamentals of laparoscopic surgery (FLS) between the universities of Toronto and Botswana. They compared a group of surgeons using telesimulation to practice FLS against another group that performed self-practice FLS. In their results, Okrainec showed that the group that used telesimulation achieved better scores in most of the skills to perform FLS, compared to the self-practice group, concluding that the use of telesimulation is an excellent method to teach, eliminating travel costs for expert instructors and using cheap equipment and software. Another collaborative work between Canada (Toronto Western Hospital) and Botswana (Princess Marina Hospital) carried out by Mikrogianakis et al. (2011), used telesimulation to teach 22 physicians the proper technique to place intraosseous needles in children. These physicians had no prior knowledge of this technique and their skills were evaluated before and after the telesimulation practices. Physicians were shown to report telesimulation teaching as an excellent experience and most of them felt better prepared to handle a pediatric resuscitation situation using intraosseous needles.

Henao et al. (2013) showed that telesimulation is a valuable tool when used to teach FLS in a group of surgeons and surgery residents in two cities in Colombia. In their work, Henao found significant improvement between the participants' pre-test and post-test scores. Next year, Manhas et al. (2014) reported their theoretical bases for the use of telesimulation as an important tool to carry out continuous teaching and practice of skills in neonatal resuscitation techniques in doctors located in geographical regions of difficult access. Then, Burckett-St Laurent et al. (2016) worked with 19 anesthesiologists in Canada to prove that teaching of ultrasound-guided regional anesthesia was just as effective in person versus using telesimulation. Subsequently, McCoy et al. (2017), concluded in their publication that the use of telesimulation was just as effective as face-to-face simulation. McCoy worked with 32 fourth-year medical students and randomized them to perform simulations for managing critically ill patients in person or through telesimulation. The surveys applied to these students after their simulations showed that there was no preference for one or another teaching technique with simulation. Finally, Jewer et al. (2019), tested a mobile telesimulation unit in rural areas to teach a chest tube insertion technique. They worked with 69 medical students, randomly divided into 3 groups (comparison, intervention and control). After analyzing their results, Jewer concluded that the students trained with telesimulation obtained learning results comparable to those trained in person. Furthermore, both groups of students were equally satisfied with their learning and training.

COVID-19 ERA

There is no doubt that in situations of disaster and adversity, necessity is the mother of inventions and although telesimulation, as we have just reviewed, is not of recent creation, its use, expansion, evolution and adoption by multiple universities and hospitals increased exponentially. The series of existing publications related to telesimulation during the COVID-19 pandemic is very notable and new ones are being added every time. Here we show some examples of how telesimulation has been used during the current pandemic to continue the development of academic activities and meet the learning objectives of students involved in health areas worldwide.

At the beginning of the COVID-19 pandemic, Chantae et al. (2019) published their work showing the design of a program using telesimulation and a low-cost 3D printed model to teach a chest tube insertion technique to doctors, residents and medical students. In May 2020, Naik et al. (2020) following the recommendations of the Association of American Medical Colleges for distal education promoting social distancing, published their experience at Weill Cornell Medical College and the New York Presbyterian Hospital using a hybrid teaching model that combined the use of a video tutorial to teach fundamentals of ventilator management in COVID-19 patients with acute respiratory failure (asynchronous mode) with post-tutorial telesimulation that allowed students to practice, learn and apply their knowledge (synchronous mode). The authors commented that after receiving feedback at the end of the course, the participants found this teaching method very useful, improving their skills in handling the mechanical ventilator and having the experience very similar to a face-to-face simulation. On the other hand, Mohos et al. (2020) at the University of Szeged, Hungary, evaluated a telesimulation model to teach their students the competence of doctor-patient communication during the pandemic. In these telesimulation, a standardized patient, small groups of 5 students and an instructor were used. After applying questionnaires to the participating students after their simulations, it was observed that these students were satisfied with the course, would take it again but still preferred the face-to-face simulation. In Canada, Kiely et al. (2020), published a series of recommendations to fulfill two purposes: the first was to carry out the training of health personnel in the obstetric services during the pandemic and comply with the protocols for the prevention of infections (use of protective equipment, transport of patients, preparation for emergency cesarean section, delivery care at various hospital sites, communication with the patient, among others). The second was to know the effects of the pathophysiology of COVID-19 in obstetric patients. They highlighted the use of a combination of synchronous and asynchronous telesimulation teaching techniques to accomplish both purposes. Also, Lara et al. (2020) used telesimulation to perform the Objective Structured Clinical Examination (OSCE) in pediatric clerkship students at Uniformed Services University of the Health Sciences, Bethesda, Md, named TeleOSCE. In their study, they showed that the 49 students who took the TeleOSCE had similar scores when compared to students who had taken the OSCE in person in the previous 3 years. In September 2020, Patel et al. (2020) from the Department of Anesthesiology and Critical Care Medicine, Johns Hopkins University, used telesimulation to work with 53 anesthesiology residents performing complicated cases scenarios. A knowledge test was applied before and after the telesimulation, as well as a survey on the value and quality of the simulation. The students showed a statistically significant improvement in the knowledge tests. During the post-simulation surveys, the students felt that it was a positive learning experience that could replace the face-to-face simulation and expressed their gratitude for being able to continue their training despite the pandemic. They also commented on areas for improvement, such as problems assessing learner engagement during telesimulation and make some improvements in the audio and video

equipment used. Clark et al. (2020) detailed how to train simulation instructors to implement fully online simulations for health science students as part of the response to the COVID-19 pandemic.

In the last month of 2020, several interesting papers about telesimulation were released. Lenes et al. (2020) published their experience using simulated patients with telesimulation to practice and develop communication skills competence in students of various courses (medical history, psychiatric interview and clinical competencies) at RWTH Aachen University in Germany. In the surveys applied to 92 students, the simulation experience was rated as very good or good, adding that the accessibility and retention of the learning objectives were satisfactorily met. Similarly, in Germany, Harendza et al. (2020) worked at the University Hospital Hamburg Eppendorf with a group of 32 final-year medical students in a program simulating first day of residency that included consultation hours with four simulated patients per participant, patient documentation and management with a newly developed electronic patient chart using Zoom with simulated patients. After applying the corresponding surveys to 135 students (100 who carried out the face-to-face program vs 32 who used telemedicine) they observed that the students in both groups were very satisfied with the content of the training, they identified it as very useful and they would like exercises with "telemedicine" will be used more frequently. Finally, also in December 2020, Peters et al. (2020), published proposals to make the transition from face-to-face simulated patients (SP) to online simulated patients, caring for the integrity, privacy and health of the SP during the COVID-19 pandemic, preserving the learning objectives.

At the beginning of 2021, Hartmann et al. (2021) from the Mannheim medical school at the University of Heidelberg, Germany published their work with 354 medical students of 3rd, 4th and 5th years when conducting interviews and conversation (NURSE and SPIKES techniques) with simulated patients (SP) using telesimulation. For this practice they used the "HeiConf" software for privacy and data security reasons. Surveys applied to the students after doing their practices, showed that they had a similar experience with telesimulation compared to the face-to-face activity and they managed to practice the conversation techniques appropriately. The SP who participated also commented that the emotional aspects and authenticity of the setting were very good. Both students and SP agreed that a difficult aspect to evaluate was non-verbal communication. Then Thomas et al. (2021) showed in their publication a series of 12 very interesting recommendations to carry out telesimulation and maintain educational objectives in institutions despite the COVID-19 pandemic. In February, Yang et al. (2021) from the Yale University School of Medicine Center for Medical Simulation, published their work with 48 medical students and the simulation center staff. They conducted a series of 16 telesimulation sessions on the Zoom platform, practicing pediatric patient scenarios. After surveying the participants (students and instructors), the authors reported that 90% of the students agreed that they felt more secure caring for pediatric patients, improved in their pediatric knowledge/skills, and that the sessions were more useful than other academic activities. 70% of the students commented that they learned as much when they participated actively in the simulation, as when they were only observers. However, 60% of the instructors disagreed that the virtual simulation was equal to or better than the face-to-face simulation. Both students and instructors agreed to recommend this type of practice. There was another publication in February by Mileder et al. (2021) from the Medical University of Graz, Graz, Austria. These authors conducted 7 telesimulation sessions using the "Cisco Webex'' platform to teach neonatal resuscitation techniques to 9 medical students and 9 neonatal care nurses, all of them volunteers. Neonatal resuscitation knowledge tests were obtained before and after participation in telesimulation. The results obtained show that the volunteers enjoyed the telesimulation sessions very much, acquired new knowledge and improved their knowledge score in neonatal resuscitation. In March, a group of Japanese researchers led by Kasai et

al (2021) at Chiba University School of Medicine worked with final year medical students to avoid the suspension of academic activities during the clinical clerkship due to the COVID-19 pandemic. The authors implemented a series of mixed, face-to-face and online activities to continue teaching medical skills to their students. Among these activities were telesimulation, where the same faculty members served as simulated patients. The practices were complemented with images and videos appropriate for the cases that the students practiced. Likewise, other students could observe the case and later participate in its feedback. A group of 43 students participated in this model and it was observed specifically for the telesimulation part that the students were satisfied with the practice, they dedicated more time to self-study compared to the traditional face-to-face model. In addition, students rated telesimulation with higher scores than face-to-face clinical activities in terms of organization and efficiency of learning and for writing medical summaries. More recently, in April, Ray et al. (2021) reported their experience with telesimulation through a project between the emergency department and the Center for Medical Simulation at Yale University. Faced with the adversity of the COVID-19 pandemic, these authors created a 6-week elective using telesimulation to continue to provide students with clinical training, which could be carried out with up to 48 students. They used software such as ZOOM and Google Hangouts to carry out their sessions and decided that each practice would be carried out with a maximum of 3 students to avoid communication problems and passive roles. In the same way, medical educators from other medical schools were invited to participate as faculty observers during the simulations, who received advice on how to carry out the simulations and the use of teleconference technology for simulations. Finally, we close mentioning Díaz et al. (2021) who also published in April their recommendations to plan and carry out successful telesimulation sessions, emphasizing that communication equipment and technology should be available with the same ease for everyone involved in the sessions.

This is a first attempt (very surely not all publications on the subject are included) to compile the existing evidence on the use of telesimulation to continue with the development of academic activities and meet the learning objectives and competencies of the students involved in health areas worldwide. The pandemic is not over yet, publications continue to accumulate evidence that supports the use of telesimulation as a very useful tool to complement the curriculum and fulfill the competencies of students in the health sciences careers. Please be assured that we will continue to use telesimulation despite the end of this pandemic**.**

MAIN FOCUS OF THE CHAPTER

Processes for the Development of Telesimulation

The term "clinical simulation" is sometimes erroneously believed to refer exclusively to the use of robotic simulators, large spaces or the necessary computer infrastructure. It is therefore often assumed that telesimulation would also require these resources. However, the latter is a teaching method that may be easier to use and sets to rest these false beliefs of complexity. It is important to follow a fundamental process to create and educational experience of excellence to ensure that the end result of the teaching scenario is the desired one, and this will be discussed in greater detail.

Bustos (2010) indicates that virtual teaching environments are characterized by the different components that constitute them, as described below:

- **Technological resources:** These can be divided into physical or tangible resources such as hardware, computers, simulators, etc., and non-tangible resources such as applications and digital tools that are diverse educational platforms and the administration of their contents, programs, multimedia materials such as graphics, videos, audios, etc.
- **Temporality:** It can be synchronous, when the simulation exercise and its observation by the audience or the group of learners, as well as its corresponding feedback, occurs at the same time. This is the most productive way and from the etymological point of view it is the purest concept of telesimulation. It can also be asynchronous, when the transmission of a video or some multimedia resource made previously at a different time is used, for example, in the framework of a class, a conference or in a debriefing session. It is necessary to differentiate the term telesimulation from simulation through virtual reality applications or programs, for example, where the scenario is already built and assembled in a program and the learners or students interact with it in a certain way, are being followed or evaluated by the instructor and, in some cases, receive timely feedback from the program itself on certain aspects of their performance.
- **Purpose or objective:** The purpose desiging an activity with telesimulation. It follows the same principles as any other teaching methodology, to put into practice or evaluate the competences that its institutional programs pursue. In this way the purpose of the practices or scenarios with telesimulation can be formative or evaluative (summative).

Thomas et al. (2021), suggest some recommendations for telesimulation, leaving evidence that requires certain essential elements to achieve a useful experience, otherwise, it would simply be an observation of a series of actions in a simulated environment without a formal teaching context. These elements will be analyzed in depth so that the reader can consider them when planning or directing an activity with this technique.

1. **Planning**: establishing the general objectives of the activity and raising other aspects that will complement its development. In face-to-face clinical simulation and in any teaching methodology, there must first be an adequate planning that includes the methodological design of the activity. It must be viewed comprehensively:
    a. What will be done: establishing if it will be a consultation, a complex simulated case or a procedural practice, to name a few examples, and if this will be carried out with a task simulator, a robotic simulator, a simulated patient, etc., including the way in which the results obtained by the learners or their performance will be *evaluated*.
    b. Why it will be done: this must answer to the competencies that are looking to be developed. It is necessary to complement with practice what has been learned in terms of the clinical interview because certain aspects must be evaluated and students must be given feedback on their performance.
    c. What it will be done for: this aspect corresponds to the final purpose of the activity, the classification of which was previously analyzed, corresponding to either a purpose of practice or of evaluation.
    d. For whom it will be done: defining the group to whom the activity will be directed, which are usually the students of the classes, subjects, topics or specialties that they are learning with the teacher designing the activity. It is important that the activity is designed to correspond with the cognitive level of the group; as in any simulation, it is not wise to try to put into practice,

much less evaluate, aspects that have not been reviewed in class or that do not correspond to the thematic content.

e. When will be done: the scheduling of the session must be well established in date and duration, taking care that these aspects are respected for the best organization of the agendas of all participants. It is desirable that a test be carried out prior to the session, preferably using all the resources that have been planned. In this way, potential problems or incidents can be detected in a timely manner and solutions can be anticipated. Technical failures do occur during simulations, however, in a tele simulation, which depends 100% on connectivity, there may be multiple areas of opportunity for improvement (space, framing of shots, lighting, sound, etc.).

2. **Briefing:** This must be the same as in a face-to-face simulation, where both the teaching team and the simulation staff that will participate in the activity are presented. In tele simulation, instead of showing the location and implements of the physical space as one would at a simulation center, reaffirm the platforms or various information technologies/applications that will be used. In this way, the students will begin to "recognize the new learning space".

During this briefing, students receive general instructions (such as directions to take on various roles, the time that will be available for the simulation, etc.) and specific instructions (such as remembering that they can communicate through chats, request studies that will appear on the screen, etc.). The confidentiality and fiction contracts promoted by the Center for Medical Simulation, are also mentioned, where it is respectively agreed not to disclose what happens in the session, as well as it is requested that students adopt with the greatest possible credibility the roles, decisions or actions to be taken.

3. **Presentation of the case or practice:** The basic initial details or clinical information are offered for the development of the session. It can be done in several ways, but it will always be more advisable to do it supported by visual elements, either through a couple of slides, a short paragraph, a diagram or infographic that lists the facts of the case or the procedures to follow, etc., considering individual learners' characteristic approaches to learning tasks, that is, cognitive and learning styles, become a central issue (Renzulli, 2000). If there is only a reading or explanation of the facts there may be distractors that range from technical issues, such as variations in sound-reception, temporal variability of the audio, intonation or speed in reading, etc., to the degree of the participants' attention / distraction. When immersed in a digitized teaching space, visual support will always be of better value. If it is a skills practice, the objectives and methodology are presented, reinforcing what has been given as an introduction in the briefing.
4. **Development of the scenario or practice:** The whole succession of actions that are expected to be carried out by the group or participating students, which must take place within the programmed time and be long enough to allow for the observation of performance. The development of the activity should also adhere as closely as possible to the previously established planning.
5. **Debriefing:** As in any practice with face-to-face clinical simulation, it is essential to provide closure to the learning experience. This is the time that allows the teacher to interact with the students in a "learning conversation", avoiding value judgments and allowing the participants time for introspection and the analysis of mental models, to jointly offer opportunities for continuous improvement. In the case of tele simulation, debriefing will be provided in the same way, at the end of the practice or case, through the same video conference session.

6. **Evaluation:** As previously mentioned, it is ideal to have a guide for performance measurement. Although there are no specific purposes for obtaining a score (summative purpose), performance must be measured to provide well-founded feedback, thus avoiding a perception of subjectivity in the teacher. This can be done through simple instruments such as a checklist or more complex instruments such as a rubric with various dimensions and levels.

RESOURCES

The implementation of telesimulation is undoubtedly an innovative proposal, but it involves the use of different types of resources to be able to carry it out in remote places or rural regions, going through the use with remote simulated patients, to the implementation of complex scenarios for the emergency care, critical patients or surgical procedures, in large hospital or university simulation centers. (McCoy, C.E., 2017).

We can classify these resources to be used in Technological, staff and others; Next, we will mention those that correspond to each of them. (Sa-Couto, C. 2020).

- **Technological:** Undoubtedly, a simulation center located in a fixed place (hospital or school) or even mobile ones (eg for activities in rural areas) are essential for the adequate development of telesimulation. The use of mannequins of different fidelity, applications with predesigned clinical cases or multimedia resources, simulated patients, are additional but very necessary elements.

Computer equipment such as PCs and laptops, tablets or mobile devices are essential in the development of this mode of simulation; Basic or professional video recording resources, lighting and audio transmission, are elements that will allow fidelity and greater immersion in the simulation scenario to be developed.

Telecommunication platforms (zoom, meet, Skype, among others) and multimedia resources (applications, pre-recorded videos, etc) are elements that have become a necessary companion for an adequate transmission of the activity to be carried out; We cannot ignore access to internet providers with adequate capacity that allow a quality interaction and at a distance.

- **Staff:** Additionally, the multidisciplinary team of health professionals adequately trained as simulation facilitators, technicians and biomedical engineers, are of utmost importance. Among health professionals there may be undergraduate and graduate students, instructors in clinical simulation, who are elements that will allow the design and implementation of telesimulation activities. We never have to forget the following minimum essential elements to carry out simulation activities and their adequate transmission. Nor can we leave aside the students to be trained, or who will be the final recipients of the simulation activities to be developed. In the figures 1 and 2, we can exemplify two simulation activity designs and the necessary resources for each of them.
- **Others:** A database with the different elements necessary for the design, implementation, evaluation and feedback of the activity, are underestimated elements when carrying out the telesimulation. The elements that this database must at least contain are listed in table 1.

Figure 1. Telesimulation activity using synchronous mode: with a pre-recorded simulation scenario and transmission via telecommunication platform to the students.

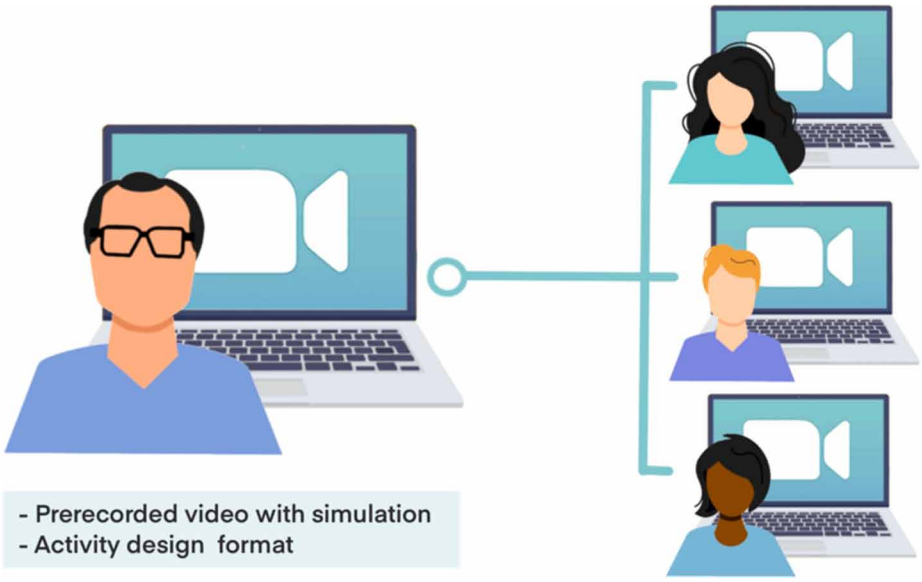

Table 1. Telesimulation Activity Database.

- Document with activity design. - Prerecorded video or multimedia resources for the activity (if-needed). - Quiz prior to the activity. - Quiz after the activity. - Quality survey of the activity carried out. - Video with implemented activity o Intro to the simulation activity (pre-briefing). o Simulation scenario. o Debriefing.

APPLICATIONS

The current context of the COVID-19 pandemic and the need to continue academic-educational programs in medicine and branches in common, have been triggers for the telesimulation that conditioned the increase in its use, expanding its concept and potential applications. The need to share experiences related to it, in different locations around the world, will be an element that will undoubtedly pay for a greater use of telesimulation.

Next the authors will mention some simulation activities developed based on the needs of a special location or type of resources that they used.

In their study Jewer et al. (2019) evaluate the educational efficacy of simulation-based training of an acute care procedure delivered remotely, using a mobile telesimulation unit, versus the traditional face-to-face approach. A total of 69 medical students were randomly assigned to comparison, intervention and control groups. For knowledge, as expected no differences were found between the groups on written

knowledge. Also, no significant differences were found between the comparison and the intervention groups on the procedural skills learning outcomes immediately after the training. However significant differences were found for the control versus comparison groups.

In another study McCoy et al. (2015) evaluate the comparative effectiveness of telesimulation versus standard simulation in teaching medical students how to evaluate and manage critically ill patients. They conducted a prospective, randomized crossover study of 32 fourth year medical students at a university medical simulation center. They found no significant difference in the mean evaluation scores of the two groups, they also found no significant difference in the favorability of teaching modality on the survey performed. These data support and highlight the capability of telesimulation to provide educational benefit to learners who do not have direct access to simulation resources.

Telesimulation and telementoring have emerged as important tools in improving access to advanced surgical techniques amongst surgeons globally. The objective of the study conducted by Choy et al. (2012) was to determine the feasibility of using the Global Operative Assessment of Laparoscopic Skills (GOALS) assessment tool to evaluate laparoscopic skills remotely via the same telecommunication technology used in telesimulation and telementoring. A Second objective was to identify how factors unique to remote assessment such as bandwidth and image quality influence the reliability of the goals assessment tool. In the results there was a statistically significant difference between the Maryland Visual Comfort Scale scores (MVCS used to evaluate the video quality between remote observers) of the high and low-bandwidth observers and the medium and low-bandwidth observers.

AUTHOR´S EXPERIENCE

The first case of COVID-19 in Monterrey, Nuevo Leon, was made official on Wednesday, March 11, 2020. On Friday the 13th, author´s university suspended face-to-face activities at a national level. In the middle of the semester and with a calendar full of practices in all different subjects at undergraduate and graduate levels, it was difficult to stop. Theoretical learning was quickly solved, but it was complex to select more and better free virtual resources, especially those that promoted procedural practice, since there was no budget or planning for this emerging situation.

For these reasons, at the Center for Clinical Simulation of the School of Medicine and Health Sciences of the Tecnologico de Monterrey, the authors began to implement telesimulation almost immediately after face-to-face closure in various undergraduate areas at all levels, from basic sciences to clinical sciences (or the internship years, as it is known in other institutions, where there is a real clinical approach in consultation, hospital shifts, etc.), as well as in postgraduate medicine and other health careers, specifically in the Bachelor's Degree in Nutrition and Integral Wellbeing and in Clinical Psychology. Next, the authors will describe their experiences so that the reader can use them as a basis to support their teaching:

- In the subjects of Introduction to the Clinic and the Histopathological Bases, both taught in the 2nd. year of all health careers, simulated consultations are carried out by practicing the clinical interview with its various sections such as medical history, review of systems, timely detection of various risks, etc. Consultations were carried out through a videoconference between one or more students acting as clinicians and a simulated patient who already has a predetermined "dialogue", while the rest of the group and the teacher observe.

- Students in Endocrine System Physiopathology and Renal Physiopathology, both in 3rd. year of the Medicine career, carry out consultations and resolution of emergency room cases with diagnoses that correspond to such subjects, using both simulated patients and robotic simulators. This results in the use of hybrid technologies because in addition to the video conference connection between students and teachers, the Simulation Center's technical support team projects onto the monitor the vital signs that are programmed in the simulator. Procedures are also performed using low-cost simulators from home, replicating maneuvers, and observed through videoconference.
- In the Pediatric clinical rotation in the 5th year of Medicine, emergency cases are carried out with the interaction of simulated patients or relatives, who respond to the interrogation. Simulated patient´s vital signs are projected and other multimedia resources are also used, such as various crying sounds, coughing, etc. at key moments in the scene. Radio-diagnostic images and laboratory results are available by just "sharing the screen".
- In the Gynecology and Obstetrics clinical rotation of the 5th year of Medicine, tele-simulations are also carried out based on consultation of various gynecological diagnosis, where the simulated patient is questioned and responds regarding her symptoms.
- In the Internal Medicine clinical rotation in the 5th year of Medicine, emergency cases have also been carried out combining physical and technological resources such as the simulated patient´s vital signs monitor, multimedia and human resources such as nursing staff, technicians, etc. The practices of the students were observed under certain variables in conjunction with two other groups of simulation instructors from Ecuador and Colombia and interesting results were obtained.
- In the Nutrition career, tele-simulation has been carried out to practice interviewing and nutritional interventions in patients with various ailments.
- In the career of Psychology, the clinical interview has been practiced in learning blocks with students from 1st to 3rd semester that address different types of patients.
- In the Pediatric postgraduate studies, emergency case management and consultations have been carried out, however, hybrid sessions have been held where a complex scenario is set up in the simulation center (crisis in the hospital ward, accident with multiple victims, explosion in a hospital, etc.) and a couple of junior residents have to manage the multiple patients, with video call support from the more senior residents in a continuous and synchronous manner.

Any of these sessions can use or combine various types of resources, ranging from just a monitor to a robot patient or simulated patient, adding the necessary realism and authenticity.

FUTURE RESEARCH DIRECTIONS

Among the main limitations that the simulation team can find when performing telesimulation is, without a doubt, the infrastructure. Having an adequate connection (fast and stable) to the network for both simulation instructors and facilitators (technicians, engineers) as well as students is a basic element for it to work in the most optimal way. As will be described in the chapter of this book, it is not essential to have specific and expensive equipment to be able to carry out this type of simulation (high fidelity simulators for example). On the other hand, the authors see many areas of future research opportunities when performing telesimulation, such as the creation of more user-friendly and specific software to perform this type of simulation, the implementation of measures to avoid technical problems that

may be generated during simulations (loss of communication by some of the participants for example), improvements to the audio and image, means to store the sessions or to be able to share and see them immediately during or at the end of the simulation, among others.

CONCLUSION

Telesimulation is a learning tool by which telecommunication and simulation resources are utilized to provide education, training different skills, and/or evaluation to learners at a distant location. This comprehensive and unifying word makes apparent the critical mass of educational research that has been conducted using telecommunication platforms and simulation resources. Previously it has been demonstrated the concept of bringing cost-effective simulation training to learners at off-site locations, including remote and resource-restricted areas of the world that in otherwise not have been able to benefit from this innovative educational tool. This area of simulation provides the opportunity for innovative ways to provide education to learners of the 21st century, by the way, it has opened the door for new research with a strong methodologic background to evaluate and establish its utility in the field of health sciences education.

COVID-19 pandemic triggered new and rapid adjustments to learning and clinical training. Telesimulation can be used to promote an enormous, interactive simulation environment, even with minimal staff resources. Other tools (free or pay-based) and combinations can be explored and used, with expected terrific results.

This chapter discussed the definition of telesimulation, its uses before and during the Covid-19 pandemic to achieve learning objectives in health professionals. In the same way, the processes and the basic requirements of equipment, personnel and information technologies were described to carry out a telesimulation. Likewise, some examples made with telesimulation by the authors were shown. Telesimulation is a valuable tool to achieve health-related learning objectives in students and even if the current Covid-19 pandemic ends, the use of telesimulation by educational institutions will continue and increase.

ACKNOWLEDGMENT

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

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Chapter 17
Focusing on Continuous Professional Development for Health Professionals: The Inward Transformation

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ABSTRACT

The context in which health professionals practice is constantly evolving. The entry of new technologies in medicine has put more than one specialist to the test. It is worth noting that these technologies are rapidly updated, generating new solutions every year. While this contributes to offering quality programs for the training of new professionals, how can a professional even aspire to keep up to date with all these developments? This chapter provides some proposals and reflections to develop professional development goals for health professionals based on a continuous professional development mindset.

INTRODUCTION

On December 31, it has become a family tradition to sit around the table, share reflections on the year ending, and talk about the dreams we want to work on in the coming year. Each grape that accompanies the chimes is a new possibility to reinvent ourselves as a person. Professionally, educators have engaged in this exercise after annual feedback cycles with their leaders at the university. These moments are pure

DOI: 10.4018/978-1-7998-8783-6.ch017

gold as they allow for new challenges and opportunities for development. A few years ago, in a talk about these objectives, one of the authors remembers the dean asked about three role models. At that time, she answered the names of former university professors, whom she admires and respects very much.

With his characteristic good humor, the dean inspired her not to limit professional development to be a professor as modeled by the university but to have professional goals. He asked to think about whom she is going to be in 15 or 20 years, looking for role models in personalities who are already doing it, and start a reverse engineering project to analyze what steps, decisions, and experiences they took 5, 10, 15 or 20 years ago.

At the time, true to be told, it seemed presumptuous to think that one should aspire to be like Audrey Azoulay, Anantha Duraiappah, or Mo Gawdat, but a quick search of their life experience in the internet search engine was convincing enough to seek the kind of experiences they had. Moreover, their training, jobs, and beliefs in the causes they served challenged the conversation and made a new one. As a result, these persons are proposing things that did not exist before.

It is an ambitious goal for health professionals, already practitioners or students alike, to dream and work to transform health systems truly. To do so, they cannot go through the very traditional and heavily transited roads of professional training. Instead, to adopt telemedicine, design e-health modules, and solve the challenges of the 21st century, they need to engage in a transformative experience of continuous professional development.

The objectives of this chapter are:

- Describe indispensable elements for the transformation of the health professional.
- To propose practical strategies to design their continuous professional development plan.

MAIN FOCUS OF THE CHAPTER

Health professionals are leaders in a disciplinary field and have academic or care participation in which they demonstrate their commitment to society (López, Heredia & Olivares, 2020). In addition, most of them have participated in an educational role; some have a desire to teach in their community of practices, others do it to follow in the footsteps of a mentor, the nature of their responsibilities requires it, or a gradual introduction to pursuing graduate studies (Steinert, 2012). Other authors distinguish between decisions made consciously and those that presented themselves as opportunities or impositions of their responsibilities (Lopez & Heredia, 2020).

Another element that is important to notice is that no matter their motivations for entering either the health or medical field, these professionals engage in different activities and take on multiple roles (AMFEM, 2018; Harden & Crosby, 2000; Lopez & Heredia, 2020). Sometimes an individual has multiple responsibilities, for example, as a clinician, professor, or department leader, to each of these corresponds a particular set of skills that require constant development (Thorndyke, Gusic, George, Quillen, & Milner, 2006).

The growth of a health professional is framed by the concept of andragogy, a term that describes the science and processes of adult education and learning (Knowles, 2001). Unlike pedagogy, in which the child learns a technique or a domain that he or she needs in the immediate future, the profession or employment andragogy is based on horizontality and participation (Morales-Pacavita, 2016). Horizontality refers to deciding how, when and what to learn. Participation describes the active involvement of the

Table 1. Conscious-competence model

Stages	Description
Unconscious incompetence	Students have learning needs; their inexperience does not allow them to identify them.
Conscious incompetence	The students have learning needs. They can identify those, and the dissatisfaction with the current state moves them to action.
Conscious competence	The students are aware of the development of competence and their learning, which they implement in practice by following a series of steps or methodologies in a reasoned manner.
Unconscious competence	The student performs activities competently and develops them naturally. Many of their skills have been internalized as habits.

learner in pursuing and evaluating the achievement of the defined goal. This transformative action requires commitment, flexibility, and catalysts to detonate profound changes in the individual (García, 2017).

A commonly used model to explain adult learning experience and competence development and acquisition is the competence-conscious model (Higginson & Hicks, 2006). This model explains a four-stage development: unconscious incompetence, conscious incompetence, conscious competence, and unconscious competence. It integrates the development of skills with the awareness of the development of these competencies in a progressive manner.

Several authors claim that this model is insufficient for the complexity and speed with which the needs of a learner evolve in the clinical setting, so they integrate another concept known as tolerance. This new variable begins with the loss of tolerance towards one's skills and later towards the lack of tolerance towards the perceived competence of others (Higginson & Hicks, 2006).

FROM CONTINUING TO CONTINUOUS

A very traditional and recurrent approach to address this lack of perceived competence is the faculty development courses offered by universities or hospitals, which focus on teaching skills, evaluation, or educational technology. The scope of these programs is to measure impacts on attitudes, knowledge, skills, and behavior (Steinert, Naismith & Mann, 2012). Most of them are designing considering basic skills for medical educators following competency frameworks.

Srinivasan et al. (2011) describe a conceptual model based on the physician competencies from the Accreditation Council for Graduate Medical Education (ACGME) and the roles described by the Royal College's Canadian Medical Education Directives for Specialists (CANMEDS). The six core competencies include:

1. **Medical knowledge:** Teach content and assess learners' abilities.
2. **Learner-centeredness:** Demonstrate commitment to learners' success and wellbeing.
3. **Interpersonal and communication skills:** Flexibility and continuous communication
4. **Professionalism and role modeling:** Demonstrate best practices and model behaviors for learners.
5. **Practice-based reflection:** Demonstrate self-assessment and lifelong learning.
6. **System-based practice:** Advocate for learners and provide optimal teaching and learning.

Tucker (2017) describes five core competencies and milestones that medical educators must develop to assume a role in this field:

1. **Facilitating learning:** The ability to use knowledge, skills, and abilities to promote an engaged learning environment.
2. **Curriculum design and instruction:** Apply educational theory to the design and evaluation of learning activities.
3. **Assessing learning:** Engage in continuous monitoring of students in both classroom and clinical settings.
4. **Scholarship of teaching and learning:** Educators involved in documentation, peer review, and dissemination of innovative teaching practices.
5. **Educational leadership and administration:** Foster collaboration, manage projects and exhibit integrity in the administration.

These competencies are similar in face-to-face and virtual teaching and learning environments; however, the challenges that educators face are different for each setting. Telemedicine and teleeducation are a testament to these transformations where the mastery of digital skills is a prerequisite to teaching. Guasch, Alvarez, and Espasa (2010) describe roles and functions that teachers fulfill:

1. **Design and planning function:** Planning a virtual environment lies in the educational planning and the concerted effort to manage the teacher, staff, and students' technological and educational coordination.
2. **Social function:** Foster interaction between students and teachers and within the students themselves. The virtual settings pose an additional challenge to achieve emotional expressions in non-verbal communication.
3. **Instructive function:** Cognitive command or expertise in the subject that the educator is enrolled.
4. **Technological domain:** Abilities required for the educator to support technological services, basic computer knowledge to use technology, multimedia, and other educational software.
5. **Management domain:** The teacher can carry out planned actions and adapt them to meet learning needs, expectations and needs.

In a more futuristic approach, Simpson et al. (2018) predicted that in 2025 physicians roles would evolve rapidly and yield to new jobs:

1. **Diagnostic assessor:** Builds on student data to construct individualized training.
2. **Content curator:** Design a sequence for high-quality content that is already developed and validated by experts.
3. **Technology adopter:** Identifies and selects the appropriate technology to integrate to the courses.
4. **Learner-Centered Navigator and Professional Coach:** Co-designs performance targets with students to help them be self-directed learners.
5. **Clinician Role Model:** Models how to be a professional in different settings, encourages learners to be the best version of themselves.
6. **Learning Environment Designer, Engineer, Architect, and Implementer:** Designs a new educational setting or optimizes one already going.

While these are important and have their place in medical and health education, they advocate development according to the profile of educators desired by the university. But what about the professional's interests? What if a physician also wants to start a virtual reality startup or become a consultant on program redesign? Who oversees developing it and designing a plan so that in 3 to 5 years, they become the national leader in these initiatives? We could say that simultaneously, two plans coexist: the faculty profile declared by the university with their plans and training programs to achieve it, and the professional development plan - the dream - of the professor (Pololi, Knight, Dennis & Frankel, 2002). This chapter focuses on the second of these plans.

A characteristic of the health professions is the constant search for updating knowledge, commonly referred to as Continuing Medical Education (CME). The CME format is a traditional tool for learning and updating knowledge in courses, conferences, journal clubs, and workshops (Raza, Coomarasamy & Khan, 2009). This training increase participants' knowledge but might have minimal impact on the more relevant end points such as participants' behavior or even patient outcomes (Zeiger, 2005). Therefore, participation is highly dependent on the self-direction of professionals, the definition of policies that promote the updating and certification of the competencies of specialist physicians, and the availability of these activities in their region (Yam, Griffiths & Yeoh, 2020). This format of episodic interventions addresses the educational needs of trainees through lectures or conferences and is teacher-centered (Filipe, Silva, Stulting, & Golnik, 2014).

Continuous Professional Development (CPD) prepares the individual for lifelong learning (LLL) by engaging in active learning and reflective environments. These educational activities focus on preparing participants to 1) recognize a learning opportunity, 2) seek resources for learning, 3) engage in resolving their areas of improvement, 4) evaluate the attainment of their goals, and 5) incorporate new learning into new scenarios (Hunt, Brannan, & Sexson, 2019). This concept includes methods beyond didactics and integrates organizational and systemic factors that impact the educator's career (Davis, Davis, & Bloch, 2009). Very simply, we could explain that, although they share some strategies, CPD is an evolution of CME (Figure 2).

THE CASE OF CONTINUOUS PROFESSIONAL DEVELOPMENT

The professional development road requires much reflection, as it integrates the emotional and social dimensions and the cognitive (Jayatilleke & Mackie, 2013). In this reflection, educators gain competence, confidence, commitment, and a sense of joy for teaching (Lessing & De Witt, 2007). Continuous professional development consists of activities in different formats, which are grouped into four categories regarding the overall objective: self-study, training, communities, and experiences (Figure 3). The first three are intertwined and contribute to the professional living experiences that prepare him/her through practical approaches. In addition, this experience builds values, culture, and relationships, thinking simultaneously in the short and long term (Pololi, Knight, Dennis & Frankel, 2002).

Self-study refers to activities where the professionals define their learning environment. These may have traditional approaches such as reading material such as articles or books that allow the educator to learn more about specific topics. Some colleagues constantly search the web using keywords to learn about new applications, which they then test and integrate into their courses. According to Lessing and De Witt (2007), this is essential as it is a way to develop their own ideas and experiment with them to determine their success.

Figure 1. Evolution of continuous professional development

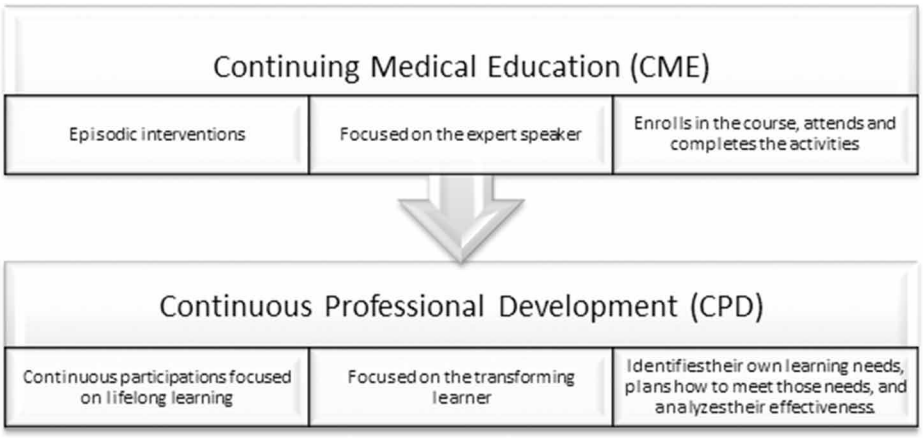
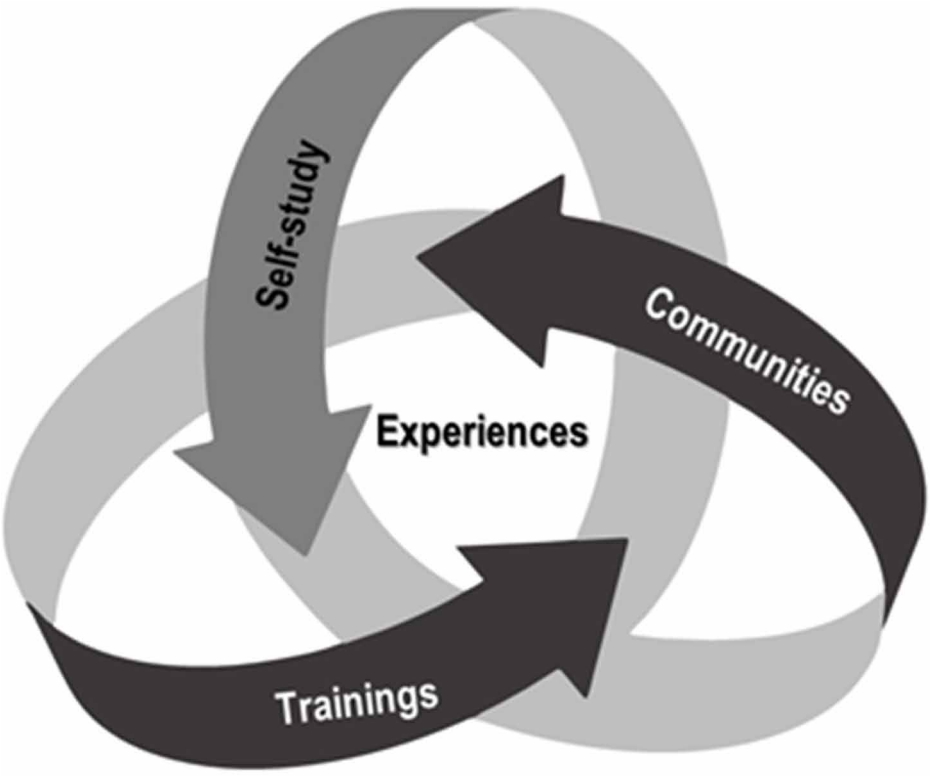


Figure 2. Categories and formats of CPD



Training refers to participating in conferences, workshops, diploma courses, or postgraduate programs that allow the professional to learn more about medical education or any of the roles in which they participate. Taking advantage of technologies, professionals can complete Massive Open Online Courses

(MOOC) from home comfort and at the pace that their activities allow. For example, in telemedicine, Tecnologico de Monterrey developed an interprofessional program partnered with Coursera. As a result, the health professionals can explore the different modules and learn about: soft skills and competencies for communication in virtual and distance-based formats, interdisciplinary work in clinical care, technology as a facilitator of care, and integration of in-training personnel in telehealth.

Communities refer to finding a professional *tribe* of people they share interests, vocabularies, and needs (López, Olivares & Heredia, 2020). In this, they can seek feedback on their courses, recommendations for the outline of their life and career plan, or camaraderie to face a problem. Some novel strategies where the professional can seek inspiration include following experts on a topic on social networks such as Twitter or Facebook, or professionals such as Linkedin or Research gate. Mentoring programs with colleagues allow the professional to grow and chart their career and enrich personal life projects (Thorndyke, Gusic, George, Quillen, & Milner, 2006). Some universities have supported unique groups to support inclusion or diversity, for example, the participation of more female professors in health careers (Bauman, Howell, & Villablanca, 2014).

Experiences refer to integrating the last three elements in a practical context and with a defined purpose. Some examples are the participation in a Fellowship or diploma program to develop a project according to the needs of the context; another could be to lead an initiative to redesign an educational process, a curricular change, etc. Although this requires a lot of time, training, and effort on the part of the educator, there is no better school than practice. In addition, this exercise enables the development of other competencies such as project management, fund acquisition, and presentation of results for accountability with leaders.

The planning of these activities must be balanced; it is useless to involve an educator directly in experiences that demand competencies and knowledge for which the individual is not prepared. This would have an impact on the success of the projects and the morale and confidence of the professionals. These elements that make up the model allow preparedness to do a successful and satisfactory job. In this regard, we would like to propose an annual plan that we have developed with the advice of mentors (Table 2). It is essential to say that it is not written in stone or that there is nothing to be added; it is a guide that allows seeing what areas need to strengthen. Each category develops a professional goal, which unfolds into activities described in the columns on the right side (regional and international).

With this example in mind, we would like to invite you to make a development plan proposal in the blank spaces of table 3. First, complete the goal column, and then consult the Internet for alternatives on how you could achieve it in the immediate (regional) context and what is available at the international level. Try to start goals with a verb and avoid using "to know" as much as possible. Raise the level of the challenge from just knowing or listening and move it to the application of this knowledge. Add only one goal per box; the objective is to define achievable objectives and motivate as they are achieved.

In the search for alternatives to achieve these goals, we are sure you have found target dates for some of these programs. We invite you to integrate this variable into the annual continuing professional development plan and share the intention with other colleagues. It will not be a pact, like setting out to lose weight or start on physical activity, you need a plan and a group of people who will become the support network when you feel you cannot do it anymore. As you meet the goals, add new interests in each box, do not wait until next year to continue to develop. As this habit becomes integrated, it becomes a natural part of the routine, and the goals become more and more rewarding challenges.

This book, and in particular this chapter, is intended to inspire you to transform your practice as a health professional, not to try to convince you that there is a single model of life and career to which all

Table 2. Example of an annual plan of continuous professional development

Categories	Goal	Regional	International
Self-study	To keep up to date on trends and projects in medical education.	Subscribe to and read the journal Investigación en Educación Médica (RIEM) of the Universidad Nacional Autónoma de México in Mexico. http://riem.facmed.unam.mx/	Subscribe and read Medical Education journal https://onlinelibrary.wiley.com/journal/13652923
Training	Develop specific skills as an educator in assessment.	MOOC Coursera course on Evaluation in Clinical Settings. https://www.coursera.org/learn/evaluacion-aprendizaje-escenarios-clinicos	Essential Skills for Medical Education (ESME) course of the Association for Medical Education in Europe (AMEE). https://amee.org/courses/amee-esme-online-courses
Communities	Integrate with colleagues whose career stage is similar to mine, share and undertake educational technology projects.	Join and participate in the activities of the National Academy of Medical Education (ACANEMED). https://www.acanemed.org/	Join, and become an Associated Fellow of the Association for Medical Education in Europe (AMEE). https://amee.org/fellowship/fellow
Experiences	Attract and manage funds for the implementation of educational projects.	Lead an educational project in the NOVUS initiative of my institution with colleagues from other disciplines.	Apply with a project to attract funds with colleagues from other universities or countries.

professionals should aspire, but convince you to follow that dream you have been struggling to embrace. It will not be easy or quick, but it will be a satisfying experience. These pages are full of examples of how things can be done and were written by colleagues and friends who want to accompany you in that all-important transformation project that is yourself. We are convinced that there are professionals with million-dollar ideas within health institutions with the potential to make education more effective, humane, and transformative.

FUTURE RESEARCH DIRECTIONS

We could say that simultaneously, two plans coexist: the professional profile declared by the university with their respective plans and programs to achieve it, and the individual's professional development plan. In addition to being excellent health professionals, there are health professionals who also want to

Table 3. Own continuous professional development plan

Categories	Goal	Regional	International
Self-study			
Training			
Communities			
Experiences			

start a virtual reality startup or become consultants on educational program redesign. From the university perspective, we need to ask ourselves, how are we preparing them? An interesting line of research would map out the training of specialists and understand what mindset and principles are guiding their decision-making process.

On the individual level, it would be interesting to understand the motivators that guide health professionals to pursue different career pathways within their contexts. It would enable the design and establishment of systems that favor alternative pathways that are part of the professional needs, goals, and dreams.

CONCLUSION

Continuous professional development comprises activities of different formats, grouped into four categories: self-study, training, communities, and experiences. Professionals need to embrace these activities as a regular habit of rediscovering themselves. The plans that were made a year ago, or five years ago, were adequate for the person back then, but we are dynamic and living beings that are "allowed" to change. It is a life-long journey to reinvent ourselves as professionals and as a person

ACKNOWLEDGMENT

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

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KEY TERMS AND DEFINITIONS

Continuing Medical Education: Workshops and training focused on updating medicine knowledge and trends after the undergraduate program is completed.

Continuous Professional Development: Continuous improvement mindset where professionals guide their own training. Applying self-direction, they assess needs and identify ways of addressing them.

Lifelong Learning: Refers to the practice where the professional never stops learning and searching for ways to do so.

Medical Education: An interdisciplinary field in which professionals from different backgrounds and disciplines share the call to train the next generation of physicians.

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