Efficacy of a Telemedicine Training Program for Physician Assistant Students

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Abstract

***Objectives*:** The purpose of this study was to develop and evaluate the outcomes of a 4-hour telemedicine program during PA students' clinical training at Radford University Carilion (RUC). The four research questions were based on whether a telemedicine training program changes PA students' ability to define telemedicine, changes the PA students' perception of their ability to conduct a virtual healthcare visit, changes the PA students' perception of self-efficacy utilizing telemedicine in their future practice, and changes the PA students' perception of telemedicine's impact on quality of care. The content material of the training program was delivered virtually to 41 clinical year PA students.

Methodology: A logic model was utilized to identify inputs, outputs, and outcomes associated with a telemedicine program. Through the utilization focused-approach, pre- and post-test surveys were developed to measure the curriculum's effectiveness based on the students' interests. The pre- and post-test surveys were based on validated survey tools from three studies. A combined pre- and post-test evaluation tool was formulated to measure the effectiveness of the telemedicine program. Through the combined evaluation tool, students had the opportunity to evaluate themselves on various aspects of clinical skills associated with providing care via telemedicine. Four subscales were identified to answer each research question proposed.

***Results*:** Overall, reliability was seen in the majority of subscales based on Cronbach alpha scores. Once the assumptions of sphericity were confirmed, 4x2 repeated measures ANOVA tests were performed on two sets of data. These data sets included data that were automatically matched based on IP address (N = 18) and data that were manually

matched based on demographic data (N = 26). There was a statistically significant difference in the means between the delivery of the telemedicine program and the time, whether before or after, the survey was taken in both datasets for all subscales ($df = 1, F = 46.211, p < 0.001$; $df = 1, F = 82.620, p < 0.001$).

Conclusions: The results of this study indicated that incorporating a telemedicine training program in PA students' curriculum does have impact on PA students' ability to define telemedicine, perception of performing a virtual telehealth visit, perception of utilizing telemedicine in future practice, and quality of care delivered during a telemedicine visit.

Keywords: telemedicine, telehealth, self-efficacy, and PA students

Dedication

To Most Revered Professor Prem Saran Satsangi

Acknowledgements

*It is due to the immense grace and mercy of the **Supreme Father** that I find myself in this enviable position today. I thank Him with Humble obeisance and deep gratitude.*

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List of Abbreviations

AMA .....American Medical Association

ARC-PA.....Accreditation Review Commission on Education for the Physician Assistant, Inc.

CDC .....Center for Disease Control

CICARE.....Connect, Introduce, Communicate, Ask, Respond, Exit

HHS.....Health and Human Services

NCCPA .....National Commission on Certification of Physician Assistants

NP .....Nurse Practitioner

PA .....Physician Assistant/Physician Associate

RUC .....Radford University Carilion

Chapter One

Introduction

The use of telemedicine is on a rise in the United States amidst the COVID-19 pandemic that forced the population to stay at home and shelter in place. In January of 2021, more than 200,000 cases of the virus were diagnosed on average per day in the United States (John Hopkins University and Medicine, 2021). As a result, healthcare systems have been pushed to identify new and innovative ways for non-contact modes of delivery of healthcare, such as telemedicine platforms (Koonin et al., 2020). The Centers of Medicare and Medicaid Services reported that over 10.1 million individuals received healthcare via telemedicine between March and June of 2020 during the COVID-19 pandemic compared to 14,000 recorded telemedicine visits that occurred prior to the pandemic (Department of Health and Human Resources [HHS] report, 2020). Thus, it is vital for medical and nursing programs to incorporate measures that help students develop skills for provision of medical care using telemedicine (Rhone et al., 2020). Recently, the American Medical Association (AMA) released a policy stating telemedicine training should be incorporated in the medical school curriculum (AMA, 2020). However, telemedicine curriculum is not included in the standards of the Accreditation Review Commission on Education for the Physician Assistant (ARC-PA) at this time. With the introduction of this new delivery system in the healthcare industry, it is critical for students to be exposed to a curriculum that teaches “webside” manner to provide high quality care to patients in a virtual format (Barthelemy, 2019).

The purpose of this project was to develop and evaluate a telemedicine curriculum utilizing a logic model. First, students completed a pre-test validated survey tool to understand their current level of knowledge of telemedicine and the Physician Assistant (PA) profession.

Then, a 4-hour telemedicine training program was piloted to clinical year PA students at Radford University Carilion (RUC). Next, students completed a post-test analysis at the end of the training session to determine the effectiveness of the program through comparison of the results from the pre-test and post-test surveys. Finally, the results were analyzed using standardized statistical techniques to determine the efficacy of the telemedicine program for training PA students in their clinical year.

It was vital that the telemedicine training session encompasses components of the mission of RUC's PA Program, which is to guide and develop PA students to practice with compassion. The mission of the program laid the foundation of this research study, as students were prepared to provide high quality patient care via telemedicine. Thus, the goal of this project was for students to highly rate their self-efficacy in providing compassionate and high-quality care through telemedicine after completion of the telemedicine curriculum.

The objectives of this project were four-fold. First, it helped students learn how telemedicine can be utilized in PA practice. Second, it prepared students to conduct a health care visit via telemedicine with high quality of care. Third, the student feedback helped identify gaps in telemedicine training within the PA curriculum. Fourth, the training provided an example for other PA programs to incorporate a telemedicine curriculum within their program.

Background

With over 22.7 million COVID-19 cases impacting the United States, telemedicine is becoming well adopted within healthcare systems to provide virtual access to care for patients especially those with chronic disease processes (John Hopkins University and Medicine, 2021). In 2010, only 35% of hospitals in the United States were equipped to provide telemedicine visits, which grew by 30% within 5 years (American Hospital Association, 2021). In March of 2020,

the United States saw a 154% increase in telemedicine visits compared to the number that occurred in March of 2019 (Koonin et al., 2020). This growth in telemedicine offers the ability to screen patients with COVID-19 symptoms, thus, helping prevent the spread in outpatient settings, increasing access to care especially for individuals living in rural areas, providing continuity of care to those who need to be closely monitored, performing pre- and post-op appointments, and helping patients participate in physical and occupational therapy (Centers for Disease Control and Prevention [CDC], 2020).

The concept of providers being able to sit in their homes and deliver care to patients remotely has revolutionized medicine (Zimiles, 2020). In a cross-sectional study with 1,800 patient responses, 83% of patients expect to continue utilizing telemedicine after the pandemic resolves, 91% of patients stated they are more likely to keep their telemedicine visit compared to an in-person visit, and 93% of individuals indicated that they would use telemedicine to manage their prescriptions (Zimiles, 2020). In addition, it was predicted that patients would save over 100 minutes per in-person visit.

Problem

The use of telemedicine is rising in the healthcare industry, yet it is not required to incorporate telemedicine into the curriculum of PA programs. Although medical schools are required to have a component of their education focus on telemedicine, the data available about effective approaches to introducing the topic is minimal (Chike-Harris et al., 2020). In addition, minimal literature was identified that included incorporation of a telemedicine curriculum in PA programs. Lastly, it was also important to identify validated survey tools to understand the effectiveness of a telemedicine program.

Developing and evaluating the outcomes of integrating a telemedicine curriculum should be included in the didactic and clinical training of PA students while obtaining patient contact hours. Furthermore, there was minimal research that evaluates the PA students' perception of defining telemedicine and citing examples of the utilization of telemedicine, defining the ability to conduct a virtual telemedicine visit, and defining the self-efficacy utilizing telemedicine in future practice after integration of a telemedicine curriculum.

Significance of Introducing Telemedicine Training Programs

With the seismic shift in the way medicine is delivered today, medical schools, PA programs, and nursing programs should develop and deliver telemedicine training, so providers are trained to provide high-quality, secure, and personalized healthcare through virtual platforms (Jumreornvong et al., 2020). However, the training of medical, PA, and nursing students in 2020-2021 has been severely impacted by the COVID-19 pandemic. Several students in their clinical year reported their training was halted until further notice, which impacted their ability to obtain clinical and hands-on experience treating patients (Gibbs, 2020). Additionally, ARC-PA mandated hands-on clinical training during the pandemic for clinical PA students to meet program competencies (Accreditation Review Commission, 2020). Thus, programs started looking for alternative training options to help students to graduate on time while obtaining the clinical hours to meet accreditation requirements. Telemedicine is one example of how students might supplement their training. Having rotations with a hybrid model of in-person and telemedicine visits, or having an elective clinical rotation in telemedicine, can be impactful. Looking forward, this could impact over 4,500 students enrolled in their clinical year of PA programs across the United States once clinical competencies are standardized for telemedicine (National Commission on Certification of Physician Assistants [NCCPA] report, 2019). As a

pilot research study, this project specifically focused on the 41 clinical PA students enrolled at RUC's PA program.

Telemedicine programs must be consistently evaluated to ensure learning objectives are met. The learning objectives must reflect the mission, vision, and values of the program. With the shift to telemedicine utilization, students should be taught on how to perform a virtual visit via telemedicine prior to seeing patients in the virtual setting. The curriculum should cater to the students' comfort with the use of technology and focus on developing adaptability with the integration of technology since medical and technological knowledge are continuously evolving (Rhone et al., 2020). Lastly, "webside" manner and how to perform a physical exam in the virtual setting are key components of any training program to boost the provider's confidence and ability to practice virtual medicine (Rhone et al., 2020).

Telemedicine has proven to reduce the costs for not only patients and health insurance companies, but for healthcare systems as well. On average, the total savings are estimated to be about 80 to 120 dollars per patient visit (Snoswell et al., 2020). These savings are associated with an increase in access to healthcare, reduction in travel costs, and lower number of non-urgent patients seen in emergency departments (Snoswell et al., 2020). Additionally, the healthcare systems are saving money on costs associated with supplies in the hospital. Providing an opportunity for medical students to attend their surgical rotation through telemedicine saves on the utilization of gowns, surgical gloves, and other personal protective equipment used in the operating rooms while keeping the quality of education at a high standard (Jumereornvong et al., 2020).

Evaluation methods should be established for telemedicine programs to ensure that students are continuing to get high quality education while meeting the technological demands of

the healthcare system. Additionally, the cost savings may impact students, as they would not have to budget for traveling to clinical sites if they had an opportunity to complete their clinical experiences through telemedicine (Jumereornvong et al., 2020).

Overview

Telemedicine should be introduced to students in the medical field, including medical students, PAs, nurse practitioners (NPs), and undergraduate nursing students to provide adequate care in a virtual setting. Although the AMA has recognized that telemedicine should be included in the medical school curriculum, the ARC-PA has not mandated telemedicine to be incorporated into the PA curriculum. Thus, this study helps demonstrate the need for a telemedicine program in PA curriculum while evaluating the effectiveness of a telemedicine program. Steps that were taken to understand the efficacy of a telemedicine program include an assessment of the students' knowledge of telemedicine prior to delivery of a telemedicine curriculum, implementation of the telemedicine curriculum, and assessment of outcomes of the education through a post-test assessment of students' perceptions as discussed later in the methodology. Thus, this study helps understand the need for a telemedicine curriculum in a PA program and assess curriculum development through validated survey tools, specifically related to telemedicine.

Study Population

The participants of this project consisted of PA students who were enrolled in the RUC PA program and had successfully completed their didactic year and were currently completing hands-on training during their clinical year. Approval was obtained from the RUC PA Program Director and Director of Clinical Education for implementation of a telemedicine curriculum with pre- and post-test survey evaluations.

Purpose of Research

The purpose of the proposed study was to develop and evaluate a telemedicine curriculum for PA students at RUC. The independent variable was the curriculum components delivered to all students at the same time. The dependent variables included the effectiveness of the information delivered and how well students applied the knowledge in real-life examples through case studies.

Theoretical Foundation: Evaluation Tools for Telemedicine Program

Since the telemedicine program was based on education theories of cognitivism, the pre- and post-evaluation test had questions integrated based on this theory. The theory of cognitivism states that students learn through study and application (Knowles et al., 2015). The validated survey tool focused on the telemedicine modules provided to students, including introduction to telemedicine, a step-by-step guide on how to have a successful telemedicine visit as a provider, and future utilization of telemedicine in the healthcare industry.

In addition, the pre- and post-surveys used a utilization-focused evaluation method that was developed by Michael Quinn Patton (2008). The guiding principle of a utilization-focused approach is to evaluate whether the program is meeting the needs of a student in training. Utilization-focused evaluation methods are the predominant way of receiving student feedback in medical education (Vassar et al., 2010).

The evaluation process of the telemedicine curriculum was defined to build a pathway for program improvement with a focus on a student's perspective (Patton, 2008). Validated survey tools given to medical students, medical residents, and nurse practitioners were combined to create a pre- and post-test evaluation form for this study. Through the utilization-focused approach program evaluation tool, the assessments helped identify the student's level of comfort

with utilizing telemedicine in a clinical setting, and analyzed the program's effectiveness (Vassar et al., 2010).

Research Questions and Hypotheses

Table 1

Research Questions, Null Hypotheses, and Alternate Hypotheses

Questions	Outcome(s)
RQ1: Does a training session in telemedicine significantly change PA students' ability to define telemedicine and cite examples of telemedicine in practice?	$H1_o$: There is no significant difference in PA students' ability to define telemedicine and cite examples of telemedicine in practice between the pre- and post-survey results. $H1_a$: There is a significant difference in PA students' ability to define telemedicine and cite examples of telemedicine in practice between the pre- and post-survey results.
RQ2: Does a training session in telemedicine significantly change PA students' perception of their ability to conduct a virtual healthcare visit?	$H2_o$: There is no significant difference in students' perception of their ability to conduct a telemedicine encounter after completing the telemedicine training between the pre- and post-survey results.

	$H2_a$: There is a significant difference in students' perception of their ability to conduct a telemedicine encounter after completing the telemedicine training between the pre- and post-survey results. .
RQ3: Does a training session in telemedicine significantly change PA students' perception of self-efficacy utilizing telemedicine in their future practice (i.e., optimizing technical aspects, utilizing a video interface, and comfort with appropriate computer etiquette)?	$H3_o$: There is no significant difference in PA students' perception of self-efficacy utilizing telemedicine in their future practice between the pre- and post-survey results. $H3_a$: There is a significant difference in PA students' perception of self-efficacy utilizing telemedicine in their future practice between the pre- and post-survey results.
RQ4: Does a training session in telemedicine significantly change PA students' perception of telemedicine's impact on quality of care?	$H4_o$: There is no significant difference in PA students' perception of telemedicine's impact on quality of care between the pre- and post-survey results.

	$H4_a$: There is a significant difference in PA students' perception of telemedicine's impact on quality of care between the pre- and post-survey results.

Implications of Research

The findings of this study will help determine the efficacy of telemedicine training and determine if PA students think it is necessary to learn about telemedicine during training through validated evaluation methods. Additionally, this curriculum will help prepare PA students to be able to conduct a healthcare visit via telemedicine through evaluation of self-efficacy. Upon dissemination, this study will provide information to help the PA program accrediting body make policy changes to establish competencies involving care provided via telemedicine. Lastly, this study will serve as a pilot for other PA programs to utilize while evaluating a telemedicine curriculum for PA students through the use of validated tools for program evaluation.

The Impact

This study impacted 41 PA students enrolled in RUC's PA program who were in their clinical year. RUC's PA program was chosen because of the ongoing collaborations with the Doctorate of Health Sciences faculty. Additionally, RUC has smaller class sizes to interact to support lower student to professor ratios, excellent PANCE pass rates, and Carilion Clinic affiliation. RUC's PA program is highly competitive as they accept 1 out of 21 applicants each year. The current PA curriculum is lecture based, case based, technology based, and practical skills based. There is advanced learning technology available to enhance the learning experience in the classroom. RUC's PA student population is composed of individuals from several states

and cultural backgrounds. With such a diverse student population and a well-integrated PA program, it will be beneficial to implement and evaluate a telemedicine program to prepare students for the future of medicine through the use of technology. Additionally, further studies can be conducted to evaluate the skills learned from telemedicine training actively during clinical rotations. The goal with this study is to develop a telemedicine curriculum and use a combined validated tool for students to evaluate themselves before and after a telemedicine training program integrated in a classroom setting. The next step would be to utilize the same tool to evaluate skills in the clinical setting for other PA programs.

Chapter Two

Review of the Literature

A review of recent relevant literature was performed to formulate better understanding of telemedicine programs and evaluation tools for telemedicine programs in medical schools, PA programs, and nursing programs. The literature search included keywords from the postulated research questions. Further, the literature review included formative research of how telemedicine is defined (i.e., by commercial agents, programs, and accrediting bodies), a brief summary of how telemedicine has impacted the PA profession (i.e., performing physical examination from home and treating patients virtually), curricular design that is currently implemented in medical schools, and evaluation tools that are currently implemented in medical programs. Table 2 lists initial research terms and search engines utilized to conduct the literature review.

Search Strategy

The first step of this project consisted of a comprehensive literature review that was conducted on research engines such as PubMed and Google Scholar, and national and worldwide databases including the CDC and World Health Organization (WHO). Inclusion criteria of this search strategy included up-to-date articles from within the past 5 years. The key terms used were telemedicine curriculum, AMA telemedicine policy, education theory, curriculum evaluation tools, program evaluation theories, and efficacy of pre- and post-program evaluation methods. These keywords were used individually and together with the use of AND between the listed keywords. Further keywords were determined based on result findings. The inclusion criteria for articles considered for this research were publication in a peer-reviewed journal, published within the past 5 years, and inclusion of key terms from the search strategy.

A PRISMA diagram was developed to show the progression of research for this proposal documented in Appendix A. A total of 400 records were identified. After preliminary screening, 135 hits were removed due to duplicate studies or removed for other reasons such as the timing of the study. Of the remaining 295 records, 95 records were excluded due to content material for the research project. Two hundred reports were sought for retrieval of which 35 were not retrievable. One hundred fifty reports were assessed for eligibility and 74 reports were excluded. A total of 76 hits were reviewed for this proposal. Lastly, key gaps were identified based on the relevant literature review, which this research will address.

Table 2

Research Terms Utilized in Literature Review

Search #	First Search Term	Second Search Term (if applicable)	Third Search Term (if applicable)	Data Base Searched	Number of Hits Obtained
1	Telemedicine			Google Scholar	52,700
2	Telehealth			Google Scholar	20,100
3	Physician Assistant	Profession History		Google Scholar	985
4	Medical Education	Education Theories	Andragogy	Google Scholar	1,505

5	Medical Education	Education Theories	Cognitivism	Google Scholar	1,000
6	Medical Education	Utilization Focused Approach		Google Scholar	100
7	Telemedicine	Curriculum Design		Google Scholar	4,500
8	Telemedicine	Program Evaluation	Medical School	Google Scholar	6,000
9	Telemedicine	Program Evaluation	Nursing	Google Scholar	10,000
10	Self-Efficacy	Nursing Education		Google Scholar	100,000
11	Self-Efficacy	Physician Assistant Education		Google Scholar	16,900

Defining Telemedicine

Telemedicine is defined as the remote diagnosis and treatment of an individual through the use of technologies that enhance two-way communication (Mechanic & Kimball, 2020). Examples of telemedicine may include video or phone consultations, review of medical imaging in a multidisciplinary team, or asynchronous visits with a medical provider and the patient (Mechanic & Kimball, 2020). The primary goal of telemedicine is to increase access of

healthcare for patients to increase coverage so that individuals living in rural areas of the United States receive care (Mechanic & Kimball, 2020).

Telemedicine was first utilized in the late 1950s and early 1960s. A closed circuit television with secure connection was utilized for consultation appointments between the Nebraska Psychiatric Institute and Norfolk State Hospital (Mechanic & Kimball, 2020). Since June of 2020, there have been over 10.1 million telemedicine visits documented (CMS, 2020). There are several models in the ambulatory and hospital settings where telemedicine has proven to improve access to care and quality of healthcare especially in rural areas of the United States. Hospital models include providing stroke care, intensive care unit care, and surgical care with the use of telemedicine.

Overall, the delivery of healthcare is greatly changing in the United States, and it is not only important for policies to change to cover telemedicine as a service, but for education models to change to incorporate telemedicine training in medical programs.

Defining Telehealth

It is critical that telemedicine is distinguished from telehealth. The Health Resources and Services Administration (HRSA) of the United States Department of Health and Human Services defines telehealth to include a broader range of services for both clinical and non-clinical encounters that occur through the use of telecommunication technology (What is Telehealth, 2018). Telehealth includes administrative meetings, provider trainings, and continuing medical education. Thus, for this project, the telemedicine training being provided to PA students through telehealth technology is a form of medical education.

History

Prior to looking at how a PA student can benefit from telemedicine training, it is vital to understand the history of the PA profession and how a PA functions in the United States healthcare system. This section provides an overview of the PA role in the healthcare industry and how the PA profession was developed since the 1960s in the United States.

Physician Assistant (PA) Profession

A PA is a licensed medical provider who is qualified to gather medical histories, conduct physical exams, diagnose illnesses, order laboratory and diagnostic studies, develop treatment plans, and prescribe medications. PAs practice in every medical setting across all 50 states and internationally in 15 countries (Hooker et al., 2016). PAs work in several medical settings including hospitals, medical offices, health centers, nursing homes, retail clinics, educational facilities, workplace clinics, and correctional institutions. PAs also serve with the uniformed services and work for the federal government (Hooker et al., 2016). In 2019, there were almost 9,500 newly graduated certified PAs who joined the profession of 125,000 PAs nationwide and work in family/internal medicine and all the subspecialities (NCCPA report, 2019).

In their book, *Physician Assistants, Policy and Practice,* Hooker et al. (2016) provided a history of the PA profession. In 1898, The Naval Hospital Corps was formally established in the United States, which comprised of medics formally trained. Soon after, in 1925, midwifery was established in the United States. In the 1930s, Dr. Alfred Blalock trained a surgical technician named Vivien Theodore Tomas to assist him during surgeries. Another event that took place in the 1930s was the training of former military corpsman to serve as physician extenders for the federal prison system. In the 1940s, Dr. Amos Johnson trained Henry Lee Treader as a Doctor's Assistant to help him cover clinic. Well into the 1940s, Dr. Eugene Stead, known as the father of

the PA profession, noticed that there were not enough residents to help physicians to cover a medical service. Dr. Stead developed a fast-track 3-year medical curriculum at Emory University during World War II. In 1965, this fast-track program evolved into Duke University's PA program, the first PA program to exist in the United States. The PA curriculum closely modeled the medical school curriculum. The first class to graduate Duke's PA program occurred on October 6 of 1967. October 6 later became known as National PA Day and is recognized by national organizations. In 1970, Kaiser Permanente was the first Health Maintenance Organization (HMO) to employ PAs. In 1971, the AMA recognized the PA profession. In 1972, certifying exams were introduced so that PA's could obtain national certification. Later in the 1970s, Medicare started reimbursing PAs for the services that they provided in rural medical clinics. PAs were not recognized as Medicare covered providers in all medical settings until the Balance Budget Act was passed in 1997. The state of Mississippi was the last state to enact legislation in regards for PAs to practice medicine. In 2007, Indiana was the last state to pass legislation on prescribing rights for PAs. In 2011, the national certifying body added qualification exams that could be obtained 3 years after practice, which include cardiovascular and thoracic surgery, emergency medicine, nephrology, orthopedic surgery, psychiatry, and pediatrics. Currently, legislation is being revised to cover the services provided by PAs via telemedicine. This is vital as the way medicine is delivered in the healthcare setting is changing.

Telemedicine and the PA Profession

In 2018, the PAs in Virtual Medicine and Telemedicine (PAVMT) national organization was created to provide resources for PAs who are providing care via telemedicine and virtual modes. Due to the shift in healthcare provided, there is minimal data published on how many PAs work in telemedicine. However, PA recruitment for telehealth has exponentially increased

in the past couple of years especially with the development of subspecialized clinics and programs (Telemedicine Physician Assistant: Salary & Job Outlook, 2021). The U.S. Bureau of Labor and Statistics rated the job growth for telemedicine PAs at an increase of 31% for the next 10 years (Telemedicine Physician Assistant: Salary & Job Outlook, 2021).

First Telemedicine Program. The first time that the concept of telemedicine was introduced in a PA curriculum was in 2001 at the University of Iowa (Asprey et al., 2001). Asprey et al. (2001) developed and focused on four 2-hour didactic training sessions. These training sessions included history of telemedicine, digitizing the patient record, observation of a simulated teleconsultation, and demonstrating usefulness of telemedicine visits. A key finding of the study was that 15 out of 18 survey responses indicated that students had no to poor knowledge of the concept of telemedicine (Asprey et al., 2001). It was clear in this study that students did not have a good understanding of telemedicine and the application of telemedicine in the medical industry. However, PA students had a very positive outlook on learning about telemedicine and gaining experience as students. This was the only study identified that looked at the effects of integrating a telemedicine program amongst PA students, which was published 20 years ago. There has been minimal research on integrating a telemedicine clinical rotation in PA curriculum although there is significant growth associated with the profession and telemedicine.

Types of Telehealth Visits. Telemedicine can be performed via synchronous and asynchronous sessions to increase the access to the healthcare system for patients. A synchronous session is the current norm utilized in telemedicine. It is described when a patient is scheduled to see a provider via video conference over a secured network. For example, the Veteran Affairs hospital systems utilizes synchronous telehealth visits to manage individual care

for mental health (Abel et al., 2018). In comparison, asynchronous formats include technology based on the concept of "store and forward." An example of this is mobile health (Mechanic & Kimball, 2020). However, these solutions do not resolve every challenge. The issues that remain with the use of telemedicine include licensure, physical exams, and consent to treatment plans.

Other forms of telehealth include remote patient monitoring, mobile health, and healthcare internet connected devices otherwise known as IoT. Remote patient monitoring, or RPM, is when medical information is collected through the use of digital technology and sent remotely from the patient to the healthcare provider. Examples of RPM include blood pressure checks for hypertensive patients. Mobile health, or mHealth, is the use of applications to manage chronic conditions. Examples of mHealth include wearable devices, applications that help patients track their medication intake or treatment plan, and applications utilized to assess patient engagement in their care plan. Lastly, healthcare IoT is rapidly changing with the introduction of artificial intelligence.

Quality of Care. Quality of patient care is critical to ensure patient safety and provider intervention is to the level of evidence-based practice. There are several qualitative measures that are monitored for patient satisfaction scores including access to care. This is a critical measure to follow as one of the main purposes of telemedicine is to meet the Healthy People 2020 goal of increasing access to medicine for individuals living in the United States (Office of Disease Prevention and Health Promotion, 2020). Additionally, it is critical to have emergency protocols in place for patients needing emergent care when they are evaluated by a PA during a telemedicine visit (Champagne-Langabeer et al., 2019). Thus, a PA's role is not only to help increase access to care, but also provide a high standard of care so that patients are more willing to participate in telemedicine (Abel et al., 2018). One way to provide this is through continuous

follow-up for continuity of care to better help manage chronic disease through the use of telemedicine (Lunney et al., 2018). For example, if labs were ordered during a telemedicine encounter, it would be important for the PA to schedule a follow-up appointment to discuss the lab results. The PA could also refer the patient to a specialist for evaluation. With the latter option, it would be vital for the PA to follow up to see how the patient is doing.

Continuity of Care. Through telemedicine, patients would be able to connect to their care team through an integrated network without having to travel to each team member (Sinha et al., 2019). Telehealth services have shown to help decrease blood pressure and A1C levels in patients diagnosed with diabetes (Wu et al., 2018). However, patients who are being evaluated through telemedicine have shown a greater need of follow-up in terms of visits (Cannon, 2018). For example, patients with scheduled telehealth visits need at least six visits per year compared to patients seen in office who needed two visits for comparable results of reducing blood pressure and decreasing A1C levels (Luo et al., 2017). Telehealth interventions can also provide the same emotional support for cancer patients as would occur in in-person encounters, which is reassuring to note in terms of quality of patient care (Larson et al., 2018). Additionally, through the use of telehealth follow-up visits, medication refills can be filled in a timely manner so that there is no gap in care provided to the patient (Badowski et al., 2018). Lastly, telehealth can be utilized to coordinate care for patients needing surgeries. Pre-op and post-op appointments, for example those needing or having a kidney transplant, could be completed through the use of technology instead of having to transport to the clinic for a simple evaluation (Forbes et al., 2018). Overall, it is the PA's responsibility to ensure coordination of care and the use of telehealth can help manage a patient's chronic disease through team-based medicine.

Theoretical Framework

There are several theories that provide a theoretical framework for this research. Education theories of cognitivism and andragogy were utilized for curriculum design.

Findings from Past Research Studies

Past research studies defining common theories have been applied to this research by identifying curriculum designs that have been integrated in medical and nursing programs identifying validated evaluation tools that have been utilized. Lastly, gaps in the literature and future impacts of this research will be discussed.

Common Theories

Education theories of cognitivism were utilized to approach the curriculum design. The pre- and post-test surveys were developed through a utilization-focused approach and focus on the theory of self-efficacy.

Cognitivism. The theory of cognitivism was developed over 50 years ago and states that students learn through study and application (Knowles et al., 2015). Thus, it is important to define the application of the program and its translational outcomes within the framework of the program with the students that will be evaluated through the post-test evaluation survey (Knowles et al., 2015). With this theory, inclusion of why there is a need to learn how to provide medical care through a virtual platform should be assessed in the pre-test and post-test surveys.

Shaker (2018) discussed the use of cognitivism and its application towards developing surgical skills amongst residents. There are five critical components to the theory of cognitivism, which include attention, perception, concept formation, memory, and learning. Attention refinement is one of the components of the theory of cognitivism, which was focused on in this study for students to learn surgical skills. Attention refinement is a critical concept to develop

new skills as this helps parse information that is needed to develop a skill from detracting information (Shaker, 2018). Although there is minimal research on attention refinement and telemedicine skills, the theory of cognitivism was one of the driving forces to ensure students had the opportunity to apply what they had learned during the training session, which was evaluated on the pre- and post-test survey tools.

Self-Efficacy Theory. The theory of self-efficacy was proposed by Bandura in 1977 in which he stated that individuals should have the opportunity for self-evaluation to determine their ability to perform key skills such as clinical skills (Bandura, 1977). The pre- and post-test evaluation surveys focused on the theory of self-efficacy as students were asked to rate themselves in their comfort with the use of telemedicine. Students had the opportunity to identify a change in their strengths and weaknesses with the use of telemedicine before and after the curriculum by completing the pre- and post-test evaluation.

The self-efficacy theory is closely related to the social cognitive theory, which focuses on a triad of person, behavior, and environment (Resnick, 2008). Additionally, it has been suggested that an individual's perception of their ability is based on direct experiences, vicarious experiences, feedback from others, and inferences. Thus, it is critical to keep these components at the forefront of pre- and post-test evaluation survey development to assess outcomes (Resnick, 2008). Self-efficacy measures are a common way to identify clinical skill competencies amongst nurses and nursing students (Resnick, 2008).

Focus on Evaluation of Self-Efficacy

Self-efficacy is defined as one's ability to perform a task or an action with commitment and confidence (Masoudi, 2014). For nursing students, it is critical to assess self-efficacy and focus on how the students feel in regard to their competency of completing a task, which helps

build confidence. Thus, students should receive up-to-date information to empower them to practice medicine and provide the best care possible (Masoudi, 2014). Additionally, self-efficacy has been associated with high performance, which is a requirement in medicine so that patient safety is kept at the forefront (Zhang et al., 2015).

A pre-test-post-test two-group design was utilized amongst 87 didactic year PA students to measure self-efficacy before and after a team-based learning event (Loftin et al., 2017). The students' level of confidence in critical thinking skills and self-efficacy scores was statistically higher for the group who participated in the team-based learning activity compared to the group that did not receive the team-based learning activity. A modified self-efficacy general survey was utilized to measure self-efficacy amongst students (Loftin et al., 2017). As seen in the sample survey tools in the previous section, it is critical that there are self-efficacy components integrated in the pre- and post-test evaluation surveys.

Curriculum Design Utilized by other Medical Professions

Components of telemedicine curriculum should include ethical, legal, and regulatory implications (Jumeroernvong et al., 2020). Not only should curriculum deal with preparing students on how to utilize telemedicine technology, but it should also focus on limitations to ensure patients are getting adequate care (Jumeroernvong et al., 2020). Pourmand et al. (2021) looked at 104 American College of Graduate Medical Education (ACGME) residency specialty milestones to identify if any aspects of telemedicine are incorporated in the milestones for residents. Only one specialty, Child and Adolescent Psychiatry, had residency milestones associated with telemedicine that was documented (Pourmand et al., 2021).

Kirkland et al. (2019) defined a 3-year longitudinal curriculum for internal medicine residents to meet the technology training needs for physicians. The training included history of

telemedicine, completion of online modules on how to communicate and perform a physical exam, and experiential learning. Overall, residents reported increased knowledge of the use of telemedicine and improved comfort and perceived ability to provide telehealth services (Kirkland et al., 2019).

Another study focused on defining nursing competencies in development of telehealth education. In this Delphi-study, 51 experts selected 32 nursing competencies that were considered as essential for providing telehealth visits (van Houwelingen et al., 2015). These competencies revolved around knowledge of the technology used and communication skills. One specific competency that was listed is knowing how to ease patients of their concerns with the use of technology (van Houwelingen et al., 2015). The previously mentioned studies were considered while developing curriculum design for integration of telemedicine.

Research of Validated Evaluation Methodologies

A review of the literature identified three validated rating scale surveys that were revised for consistent phrasing and combined for use as pre- and post-test measures. A 3-, 4-, and 5-point rating scale was utilized in the validated surveys mentioned below.

The first survey tool was developed by List et al. (2018), who studied the integration of a telemedicine curriculum in a nurse practitioner program based on a pedagogical approach. Questions were based on a 4-point Likert scale, which was utilized to assess the introduction to telemedicine to nurse practitioner students. The 4-point Likert scale was represented by numbers including 1 for lowest level of confidence and 4 for the highest level of confidence. The survey questions included:

1. I can define telehealth.
2. I can identify how telehealth may improve patient outcomes.

3. I can cite examples of telehealth in nursing education.
4. I can use telehealth technology in FNP practice environments.

The second survey was developed by Sartori et al. (2020), who developed an evaluation tool to measure specific skills and identify gaps in a telemedicine program for a medical residency program. Questions were based on a 3-point scale with descriptors of not done, partly done, and well done. The questions in this survey included:

1. Comfort with confirming patient identifiers.
2. Comfort with identifying nonverbal communication to enrich communication via camera.
3. Comfort with optimizing technical aspects of the virtual encounter.
4. Confidence with utilizing video interface.
5. Utilization of live video to augment information gathering.
6. Development of partnership with patient to perform physical examination.
7. Comfort with appropriate computer etiquette during the video encounter.

The third survey was developed by Kirkland et al. (2019), who studied the effects of a general internal medicine 3-year telemedicine curriculum on students' perceived proficiency. An online curriculum was delivered, and the following survey questions based on a scale were utilized to determine the students' perceived proficiency with telemedicine. The scale included five options: nonexistent, limited, average for someone in the health professions field, knowing more than the average person in the health professions field, or expert level. The questions included:

1. Ability to utilize telehealth in future practice.
2. Knowledge of the history of telehealth.

3. Comfort determining how telehealth improves patient access.
4. Ability to explain how telehealth applications have contributed to healthcare.
5. Comfort determining how telehealth improves quality of care and communication.
6. Telehealth is essential to future practice.

Overall, these validated tools have been combined for program evaluation and are appropriate for this study. Further, a focus on self-efficacy and confidence levels with the use of telemedicine will be included in the combined evaluation tool for this study.

Best Practice Online Delivery Methods

Overall, designing online curriculums or programs has proven to be more challenging than in-person teaching. Martin et al. (2019) evaluated eight online award-winning faculty to understand the process of curriculum development. They concluded that an effective online course requires three steps, which include design, facilitation, and assessment (Martin et al., 2019). Richards indicated the importance of a backward curriculum design (2013). A backwards curriculum design starts off with specifying learning outcomes and then defining the methodology (Richards, 2013). Interestingly, this was a common element used amongst the award-winning faculty in the study described by Martin et al. (2019). Another core element that proved success amongst the faculty was a module-based format for the curriculum. It is important to design a curriculum with meaning through modulation so that students understand where they are in the process of learning a concept (Martin et al., 2019).

Next comes meeting the learners' needs through facilitation (Martin et al., 2019). In such a critical time in society, it is important to understand the student population that is being taught. For example, it is important to identify the student population's key characteristics, such as if they are working full time, if they have access to technology, or if they have pressing

commitments that will take away from their performance in a course (Dhawan, 2020). Thus, it is critical to identify such characteristics while developing the curriculum such that the timing of the curriculum does not hinder the ability of a student to learn new concepts. Lastly, assessment and evaluation are key to identifying what parts of the curriculum need modification and what parts performed well (Martin et al., 2019). One strategy of evaluation is through the utilization-focused approach, which is heavily used in evaluation assessments for medical programs. The utilization-focused approach was first described by Patton. With the utilization-focused approach, it is critical that the program is meeting the needs of students (Patton, 2008). Another critical component in the assessment process that was highlighted by Martin et al., 2019 was self-assessments and reflection. Raupach et al. (2011) discussed defining teaching effectiveness through comparative pre- and post-self-assessments of students. The authors validated that self-assessments are a valid tool to evaluate specific learning outcomes (Raupach et al., 2011). Thus, it is critical for design, facilitation, and evaluation to occur for a curriculum or program to be effective and successful.

Best Practices for Zoom Teaching Sessions

Brainard and Watson (2020) evaluated the value of Zoom online learning compared to face-to-face classes. Just over 70% of survey participants stated that they liked utilizing technology such as Zoom as a part of their education (Brainard & Watson, 2020). Several students stated that they would rather connect remotely through Zoom compared to having to go to lecture physically. Overall, students thought that a virtual mode of communication was a critical element to include in their remote learning.

Several universities have developed a checklist on how to hold an effective Zoom session online. First off, it is critical for the instructor to understand all the functions of Zoom and how to

provide access to students if they will need to access features, such as screen sharing. Second, it is key to discuss online course expectations while in class via Zoom (i.e., methods to ask questions, break sessions, etc.). Another important thing for professors to keep in mind while conducting a Zoom session is to monitor student engagement throughout the session. The method by which the material is delivered may require modification based on student engagement. It is critical to utilize active learning to help engage the students (Columbia Center for Teaching and Learning, 2020).

Benefits of Breakout Sessions

Breakout sessions have proven to be beneficial to build a collaborative learning environment during synchronous online sessions (Chandler, 2016). Additionally, through breakout sessions, students have the ability to contribute to the session in greater depth compared to a larger group setting. Active student participation is key to meet the learning objectives of any given curriculum. Not only do breakout sessions promote student learning, but they also promote student engagement in how to apply the material learned (Singhal, 2020). A study looked at comparison of assignment scores based on content delivery in an in-person classroom setting and Zoom-based learning via breakout sessions. It was concluded that there was no significant difference in assignment scores based on in-person and virtual learning (Singhal, 2020). Thus, Zoom-based learning is an effective teaching method.

Strategy of Curriculum Design and Evaluation

A logic model provided a theoretical framework for designing and implementing the telemedicine curriculum for PA students, which parallels with best practices of an online curriculum development. Additionally, pre- and post-test surveys were developed through a utilized-focused approach to ensure the curriculum was not only meeting the learning objectives

but also meeting the student's learning goals described in the free response question in the pre-test survey tool.

Logic Models

Logic models are frequently used to develop and guide the planning, implementation, and evaluation of curricula (Using Logic Models, n.d.). This research project focused on the use of logic models for program design and the program evaluation process. First a list of resources was developed to identify those that can be utilized for delivery of pre- and post-test survey links. For example, the students must be able to readily access their emails and utilize Qualtrics™ survey links to complete the pre- and post-test evaluation surveys. The survey may need to be available with a voice over for student accommodation. Overall, the planning and implementation stage of the pre-test and post-test survey is important to evaluate the telemedicine curriculum.

Historically, logic models provide a visual snapshot of a curriculum, which shows the activities planned, outputs, and outcomes (Balmer et al., 2019). Additionally, logic models can be used to reassess the curriculum through feedback received and identify areas that require improvement through the use of a post-test evaluation survey. Logic models can be used to improve educational outcomes and social outcomes based on evaluation response (Anderson et al., 2011). In addition, logic models can be used to illustrate systematic reviews and identify mediators and moderators, specify intermediate outcomes, and look for any potential negative effects during a review process (Anderson et al., 2011).

Utilization-Focused Approach

In medical training, pre- and post-surveys commonly follow the utilization-focused approach. The guiding principle of Michael Quinn Patton's utilization-focused approach is to evaluate whether the program is meeting the needs of training (Patton, 2008). Additionally, in

using the utilization-focused approach, the evaluation process may build a pathway for program improvement while focusing on the student's perspective (Patton, 2008).

The utilization-focused approach is utilized in medical education through evaluation tools. A pre-test assessment helps identify the student's level of comfort with regard to specific competencies in a clinical setting prior to specific training (Vassar et al., 2010). Additionally, the evaluation process is defined based on the learning outcomes of a curriculum and its relation to the competencies developed. Thus, the utilization-focused approach is a guiding principle for medical education through pre- and post-surveys.

Skill Development for Providers Utilizing Telemedicine

With the dynamic shift of the use of telemedicine due to the global pandemic, a Delphi study looked at what skills are needed to provide high quality care to patients in a virtual setting. Galpin et al. (2020) identified nine domains comparable to skill sets that providers should have to practice telemedicine. These domains include patient and practice readiness for change, remote clinical evaluation, communication utilizing telehealth, professionalism, information technology, privacy and legal aspects of virtual care, ethics, patient safety, and access and equity (Galpin et al., 2020). Further, the authors indicated that the Association of American Medical Colleges will develop competencies based on these domains for medical students and residents to gain during their training.

A key domain expanded on by Morony et al. (2018) was enhancing communication skills amongst providers utilizing telemedicine to compensate for the lack of visual cues that may not be captured on the screen. The authors focused on analyzing the development of the teach-back method amongst nurses, as this method is considered as one of the best practices for communicating with patients (Morony et al., 2018). Overall, nurses had the opportunity to

develop this skill through self-reflection, focus groups, and interviews. The nurses reported that actively self-reflecting on their interactions was very helpful in developing teach-back communication skills.

Iancu et al. (2020) concluded that providing care through the use of telemedicine requires a unique skillset. These include physical exam skills and communication skills. Iancu et al. (2020) recommended that all medical schools integrate competencies for students to learn how to perform a physical examination virtually. In the current state, there is a lot of time spent for students to practice physical exam technique in person and the authors recommended the same amount of time be spent to learn how to do a proper physical exam virtually (Iancu et al., 2020). Additionally, they emphasized the importance of developing the provider-patient relationship through developed communication skills.

Another aspect to consider is consenting for treatment in a virtual setting. A consent to treat should be documented by all PAs prior to proceeding with a telehealth visit (Balestra, 2018). Patients should consent to any technological applications that will be utilized during the visit prior to forwarding the patient information through technology (Watzlaf et al., 2017). Similar to when performed in a clinical setting, PAs should confirm the patient via two patient identifiers while using telemedicine technologies. Additionally, to set patient expectations of a telemedicine visit, PAs should review the limitations of the telemedicine encounter with the patient. Information regarding security measures should also be discussed with the patient along with risk of privacy concerns while using telemedicine technologies (Watzlaf et al., 2017). Additionally, standards and policies of electronic programs utilized during telemedicine visits should be held at the same standard as in-person visits (Young et al., 2019). For example,

prescribing patients with an e-prescription should follow the same standards as the use of electronic medical records when a patient is seen in the clinic (Badowski et al., 2018).

Overall, these findings guided the development of the 4-hour telemedicine program developed for PA students at RUC. The curriculum focused on the history of telemedicine and how to provide high quality care in the virtual setting, discussed how to perform a physical examination in the virtual setting, and learned how to identify nonverbal cues in the virtual setting to really be enabled to provide the medical attention a patient needs.

Content Delivery Methods

Problem-based learning (PBL)/Case-based learning (CBL). PBL, otherwise termed CBL, is a teaching-learning method where a group discussion of clinical cases helps students acquire medical knowledge and clinical skills. PBL, which is an alternative to the traditional lecture-based learning (LBL) methodology, is a self-directed teaching-learning method where patient cases are used to stimulate hypothetico-deductive reasoning and collaboration-based independent study (Vernon & Blake, 1993). There are numerous advantages of incorporating PBL into a medical program (Van Rhee et al., 2003). Students have the opportunity to develop strong analytical and clinical reasoning skills. Since most clinical cases correspond to real-life medical problems, students are forced to integrate knowledge from varied disciplines including social psychology and human behavior apart from just applying clinical science. PBL encourages students to take responsibility for their own self-directed learning, which promotes a lifelong learning ethic along with the collaborative skills required to work effectively in teams.

In group learning, learners are actively engaged in working at tasks and activities that are authentic to the environment in which they would be used, and learning is synthesized and organized in the context of the problem. Using data from a 3-year retrospective study comparing

reiterative PBL (R-PBL) to LBL curriculums, it was observed that students in R-PBL perform as well or better on curriculum-based metrics as well as in basic or clinical science knowledge acquisition (Distlehorst & Robbs, 1998).

The key levels of the knowledge structure, including understanding of concepts, understanding of the principles that link concepts, and linking of concepts and principles to conditions and procedures, must be targeted by PBL (Gijbels et al., 2005). Using video and audio recordings of second year medical students, it was demonstrated that verbal interactions after PBL helps with theory building and stimulation recall of the thinking process helps with meta-reasoning and conceptual change (De Grave et al., 1996). PBL enhances intrinsic interest in the subject matter and may enhance both transfer of concepts to new problems and integration of basic science concepts into clinical problems.

Lecture-based learning (LBL). Although studies suggest there are advantages to PBL/CBL structured curriculum components, there are still advantages for LBL. The analysis of data from knowledge and clinical skill assessments as well as multiple choice questionnaires acquired from a 5-year study of PA students at Western Michigan University indicated that PBL scores were significantly greater than LBL scores only in the psychiatric organ system category while LBL scores were significantly greater for the clinical therapeutics skillset (Van Rhee et al., 2003; Wardley et al., 2013). Dahle et al. (2002) suggested that vertical integration of material through LBL must occur with horizontal integration of teaching through PBL. The advantages were seen in an undergraduate medical curriculum where students had the ability to understand complex biomedical pathways with knowledge retention (Dahle et al., 2002). Thus, consideration of both of these strategies must be considered during curriculum design and development.

Pros and Cons of Pre- and Post-Evaluation Surveys

Pre- and post-test evaluation surveys were utilized for this exploratory experimental study design. This strengthened the data analysis for this study. Shuttleworth (2009) described the importance of a pre-test evaluation as a means to obtain a baseline of a student's self-efficacy so as to assess any change in a student's perception when compared to the post-test evaluation survey. This will help determine how effective the telemedicine program is based on post-test evaluation data. However, pre-test surveys can also sensitize the participants of the study by revealing what topics will be covered in the telemedicine curriculum (Shuttleworth, 2009). Thus, there may be an increase in self-perception on the post-test survey because participants are paying attention to those critical components during the delivery of the telemedicine program. Overall, there will be strong internal validity and poor external validity with this method; however, this is appropriate for this pilot study design.

Gaps in the Literature

A review of the literature provided insight into the importance of integrating a telemedicine curriculum in PA programs and utilizing a validated pre- and post-test evaluation tool to analyze the effects of a telemedicine program. The literature provided a precedent for the introduction of telemedicine in medical, residency, and nursing programs, but there is a gap in identifying how training in telemedicine should be evaluated among PA students. Findings from this research will help identify whether students perceive themselves to be more competent in providing care through the use of telemedicine after completing a telemedicine program. Additionally, there is not one validated tool that can be utilized to evaluate a telemedicine curriculum delivered to PA students. Overall, this study utilized a combined approach to use survey tools that have been validated for evaluation of a telemedicine program through a pre-

and post-test evaluation survey. The pre- and post-test evaluation tool measured self-efficacy and understanding of how telemedicine is used in medical practice. Overall, this study identified a telemedicine curriculum for PA students and provided an evaluation tool to measure the effects of the curriculum on self-efficacy and understanding of telemedicine in medical practice.

Chapter Three

Methodology

The purpose of this study was to design and evaluate the effectiveness of a 4-hour telemedicine program for PA students attending RUC. First, a telemedicine program for PA students was developed. Then a pre-test evaluation survey was administered to determine students' prior knowledge and areas of interest. Then, the telemedicine program was delivered. Finally, a post-test evaluation survey was administered to evaluate the effectiveness of the telemedicine program.

The methodology used for this study is described in this chapter, including the study design, IRB approval, the target population and sample size, instrument used, and the curriculum design, development, and delivery. Finally, the processes used to collect and analyze data are provided.

Study Design

The choice of study design for this project was a pre- and post-test exploratory study. The study was designed to answer the following research questions:

1. Does a training session in telemedicine significantly change PA students' ability to define telemedicine and cite examples of telemedicine in practice?
2. Doe a training session in telemedicine significantly change PA students' perception of their ability to conduct a virtual healthcare visit?
3. Does a training session in telemedicine significantly change PA students' perception of self-efficacy utilizing telemedicine in their future practice (i.e., optimizing technical aspects, utilizing a video interface, and comfort with appropriate computer etiquette)?

4. Does a training session in telemedicine significantly change PA students' perception of telemedicine's impact on quality of care?

IRB Approval

This proposal was submitted along with an application to RUC Institutional Review Board (IRB) after proposal approval from the DHSc committee on May 17, 2021. A project description was submitted to the RUC IRB Committee with agreement that this proposal will be reviewed under an expedited review category per email communication (see Appendix G). An xFORM was completed via the IRB Review portal through OneCampus software. This project was submitted in the minimal risk category for expedited review. Requested documents and changes were made as recommended by the IRB Review Board. IRB approval was obtained on June 16, 2021.

Target Population

The target population of this study included all students enrolled in a PA program. For this particular study, the sample population consisted of 41 students who had successfully completed their didactic year and were currently enrolled in supervised clinical practice experiences at the RUC PA program.

Sampling Method. A form of nonprobability sampling method, convenience sampling, was utilized for this study since the RUC PA program was accessible to the researcher. The downside of convenience sampling is that the number of survey responses may be undiscernible for data analysis. However, this type of sampling works well for exploratory research.

Inclusion. The primary inclusion criteria for participating in this study was that a student must be enrolled in the RUC PA program and must be in their clinical year. Participants must reside in the United States and were a minimum of 21 years of age. In addition, all students had a

bachelor's degree since it is a requirement for admission into the RUC PA program. The inclusion criteria were met for all participants of the study and all surveys were be incorporated in the data analysis.

Exclusion. PA students enrolled in the RUC PA program didactic year study were excluded from this research study. Additionally, former students were not able to participate in this research study.

Sample Size. A power analysis was considered for this study. However, since the sample size was relatively small for this exploratory study, we aimed for the highest survey return and analyzed for statistical significance. Overall, a total of 41 students completed the telemedicine training program of which 37 students (90.24%) completed the pre-test evaluation survey and 36 students (87.80%) completed the post-test evaluation survey. The data that was matched for the ANOVA analysis consisted of 63.41% of the responses. Due to the high number of survey responses needed for this study, an incentive of a $50 Amazon gift card was provided for students who completed the pre-test evaluation survey, the telemedicine program, and post-test evaluation survey. A random drawing for the $50 Amazon gift card occurred 4 weeks after the telemedicine curriculum was delivered.

Variables

Both independent and dependent variables were identified for this study. The predominant independent variable was the delivery of the telemedicine curriculum. The dependent variables were based off of the pre- and post-test survey questions found in Appendix K and L. Appendix M outlines a codebook including the variable name associated with the survey question, value definition, and data type. Overall, 18 variables were mapped out to the research questions asked for this project to test the four hypotheses defined in Table 1.

Instrumentation

Questions from three validated survey tools (Kirkland et al., 2019; List et al., 2018; Sartori et al., 2020) were modified for consistent phrasing and used with permission from the authors to develop the pre- and post-test surveys for this research study. The original survey questions were based on varying scales based on a 3-point evaluation scale, a 4-point evaluation scale, and a 5-point evaluation scale. For consistency amongst rating scales, all questions in the combined survey were based on a 5-point Likert scale with numbers 1, 2, 3, 4, and 5. The first survey tool was developed by List et al. (2018), who studied the integration of a telemedicine curriculum in a nurse practitioner program based on a pedagogical approach. The second survey was developed by Sartori et al. (2020), who identified an evaluation tool to measure specific skills and identify gaps in a telemedicine program for a medical residency program. The third survey was developed by Kirkland et al. (2019), who studied the effects on a student's proficiency in telemedicine based on a general internal medicine 3-year telemedicine curriculum after delivery of an online curriculum.

Wording of questions that were changed include combined survey question numbers 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, and 14. The wording of these questions was changed to provide consistency with how the questions were asked in the survey. All the survey questions have the same starting word to improve readability. The 11 questions in which the wording changed at the beginning of the sentence include the following:

4. I feel comfortable with confirming patient identifiers.
5. I feel comfortable with identifying nonverbal communication to enrich communication via camera.
6. I feel comfortable with optimizing technical aspects of the virtual encounter.

7. I feel confident with utilizing video interface.
8. I feel comfortable utilizing live video to augment information gathering.
9. I am comfortable reviewing consents with a patient via telemedicine.
10. I feel comfortable with developing a partnership with the patient to perform a physical examination.
11. I feel comfortable with appropriate computer etiquette during the video encounter.
12. I have the ability to utilize telehealth in future practice.
13. I have the ability to explain how telehealth applications have contributed to healthcare.
14. I understand how telehealth is essential to future practice.

Survey Validation Methods

There were several processes described by the authors of the three validated survey tools utilized in this study. List et al. (2018) utilized a knowledge survey to analyze a change in student's confidence level in providing care through the use of telemedicine. The knowledge survey items were validated based on established expert knowledge and content review of prior research. Additionally, the survey items were reviewed by experts of the field (List et al., 2018).

Sartori et al. (2020) based their objective structured clinical examination (OSCE) tool on the graduate medical education OSCE tool that is commonly utilized for in-person patient encounters. The OSCE tool developed for telemedicine was utilized in several case scenarios throughout the academic year including a video visit with a standardized patient and 3 hours of assessment-specific instruction (Sartori et al., 2020). The domains focused on the evaluation tools, which is in congruence with OSCE evaluation tools. These domains included information gathering, relationship development, education and counseling, and telemedicine skills (Sartori

et al., 2020). The telemedicine-specific assessment items of the evaluation tool were developed by clinicians who directly observed virtual visits and interviewed clinicians who provide care through telemedicine. Additionally, the telemedicine skills were similar to the skills described by Cantone and colleagues (2019). The particular telemedicine-specific skills that were mirrored in both studies include optimizing technical aspects of a visit, maintaining eye contact throughout the visit, describing to the patient when documenting or looking at another screen, and having a backup plan for technological difficulties (Sartori et al., 2020). The authors also discussed that these telemedicine specific assessment items matched with nursing telehealth activities and the American Telemedicine Association (American Telemedicine Association, 2020; van Houwelingen et al., 2016). Lastly, a 3x3 Pearson's chi square statistical test was used to correlate the data obtained with any associations of type of training and telemedicine competencies.

Lastly, Kirkland et al. (2019) derived their survey tool from a validated undergraduate graduate health professional tool that was utilized in interprofessional telehealth team courses for 5 years. Additionally, some of the components of their survey came from a needs assessment that they collected from attendees of the internal medicine program (Kirkland et al., 2019).

Pilot Questions. A pilot set of questions was also included in the pre-test and post-test evaluation survey, which have not been validated. These included:

1. I understand how telemedicine is utilized in the healthcare industry.
2. I am comfortable performing a telemedicine visit as a future clinician.
3. I am confident in my communication skills with patients through the use of technology.
4. I understand how to bill for telemedicine visits.
5. I am comfortable performing a physical exam through the use of telemedicine.

6. I am comfortable reviewing the treatment plan with the patient.
7. I am comfortable reviewing consents with a patient via telemedicine.
8. Overall, I think having telemedicine integrated in the PA curriculum is beneficial.

Curriculum Design and Development

The purpose of the virtual telemedicine curriculum was to provide PA students fundamental skills and foundational content to practice telemedicine during their clinical year of training. Core education values include equality, respect, commitment, and hard work. The goal was to build a virtual classroom environment through active student participation and motivate students to learn through group work and reflective thinking throughout the 4-hour curriculum. This section reviews the program outcomes, learning objectives, components of the curriculum, and preparation of content material.

Program Outcomes

The telemedicine curriculum was designed to provide PA students with the knowledge and ability to feel comfortable while providing care via telemedicine through lectures, group-based work, and a case base analysis. Specific program outcomes included:

1. Ability to define telemedicine and cite examples of telemedicine in practice.
2. Ability to conduct a virtual healthcare visit.
3. Demonstrate comfort utilizing telemedicine in their future practice.
4. Demonstrate understanding telemedicine's impact on quality of care.

The telemedicine curriculum's learning objectives discussed in the section below was mapped out to the program outcomes. The learning outcomes of the telemedicine curriculum can also be found in Appendix B.

Learning Objectives

The learning objectives were based on the program outcomes of medical knowledge, interpersonal and communication skills, patient care, professionalism, practice-based learning, and systems-based practice. The learning outcomes of the training program included:

1. Develop understanding of telehealth and how telemedicine is utilized in the healthcare industry.
2. Identify how telehealth may improve patient outcomes.
3. Develop fundamental skills to provide high quality medical care using telemedicine.
4. Develop physical examination skills via a virtual mode.
5. Describe when to see patients in-person versus continuing the visit via telemedicine.
6. Develop communication skills to aid the conversation in a virtual setting.
7. Describe how to bill for telemedicine visits.

Components of the Curriculum

The 4-hour telemedicine program was split into three modules for good outcomes of curriculum delivery. The content was delivered via a module-based format based on the literature review findings. The title of the modules included: 1) Introduction to Telemedicine; 2) Physical Examination Techniques; and 3) Billing and Case Based Scenarios. These modules were formulated based on review of other telemedicine curriculums that were delivered to medical students, internal medicine residents, and nurse practitioner students. A list of the modules and components can be found in Appendix E.

Curriculum Development through a Logic Model

A logic model was utilized to evaluate the inputs (i.e., student, faculty moderators, technology and equipment, time, and incentives), outputs (i.e., training program, learning

outcomes), and outcomes (i.e., learning, clinical skills, practice, behavioral change, and decision making) of the telemedicine program. The program was delivered virtually on June 25, 2021 from 1:00 PM EST to 5:00 PM EST.

The inputs of the logic model (see Appendix D) were reviewed with the RUC program director during the presentation of the proposal for this project that took place on May 10, 2021. Faculty and staff moderators included the Director of Clinical Education at RUC, who provided a quick introduction to the topic and speaker, and the Clinical Resource Coordinator, who was present during the telemedicine training program to assist with technology needs such as creating breakout rooms and sharing links in the chat box. Technology utilized included Zoom, which was the electronic platform utilized to deliver the telemedicine platform, Poll Everywhere, which was an engaging tool utilized to answer questions throughout the presentation in real time, and Qualtrics™, which was utilized for pre-test survey and post-test survey evaluations. Additionally, the RUC IRB Committee approved the utilization of one $50 Amazon gift card drawing for students who completed the pre-test survey evaluation form, attended the telemedicine program, and completed the post-test survey evaluation form.

The curriculum modules were developed based on the program outcomes and learning objectives formulated for the telemedicine program. Further discussion of how the curriculum was developed for the telemedicine program will be discussed in the Content Preparation section below. After the curriculum was delivered, a web-based post-test survey was utilized to evaluate the student's confidence level with various aspects of telemedicine. The post-test evaluation survey was based on validated survey tools along with newly designed questions to test the stated hypotheses in Table 1. The post-test survey questions were the same questions that

students answered in the pre-test evaluation with the exception of the qualitative component in the pre-test survey.

For students who completed the pre-test evaluation survey and did not complete the post-test evaluation survey, two weekly reminders were emailed. A draft of the weekly survey reminder can be found in Appendix J. Overall, the data collection period occurred 1 week prior to the telemedicine program delivery and 3 weeks afterwards. The study design, survey tools, and project execution were reviewed and approved by the IRB at RUC on June 16, 2021. A copy of the IRB approval email can be found in Appendix I.

Content Preparation

In preparation of the content of the telemedicine curriculum, contact was made to a representative at MomentMD per the recommendation of the PA Program Director on March 10, 2021. MomentMD is a telemedicine platform that provides care to patients virtually. They recently started accepted clinical year students for telemedicine rotations in a number of specialties. Additionally, MomentMD has lecture series opened to students to learn more about telemedicine. A virtual meeting was scheduled on May 6, 2021 to discuss critical topics to cover for students in training to perform well during a telemedicine clinical rotation. Key skills discussed included obtaining a thorough history from the patient via telemedicine, completing the physical exam via telemedicine, and discussing the assessment, plan, and next steps with patients for continuity of care.

In the interim, additional resources reviewed included completing courses titled "Telehealth Foundations" and "Patient Encounters in Virtual Medicine" provided by PAs in Virtual Medicine and Telemedicine, which was a 5-hour training session. In addition, telemedicine education provided by Johns Hopkins for providers was reviewed and a checklist

was incorporated and reviewed with the students at the end of the telemedicine program. A 6-hour “Telemedicine Basics” course created by Mayo Clinic was completed. Lastly, several articles published by Stanford providers were reviewed on topics such as the Presence 5 and the C-I-CARE model. Components of these resources were utilized and incorporated into the three modules of the telemedicine program.

Prior to the delivery of the telemedicine program, the program was reviewed by Dr. Lisa Allison-Jones and Dr. Nicely on June 17, 2021 for content. Suggested changes included reviewing “housekeeping” rules with the students prior to the presentation to keep the students engaged during the program. Additionally, changes were incorporated based on the students’ feedback obtained in the pre-test survey evaluation in regard to what topics they would like to cover during the telemedicine program.

Prior to Curriculum Delivery

This section will review the recruitment process of this study, discuss the participant time commitment, how the pre-test evaluation survey was administered, and discuss topics that students indicated they would like to cover in the telemedicine training program.

Recruitment

An introductory letter to the study was emailed by the RUC PA program director on June 18, 2021. The email was sent to the 41 clinical year PA students enrolled at the RUC PA program. The introductory email included the study description, link to the pre-test survey evaluation, and consent to participate. The introductory email was titled, “You’ve been selected to participate in a research study.” The first part of the email discussed the purpose of the study. The second part discussed the pre-test and post-test evaluation process. The third part of the

email discussed information regarding the incentive to participate in the study. A draft of the email that was sent to the students by the Program Director can be found in Appendix F.

Participant Time Commitment

As indicated in the introductory email, the students were informed that the pre-test and post-test surveys should take no longer than 20 minutes to complete. The telemedicine program was scheduled as a 4-hour program. Overall, participants were asked to commit 5 to 6 hours of their time to participate in this study.

Administration of the Pre-Test Evaluation Survey

An electronic platform, Qualtrics™, was used to deliver the pre-test evaluation survey to students. The survey tool was based on a 5-point scale. The 5-point scale descriptor include strongly agree (5), agree (4), neither agree or disagree (3), disagree (2), and strongly disagree (1). Each question was associated with this particular rating scale. A copy of the pre-test evaluation form can be found in Appendix K.

Research participants were encouraged to complete a web-based pre-test survey 1 week prior to the telemedicine program delivery date, which was June 25, 2021. In addition, students were given 15 minutes to complete the pre-test evaluation survey prior to content delivery of the telemedicine program on June 25, 2021. Overall, there were 37 responses received and the pre-test survey was closed on June 25, 2021 prior to content delivery. Additionally, the pre-test survey provided data regarding the initial understanding of the use of telemedicine amongst clinical year PA students.

Open-Ended Comments from the Pre-test Evaluation Surveys

The pre-test survey had a qualitative component that helped identify specific topics that PA students would like to review during the telemedicine program. Table 3 shows the topics that

students would like to see covered in a telemedicine program. Overall, there were 34 open-ended responses. Of these responses, 24 responses included focusing on how a physical examination process differs in a telemedicine setting, 15 responses included some discussion of billing aspects of telemedicine, and there were four responses focusing on the various applications that can be utilized to enhance a telemedicine visit and limitations of a telemedicine visit.

Table 3

Student Response Categories for Topics to be Covered in the Curriculum

Open-Ended Comment Category	Number of Responses
How to perform a comprehensive physical examination via telemedicine.	24
Billing aspects of telemedicine.	15
Discuss limitations of telemedicine versus an in-person visit.	4
Defining telemedicine and its utilization.	1
Reviewing applications utilized with telemedicine care delivery.	1
ENT topics	1

Curriculum Delivery

Module Delivery Methods

As seen with the module descriptions, there were several components to the curriculum, including a PowerPoint presentation, instructions for the breakout session, and case-based studies. These modes of delivery were chosen to meet with best practice of content delivery methods in a classroom setting based on the literature review findings. The PowerPoint presentation was developed based on the information collected from the literature review, completed coursework, and videos. Instructions for the breakout session were formulated and

mentioned at the start of the activity. Two case studies were developed to review developing a broad differential diagnosis and billing aspects of telemedicine. The instructor formulated the two case studies.

Curriculum Breakdown

Module 1 was planned for 30-45 minutes and took about 70 minutes to complete during the delivery of the telemedicine program. Topics covered included defining telemedicine and telehealth, the history of telemedicine and the PA profession, subspecialities and telemedicine, and telemedicine and the healthcare industry. A PowerPoint presentation was developed to cover these topics in detail. Additionally, Poll Everywhere was utilized to build a word map of how the students defined telemedicine utilizing one word and ask real-time questions with the topics covered. Breakout sessions were utilized to complete activities to identify nonverbal cues. The names of these activities were “Turnip” and “Are you cold?” Information was obtained from publications and academic videos to meet the learning objectives of Module 1.

Module 2 was planned for 45-60 minutes and took about 80 minutes to complete. This module focused on the physical examination process via telemedicine as a majority of the students wanted to cover this topic in great detail based on the pre-test evaluation survey. Rather than unidirectional teaching, this module was taught by the students and key clinical pearls were reviewed at the end of this module. Students were split up into groups of two to three individuals based on a system of the physical exam. Students had 40 minutes to prepare a 2-minute presentation on the most effective way to evaluate the system via telemedicine. Teams identified a lead to present the material reviewed to discuss with the class. Groups were asked to prepare one slide and share with the presenter to formulate a comprehensive list of key differences of a

physical exam that occurs via telemedicine versus an in-person visit. Aspects of the physical exam that were missed were reviewed at the end of all the rapid-fire presentations.

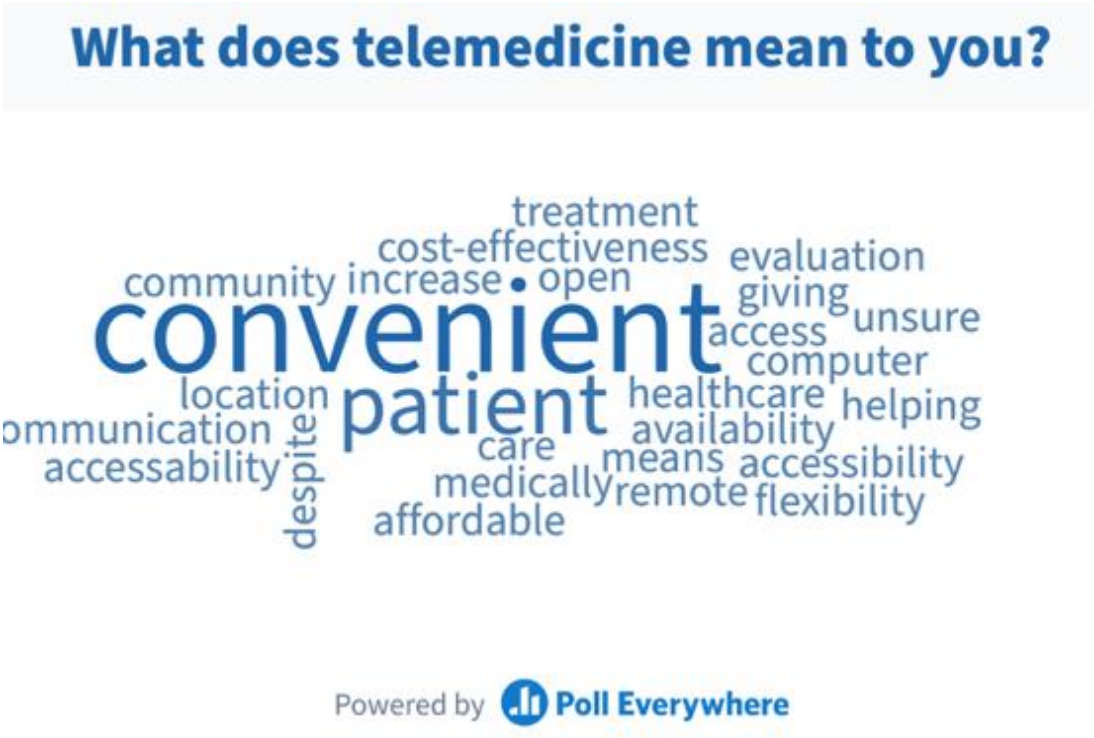
Module 3 was planned for 40 minutes and took about 40 minutes to complete during the delivery of the telemedicine program. This module covered billing and legal aspects of telemedicine. This included case-based scenarios, billing for telemedicine visits, and strategies on how to augment the virtual visit. The module was split into two case-based scenarios to cover the material. The telemedicine curriculum ended with sharing a link to the post-test evaluation survey for students to have the opportunity to provide feedback.

Poll Everywhere Participation

Overall, there were nine Poll Everywhere activities that were utilized in modules one and three. Participation of students with the Poll Everywhere questions was greater than expected. A total of 130 responses were received for nine questions. Additionally, Poll Everywhere was utilized to develop a word map showing one word that students felt was associated the most with telemedicine. Figure 1 shows the word map that was developed.

Figure 1

Word Map of what Telemedicine Means Developed by Students



The first Poll Everywhere question focused on the definition of telemedicine with four multiple choice answers. Seventeen responses were received for question one. The correct answer choice was answer choice D. Figure 2 shows the distribution of answer choices selected by the respondents. All the participants selected answer choice D for this question.

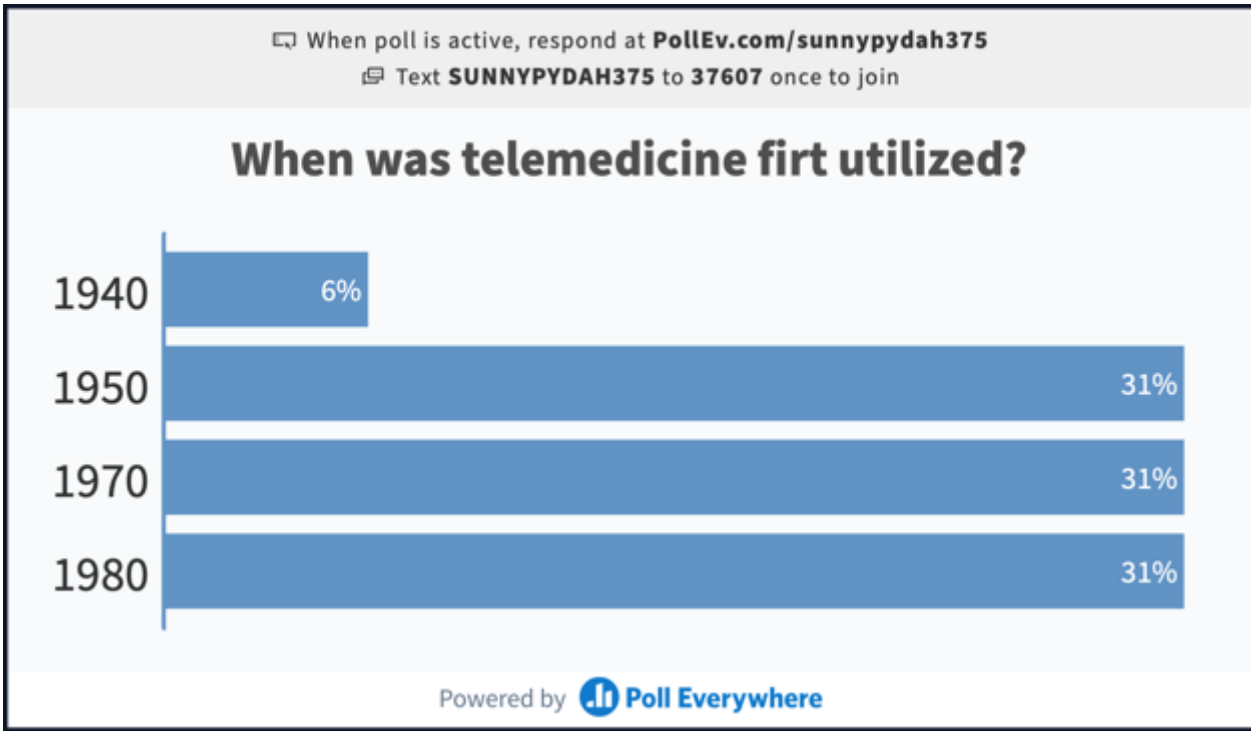
Figure 2

Distribution of Answers for Question One

The second Poll Everywhere question focused on the history of telemedicine and when it was first utilized. This question had four multiple choice answers. Sixteen responses were received for question two. The correct answer choice was answer choice B. Figure 3 shows the distribution of answer choices selected by the respondents. As seen in Figure 3, 6% of respondents selected answer choice A, 31% of respondents selected answer choice B, 31% of respondents selected answer choice C, and 31% of respondents selected answer choice D.

Figure 3

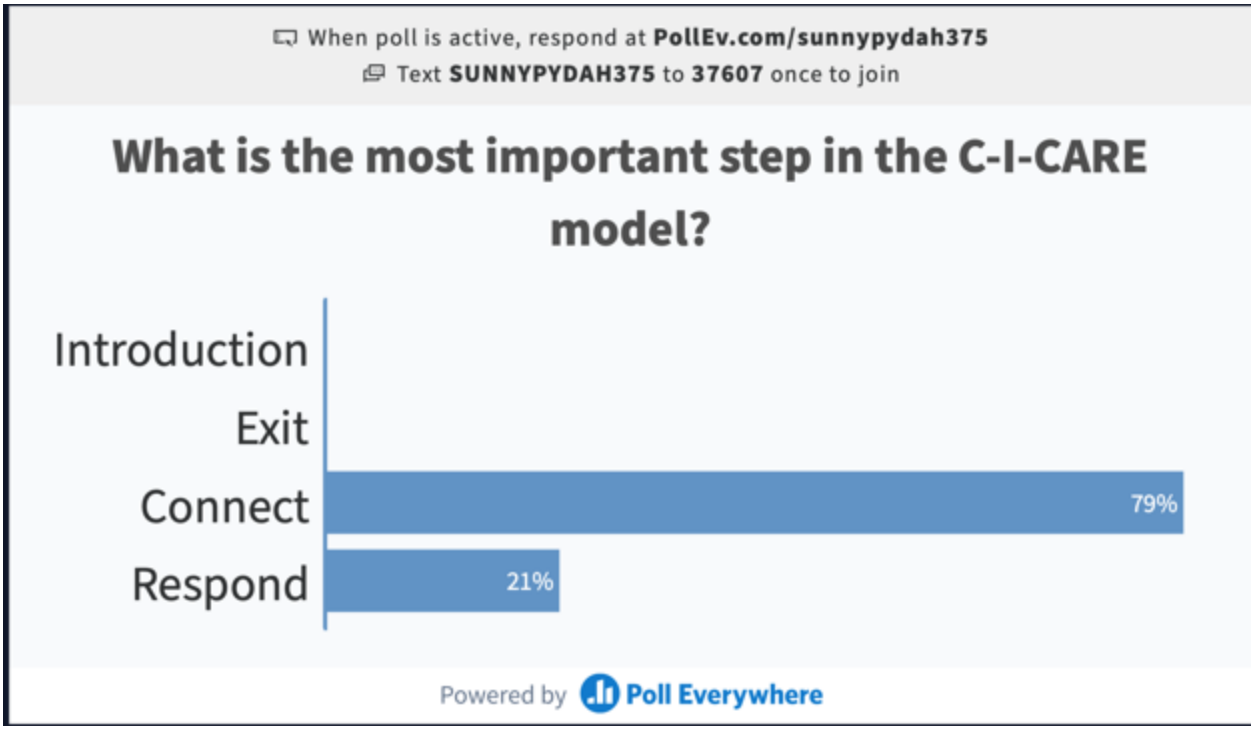
Distribution of Answers for Question Two



The third Poll Everywhere question focused on the most important step of the C-I-CARE model. This question had four multiple choice answers. Fourteen responses were received for question three. The correct answer choice was answer choice B. Figure 4 shows the distribution of answer choices selected by the respondents. As seen in Figure 4, 79% of respondents selected answer choice C and 21% of respondents selected answer choice D.

Figure 4

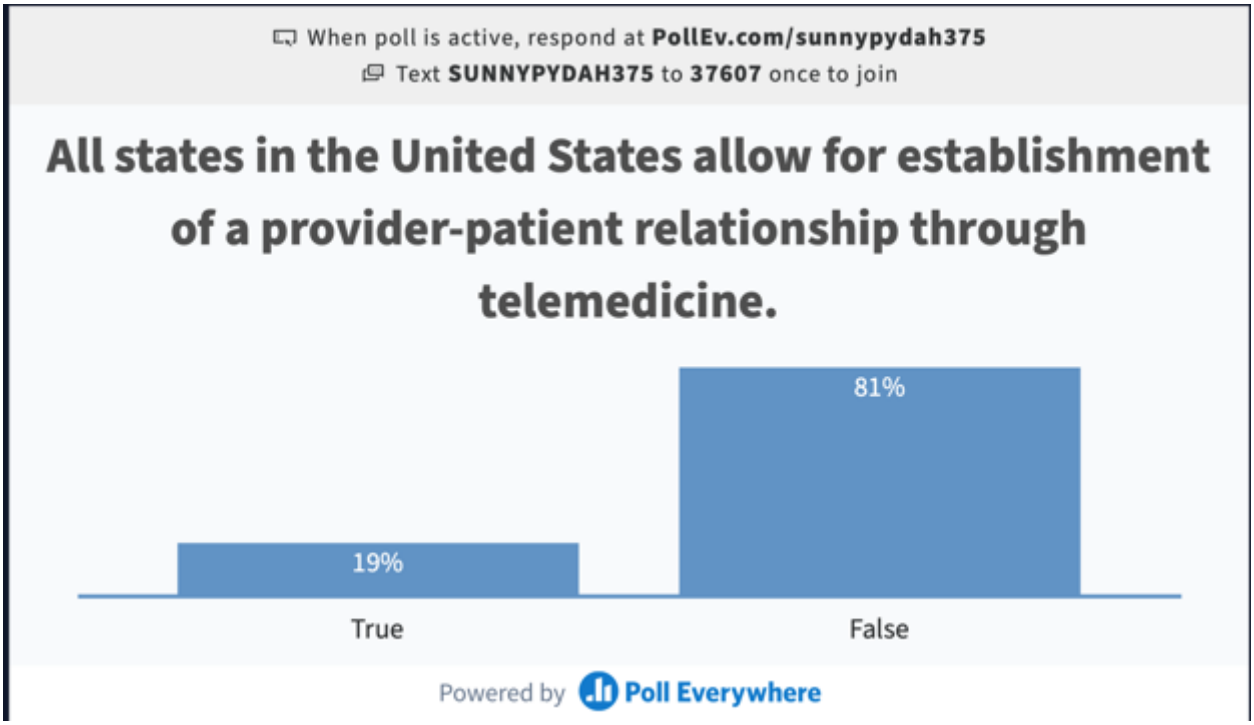
Distribution of Answers for Question Three



The fourth Poll Everywhere question focused on the legal aspects of telemedicine and whether it can be practiced in all 50 states. This question was a true and false question type. Sixteen responses were received for question four. The correct answer choice was true. Figure 5 shows the distribution of answer choices selected by the respondents. As seen in Figure 5, 19% of respondents selected true and 81% of respondents selected false.

Figure 5

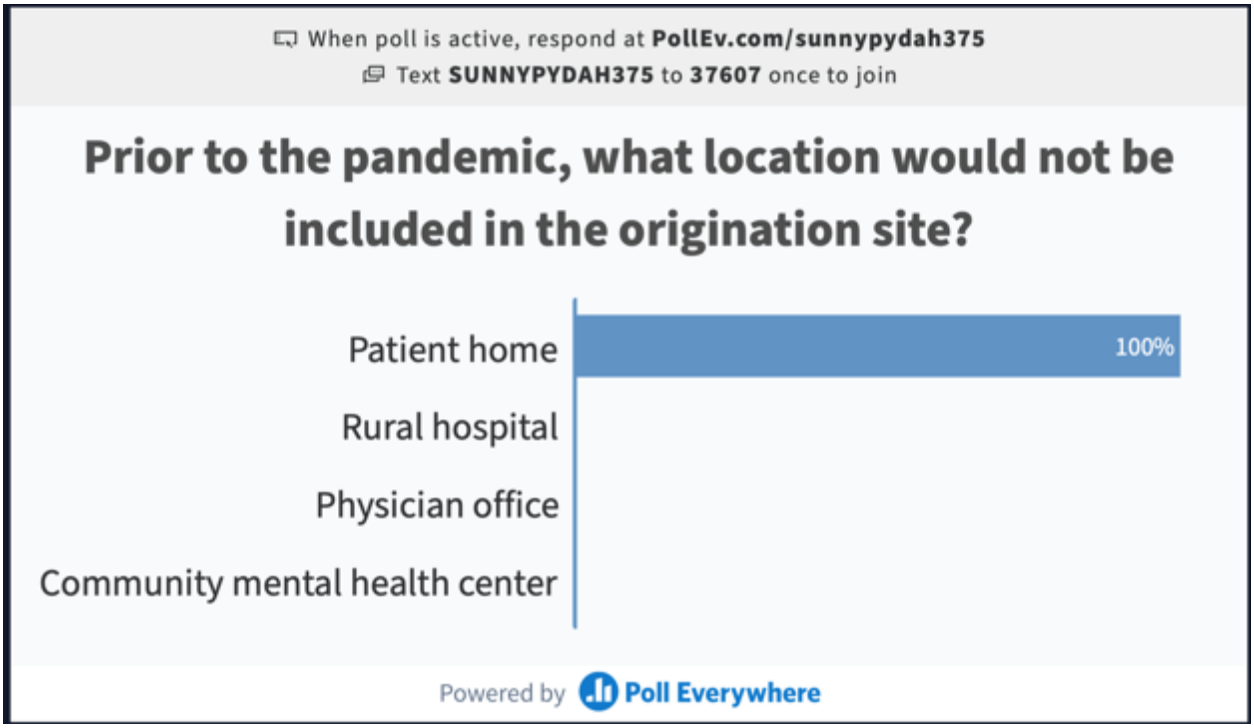
Distribution of Answers for Question Four



The fifth Poll Everywhere question focused on where telemedicine could be provided prior to the COVID-19 pandemic. This question had four multiple choice answers. Nine responses were received for question five. The correct answer choice was answer choice A. Figure 6 shows the distribution of answer choices selected by the respondents. As seen in Figure 6, 100% of respondents selected answer choice A.

Figure 6

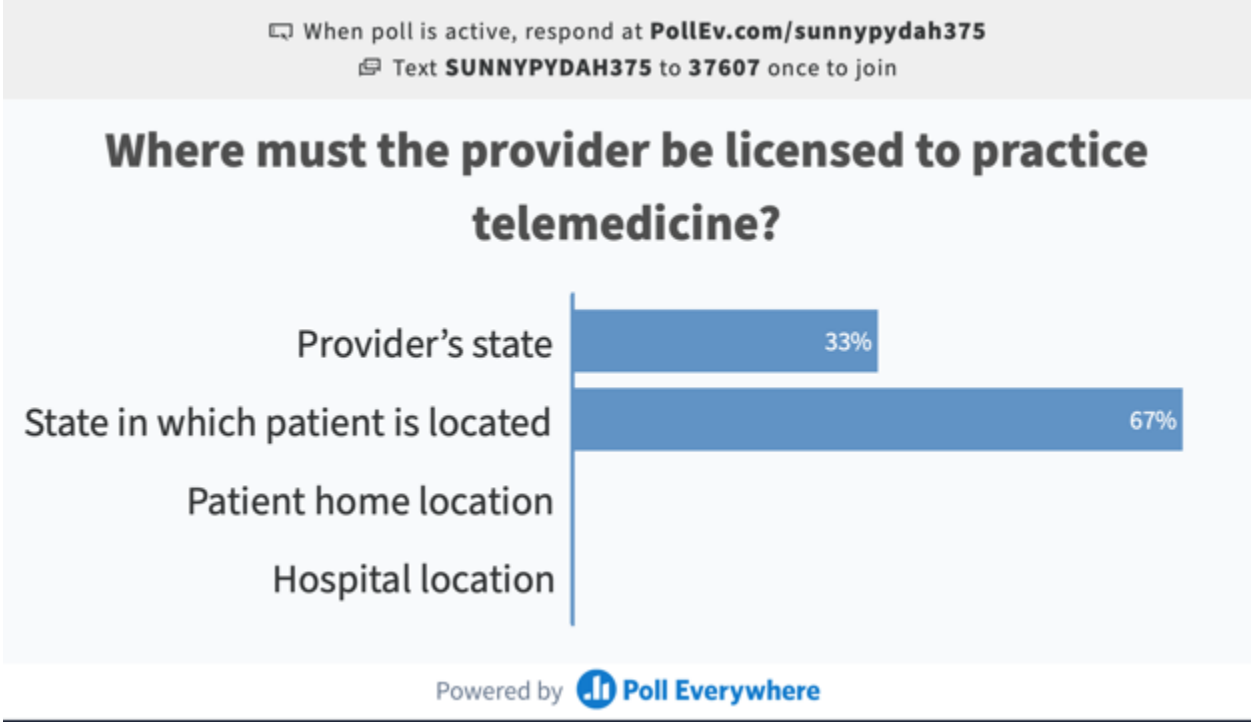
Distribution of Answers for Question Five



The sixth Poll Everywhere question focused on where the provider should be licensed to practice telemedicine. This question had four multiple choice answers. Fifteen responses were received for question six. The correct answer choice was answer choice B. Figure 7 shows the distribution of answer choices selected by the respondents. As seen in Figure 7, 33% of respondents selected answer choice A and 67% of respondents selected answer choice B.

Figure 7

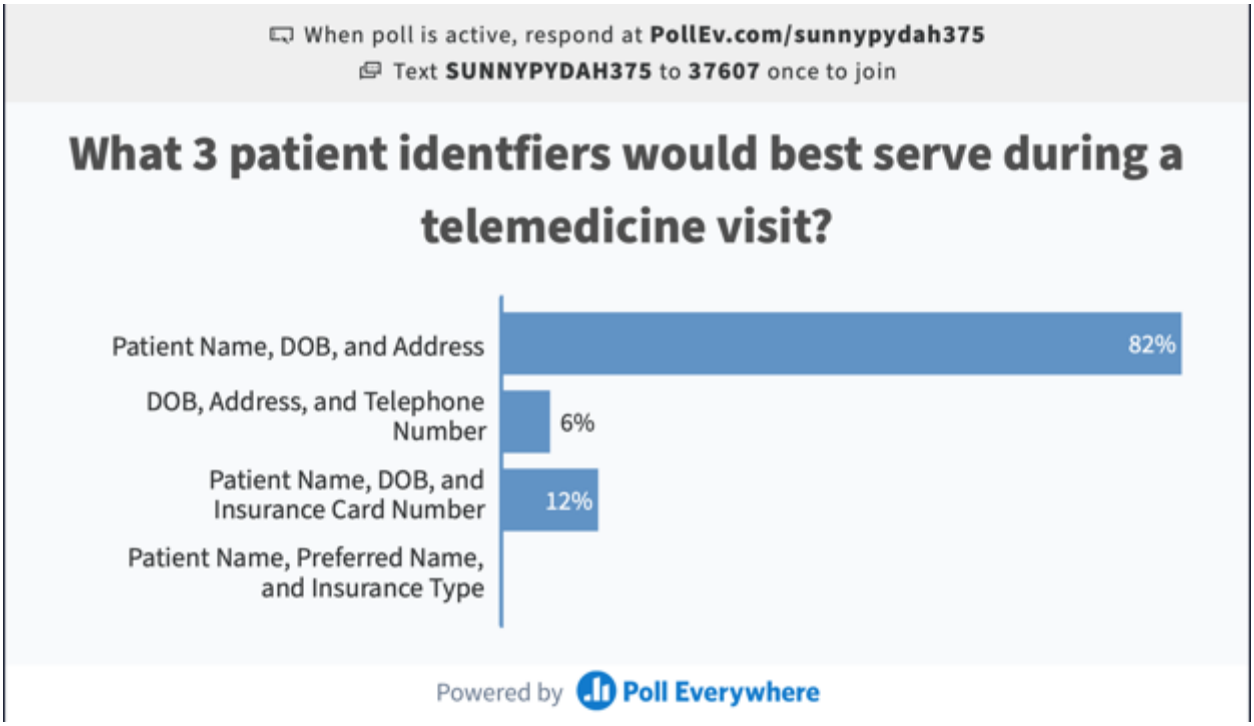
Distribution of Answers for Question Six



The seventh Poll Everywhere question focused on which three patient identifiers would be most beneficial to obtain during a telemedicine visit. This question had four multiple choice answers. Seventeen responses were received for question two. The correct answer choice was answer choice B. Figure 8 shows the distribution of answer choices selected by the respondents. As seen in Figure 8, 82% of respondents selected answer choice A, 6% of respondents selected answer choice B, and 12% of respondents selected answer choice C.

Figure 8

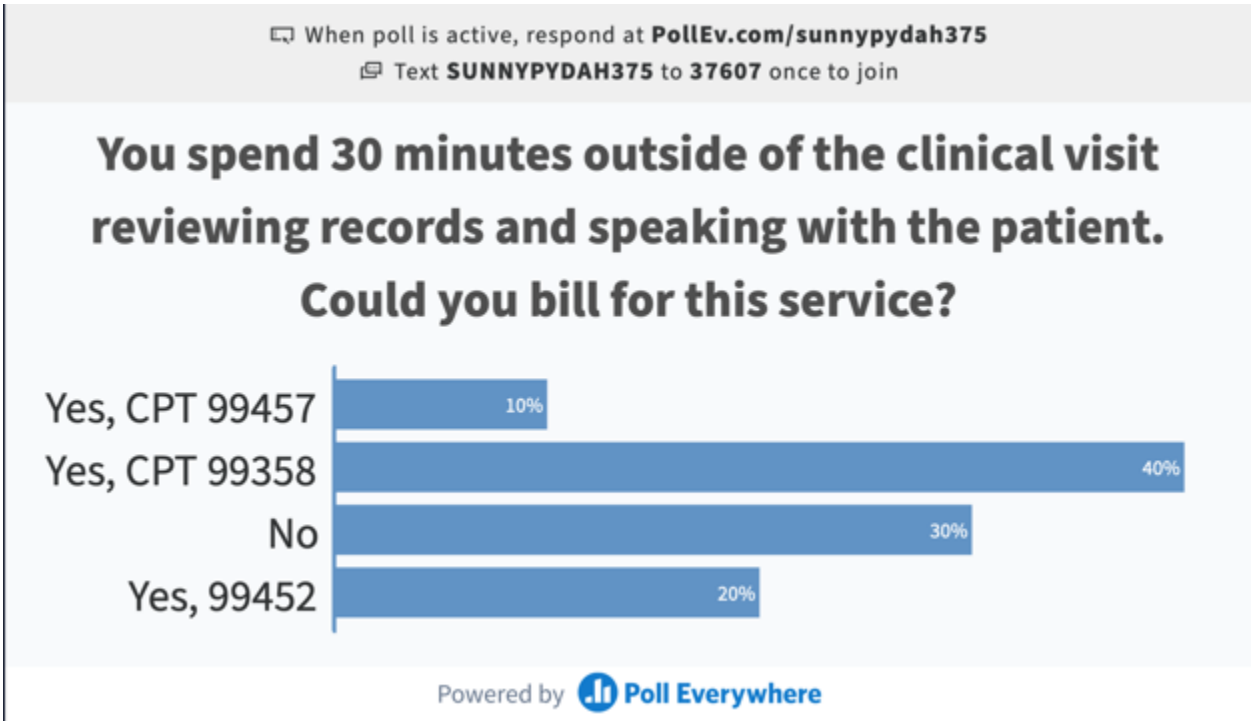
Distribution of Answers for Question Seven



The final Poll Everywhere question focused on a telemedicine scenario and how the visit should be billed. This question had four multiple choice answers. Ten responses were received for question eight. The correct answer choice was answer choice B. Figure 9 shows the distribution of answer choices selected by the respondents. As seen in Figure 9, 10% of respondents selected answer choice A, 40% of respondents selected answer choice B, 30% of respondents selected answer choice C, and 20% of respondents selected answer choice D.

Figure 9

Distribution of Answers for Question Eight



Having these Poll Everywhere questions embedded in the telemedicine training program modules was beneficial to prompt discussion of topics and support active learning during the telemedicine program. Additionally, there were several learning points embedded in these questions as for some questions, a majority of the class selected the incorrect answer. Overall, this was a very engaging exercise especially since the telemedicine program was being delivered on a virtual platform.

After Curriculum Delivery

The post-test evaluation survey was administered right after the telemedicine program delivery. This section will review how the post-test evaluation survey was disseminated and the open-ended feedback received from students after completing the telemedicine training program.

Administration of the Post-Test Evaluation Survey

Similar to the pre-test evaluation survey, an electronic platform, Qualtrics™, was used to deliver the post-test evaluation survey to students. To mimic the pre-test evaluation survey, the survey tool was based on a 5-point scale. The 5-point scale descriptors included strongly agree (5), agree (4), neither agree or disagree (3), disagree (2), and strongly disagree (1). Each question was associated with this particular rating scale. A copy of the post-test evaluation form can be found in Appendix L.

Research participants were encouraged to complete a web-based post-test evaluation survey right after the telemedicine program delivery on June 25, 2021. In addition, students were provided with weekly reminders for 2 weeks to complete the post-test evaluation survey on June 30, 2021 and July 7, 2021. Overall, there were 28 responses received and the post-test survey was closed on July 10, 2021.

Open-Ended Comments from the Post-test Evaluation Surveys

The post-test survey had a qualitative component that provided a way for students to provide constructive feedback and thoughts about topics they would like to see in future telemedicine trainings. Overall, there were 10 open-ended responses received. Of these responses, four responses received stated the topics today were very comprehensive, two responses received stated they would like a video example of a visit, one response received stated they would like to learn more about micro expressions and how to better identify them, one response received wanted additional information on billing aspects of telemedicine, one response received wanted to cover additional information on virtual reality technology and home lab kit utilization, and lastly, one response received discussed splitting the content of the program over multiple sessions.

Amazon Gift Card Winner Selection

There were 25 students who submitted a screen shot of their survey completion screens for both pre-test and post-test surveys. All 25 names of the students were entered in an Excel document. A formula utilized for random selection was utilized within Excel to choose the winner of the $50 Amazon gift card. The formula used ensured that a name was randomly selected from the list. The $50 dollar Amazon gift card was purchased by the researcher and shared to the student via email. A confirmation email was received indicating that the winner received the gift card.

Data Collection

Data collection occurred before and after the delivery of the telemedicine program. All participants received an introductory email at their school email address. As briefly discussed, students received a link to the pre-test survey evaluation form in the introductory email. An electronic survey format was utilized through Qualtrics™ to increase accessibility of the survey at no associated cost. Qualtrics™ recoded the data received from the pre-test evaluation surveys with a random number so that the participant's email address was not associated with the survey submitted and to preserve confidentiality. All data from the pre-test survey was stored electronically and securely in a password protected folder.

The post-test survey Qualtrics™ link was released immediately at the end of the delivery of the telemedicine program on June 25, 2021. Survey responses were recoded with a random number so that survey answers are not associated with a student's email address through the use of Qualtrics™. To encourage participation, two reminder emails were sent for survey completion on a weekly basis after completion of the telemedicine program.

The research team reviewed all surveys submitted. No data points were missing as the surveys were set where the participants could not submit the survey unless each field had a value. Test survey responses that were utilized to test the surveys in Qualtrics™ before the surveys went live were removed from the data prior to performing the data analysis. Thus, all surveys were complete and included in the data analysis. With the help of RUC's statistician team, data analysis was performed on the pre- and post-test survey results.

Data Analysis

Descriptive analysis was utilized for the first four questions asked on the survey, including gender, age, hometown classification, and years of experience utilizing telemedicine. Once the survey results were analyzed for completion, the data was uploaded into IBM SPSS Statistics (Version 25) through Qualtrics™. Data collected was reviewed for accuracy based on the answers submitted by the research participants. Recoding of variables for the pre-test and post-test evaluations was utilized to run statistical tests. It was not necessary to recode blank answers for the data obtained as all surveys received were complete. The pre- and post-test responses were matched automatically in SPSS through the use of IP addresses, which gave 18 matched pairs. Additionally, a second dataset was created that was matched based on demographic information, including age, gender, and hometown classification, which resulted in 26 matched pairs.

Subscales were created based on the variables associated with each research question as defined in Table 4 on page 77. There were four subscales used for the four research questions of this project. Further analysis of subscale utilization was discussed with RUC's statistician to ensure significance of data collection.

An average of each subscale was calculated. The data was then checked for normality. If the data did not follow a normal distribution, a square root of the distribution was taken to account for normality. In this case, the data did follow a normal distribution. Cronbach alpha was calculated for each subscale to measure reliability. Lastly, an analysis of variance (ANOVA) 4x2 table was analyzed to measure significant differences between the means. The data analysis portion was reviewed by Dr. Dane, RUC Statistics professor, to ensure proper statistical tests were executed to analyze the data for this project.

Cronbach alpha

Cronbach alpha is a helpful tool to measure reliability of items on a survey tool. In this study, Cronbach alpha was calculated to analyze internal consistency amongst each subscale (Heo et al., 2015). A Cronbach alpha score was calculated separately for each subscale corresponding to the research question. It is important to note that Cronbach's alpha may be low due to a small number of items associated with each subscale. However, the Cronbach alpha may be elevated in this study on the basis of high item correlation amongst each subscale. Overall, an alpha of 0.7 or higher is evidence of good reliability. Since this study utilized a survey tool to measure learning outcomes, a Cronbach alpha will increase the statistical power of this study (Heo et al., 2015).

Analysis of variance (ANOVA)

Analysis of variance (ANOVA) was utilized to compare the means amongst data. ANOVA is the most common test notated in research studies (Ostertagova & Ostertag, 2013). Since each research participant received the same educational experience through the telemedicine curriculum, a repeated measure ANOVA is an appropriate tool to use because the

same data was collected amongst participants. Another name for repeated measure ANOVA is within subjects ANOVA.

For this study, IBM SPSS statistics was utilized as an analytical software that performs various statistical tests, such as repeated measures ANOVA (IBM Corp, 2017). With ANOVA, specific variables were identified to see if they had a main effect for each subscale. ANOVA helped determine if statistically one of the research questions changed the mean more than the other. One of the assumptions made for ANOVA testing was that observations should be normally distributed. If data is not normally distributed, a Kruskal-Wallis rank test may be utilized (Ostertagova & Ostertag, 2013). Overall, ANOVA gave much more power to the analysis because all of the data went into a single analysis instead of four separate analyses. Additionally, the test requires a smaller number of subjects due to increased power.

Table 4

Definitions of Subscales

Questions	**Hypothesis**	**IV**	**IV Data Type**	**DV**	**DV Data Type**	**Statistical Test**
RQ1: Does a training session in telemedicine significantly change PA students' ability to define telehealth and cite examples of telehealth in practice?	$H1_a$: There is a significant difference in PA students' ability to define telehealth and cite examples of telehealth in practice between the pre- and post-	TRAINING	Categorical (Nominal)	DEFINE UTILIZE CONTRIBUTION	Categorical Categorical Categorical	Repeated Measures ANOVA

	survey results.					
RQ2: Does a training session in telemedicine significantly change PA students' perception of their ability to conduct a virtual healthcare visit?	$H2_a$: There is a significant difference in students' perception of their ability to conduct a telemedicine encounter after completing the telemedicine training between the pre- and post-survey results.	TRAINING	Categorical (Nominal)	PATEINT_IDEN VIRTUAL VIDEO AUGMENT CONSENTS PARTNERSHIP BILL PHYSICALEXAM	Categorical Categorical Categorical Categorical Categorical Categorical Categorical	Repeated Measures ANOVA
RQ3: Does a training session in telemedicine significantly change PA students' perception of self-efficacy utilizing telemedicine in their future practice (i.e., optimizing technical aspects, utilizing a video	$H3_a$: There is a significant difference in PA students' perception of self-efficacy utilizing telemedicine in their future practice between the pre- and post-	TRAINING	Categorical (Nominal)	FUTURE ESSENTIAL COMFORT BENEFIT	Categorical Categorical Categorical Categorical	Repeated Measures ANOVA

interface, and comfort with appropriate computer etiquette)?	survey results.					
RQ4: Does a training session in telemedicine significantly change PA students' perception of telemedicine's impact on quality of care?	$H4_a$: There is a significant difference in PA students' perception of telemedicine's impact on quality of care between the pre- and post-survey results.	TRAINING	Categorical (Nominal)	IMPROVEHLTH ETIQUETTE COMMUNICATION	Categorical Categorical Categorical	Repeated Measures ANOVA

Limitations

The convenience sampling method was a limitation of this study as this allows for bias due to grouping of data. Nonrandom sampling was chosen for this study due to time constraints and limited access to subjects from other PA programs. Additionally, the high number of survey responses needed to test for significance was a limitation of this study. There may be prior academic engagements that students need to complete, which may have hindered the survey response rate.

Delimitations

The strengths of this study included the use of validated survey questionnaires, the purpose of this study, the curriculum design of the telemedicine program, and student engagement during delivery of the program. Survey questions utilized minimal open-ended

responses for ease of data compilation. This research could lead to identification of a combined evaluation tool for a telemedicine program that may be utilized across other PA programs. Results will be discussed in the next chapter.

Chapter Four

Results and Data Analysis

To help answer the four research questions proposed and test the hypotheses, the pre-test and post-test evaluation survey responses were analyzed utilizing Cronbach's alpha and one-way ANOVA testing. This chapter will discuss the demographic information of the sample population for both the pre-test and post-test survey data, how the pre-test and post-test surveys were matched, how the subscales were identified to answer each of the four specific research questions, and the statistical tests that were completed to analyze the data. To recap, the subscale definitions can be found in Table 4 of the methodology section. Additionally, an overall analysis of the data will be discussed at the end of this chapter.

Pre-Test and Post-Test Survey Evaluation Demographic Data

Non-identifying demographic data that was collected in this study included the participants' age, gender, hometown population classification, and how many weeks of prior telemedicine experience they had prior to the telemedicine training. Overall, there was a 90.24% response rate to the pre-test evaluation survey, which comprised of 37 students out of the 41 students who attended the telemedicine training program. Table 5 summarizes the age, gender, hometown classification, and telemedicine distributions of the pre-test evaluation survey and post-test evaluation survey.

Overall, for the pre-test survey evaluation data, there were 30 participants who were between the ages 20-29; four participants who were between the ages 30-39; and three participants who were 40 or older. There were 27 females and 10 males who participated in the study. Of the 37 students who participated in the pre-test evaluation survey, six individuals came from urban hometowns, 17 individuals came from suburban hometowns, and 14 individuals

came from rural hometowns. Lastly, of the 37 participants, 24 students had 0 to 2 weeks of past experience with telemedicine, 10 students had 3 to 4 weeks of past experience with telemedicine, and two students had greater than 8 weeks of experience with telemedicine.

There were 36 post-test survey evaluations completed for this research study with a response rate of 87.80%. Thirty participants were between the ages 20-29, four participants were between the ages 30-39, and two participants were 40 or older. There were 28 females and eight males who participated in the study. Of the 36 students who participated in the post-test evaluation survey, five individuals came from urban hometowns, 17 individuals came from suburban hometowns, and 14 individuals came from rural hometowns. Lastly, 24 students had 0 to 2 weeks of past experience with telemedicine, six students had 3 to 4 weeks of past experience with telemedicine, and six students had greater than 8 weeks of experience with telemedicine.

Age, gender, and hometown classification were also utilized to match survey data for the pre-test and post-test datasets. Overall, there were an additional eight matches identified utilizing the age, gender, and hometown classification giving a N of 26 matches. Further data analysis on both groups will be discussed later on in this chapter.

Table 5

Demographic Data of 37 Pre-Test Evaluation Surveys and 36 Post-Test Evaluation Surveys

Characteristic	**Pre-Test N**	**Pre-Test %**	**Post-Test N**	**Post-Test %**
Total Responses	37		36	
Age				
20-29	30	81.08%	30	83.33%
30-39	4	10.81%	4	11.11%
40-49	3	8.11%	2	5.56%
Gender				
Male	10	27.02%	8	22.22%
Female	27	72.97%	28	77.78%
Hometown Classification				
Urban	6	16.22%	5	13.89%
Suburban	17	45.95%	17	47.22%
Rural	14	37.84%	14	38.89%
Past Experience				
0 to 2 weeks	24	64.86%	24	66.67%
2 to 4 weeks	10	27.03%	6	16.67%
More than 8 weeks	2	5.41%	6	16.67%

Validity and Reliability of Data

To validate the results, the IP addresses of the pre-test and post-test surveys were matched. Overall, there were 18 matching results based on IP addresses. Because the demographic matches were less reliable than the IP address matches, data were evaluated using both matching approaches. Analysis of the survey response data showed that there was normality as assessed by the Kolmogorov-Smirnov and Shapiro-Wilk test of normality with no outliers observed ($df = 37$, $p < 0.05$; $df = 36$, $p < 0.05$). Additionally, there was no concern of duplicate surveys as all data utilized to run the statistical test was matched either with IP addresses or based on their demographic information manually.

A Cronbach's alpha score was calculated for each subscale in the pre-test and post-test survey results to measure for reliability and internal consistency amongst subscales. As depicted in Table 6, post-test Cronbach's alpha scores were above 0.7, showing evidence of good reliability (Hoe et al., 2015). However, for three of the pre-test subscales, Cronbach's alpha scores were lower than 0.7. This was due to the number of items in each subscale as some subscales only had three to four items associated, which lowered the Cronbach's alpha score, especially for the pre-test Cronbach's alpha value for subscale quality of care. Additionally, there were some variances amongst Cronbach's alpha values because the sample size was relatively small. The Cronbach's alpha score was higher for the post-test data compared to the pre-test data, meaning that there is higher consistency amongst the post-test findings. This difference may indicate the shared understanding of the three items included in this subscale after participation in the telemedicine training program.

Table 6

Cronbach's Alpha Scores for Subscales of Pre-Test and Post-Test Data

Subscale (4)	**Pre-Test Cronbach's Alpha**	**Post-Test Cronbach's Alpha**
Define Telemedicine (3)	0.690	0.774
Virtual Healthcare Visit (8)	0.673	0.836
Utilizing Telemedicine (4)	0.796	0.768
Quality of Care (3)	0.394	0.701

Means

The mean scores for each data set were evaluated and can be found in Table 7. The lowest mean score was for subscale virtual telehealth visit followed by subscale telemedicine utilization. Comparing the 18 IP address matched data and the 26 manually matched data, the trend for the means of subscales define telemedicine, telemedicine utilization, and quality of care slightly increased with the narrowing of confidence intervals for the manually matched dataset. Figure 10a and Figure 10b show a graphical depiction of the estimated marginal means of each of the four subscales for the IP address matched data and the manually matched data set.

Additionally, there was an increase in average means comparing the pre-test survey data and post-test survey of both datasets. Figure 11a and Figure 11b depict that change in mean averages seen. The average mean for the pre-test questions based on time for the IP address matched data set was 3.462 (95% CI of 3.142 to 3.783). In contrast, the average mean for the post-test questions was 4.488 (95% CI of 4.212 to 4.764). These trends were similarly seen in the

manually matched data. The average mean for the pre-test questions based on time for the manually matched data set was 3.500 (95% CI of 3.265 to 3.735) and the average mean for the post-test questions was 4.514 (95% CI of 4.322 to 4.707).

Table 7

Estimated Means and 95% Confidence Intervals for Four Subscales for Matched Datasets

		IP Address Matched Data (N = 18)			**Manually Matched Data (N = 26)**		
Subscale	**Pre/Post Test**	**Mean**	**Lower Bound**	**Upper Bound**	**Mean**	**Lower Bound**	**Upper Bound**
Define Telemedicine	Pre-Test	3.593	3.213	3.972	3.628	3.366	3.890
	Post-Test	4.500	4.172	4.828	4.577	4.347	4.807
Virtual Health Visits	Pre-Test	3.201	2.928	3.475	3.192	2.962	3.423
	Post-Test	4.451	4.157	4.745	4.385	4.153	4.616
Telemedicine Utilization	Pre-Test	3.444	2.988	3.901	3.538	3.193	3.884
	Post-Test	4.389	4.075	4.703	4.442	4.211	4.673
Quality of Care	Pre-Test	3.611	3.229	3.994	3.641	3.351	3.931
	Post-Test	4.611	4.331	4.891	4.654	4.458	4.850

Figure 10a

Plot of Estimated Marginal Means for the Four Subscales for IP Address Matched Data (N = 18)

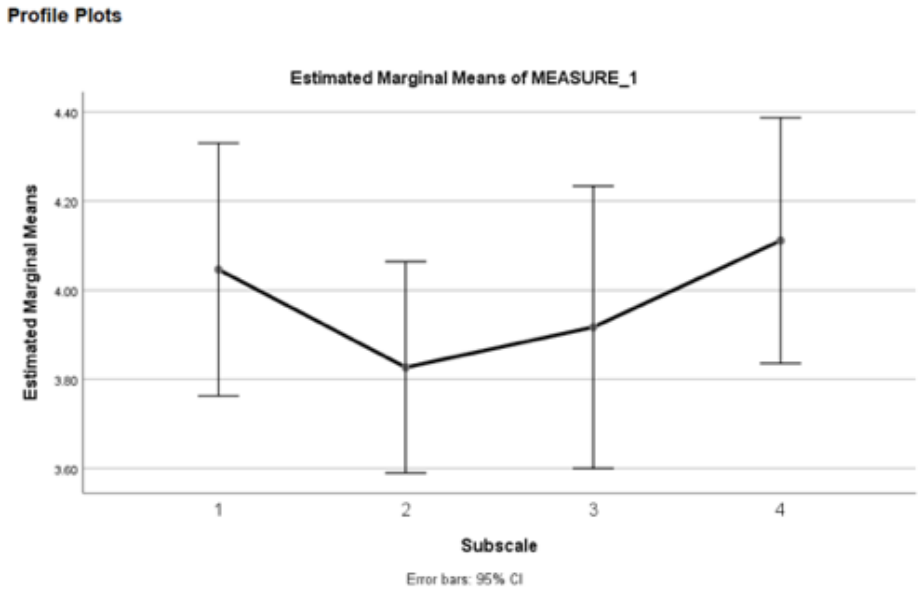


Figure 10b

Plot of Estimated Marginal Means for the Four Subscales of Manually Matched Data (N = 26)

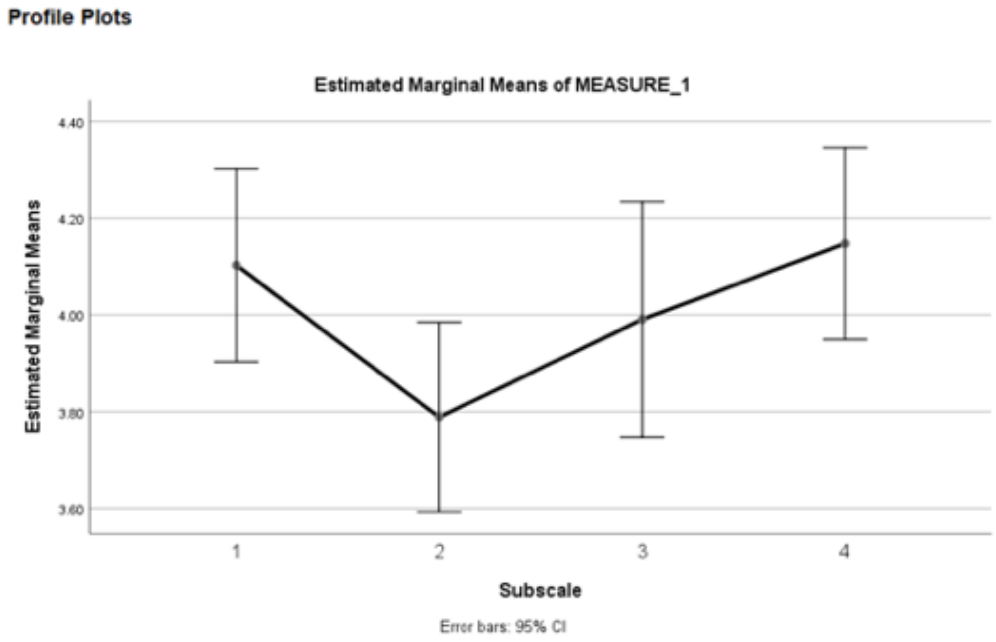


Figure 11a

Plot of Estimated Marginal Means for the Pre- and Post-Test Time Period for IP Address Matched Dataset

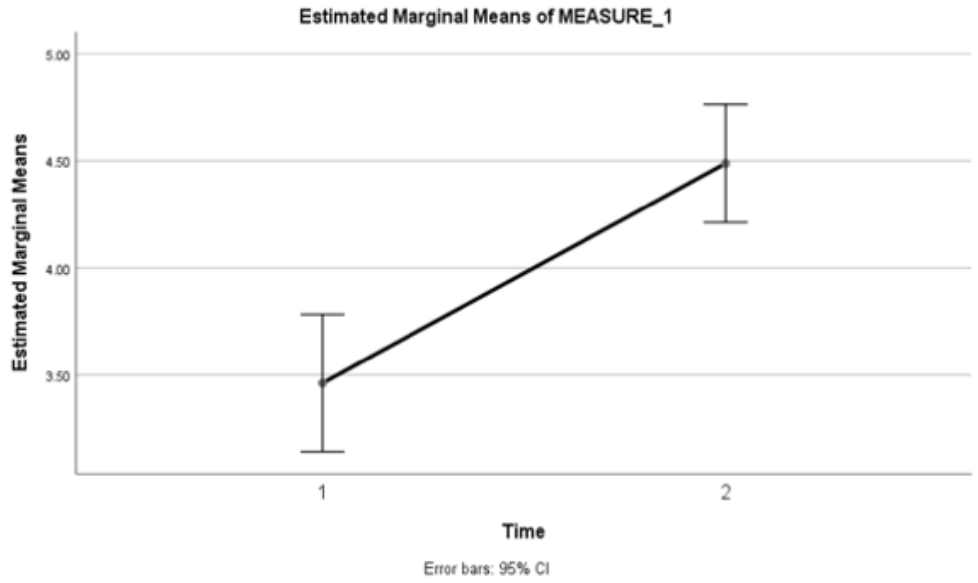
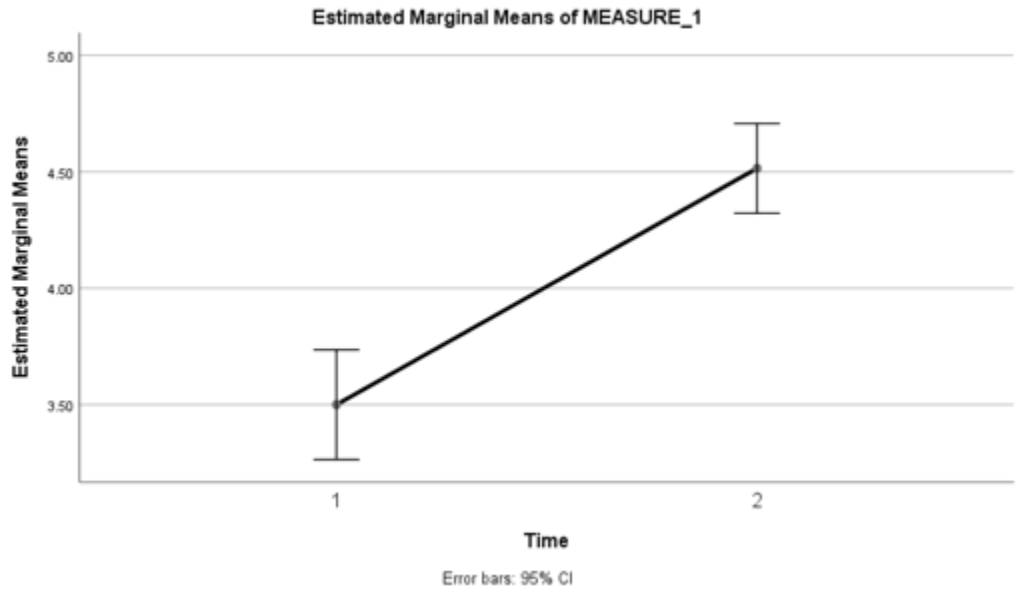


Figure 11b

Plot of Estimated Marginal Means for the Pre- and Post-Test Time Period for Manually Matched Dataset



Analysis of Variance

This study evaluated statistical significance in the difference of the means through the use of 4x2 repeated measures ANOVA statistical testing. The repeated measures ANOVA test was chosen to identify the differences in mean scores amongst four subscales defined earlier in two separate datasets, one with 18 matches (based on IP addresses) and one with 26 matches (based on manual review of demographic data). Both ANOVA tests were evaluated and will be discussed in this section. Each research question was assigned a subscale that was matched to specific questions on the pre-test and post-test evaluation surveys.

Assumptions of Sphericity. One consideration with repeated measures ANOVA testing is to ensure the assumptions of sphericity is not violated, which is a common issue with repeated measures ANOVA testing. Sphericity is defined as the differences in equality of variances based on group of the within-subject factors. Mauchly's Test of Sphericity was utilized to ensure that the assumptions of sphericity were not violated amongst the data set. The null hypothesis for this test was that the variances of the differences are equal, and the alternative hypothesis was that the variances of the differences are not equal.

Subscale, time, and subscale versus time were analyzed while running the ANOVA test. Subscale looked at each subscale identified within the survey, time was defined by the survey data obtained prior to the telemedicine training program and after the telemedicine training program, and subscale versus time was defined by analyzing the subscale means based on time. There is sphericity for the subscales in the IP address matched data, as assessed by Mauchly's test of sphericity ($p > 0.05$, Table 8). Additionally, there is sphericity for the subscales versus time in the IP address matched data, as assessed by Mauchly's test of sphericity ($p > 0.05$, Table 8). Similarly, there was sphericity for the subscales and subscales versus time manually matched

data (N = 26), as assessed by Mauchly's test of sphericity ($p > 0.05$, Table 9). These significance levels indicate that we can fail to reject the null hypothesis. Thus, the assumption of sphericity was not violated for either data set.

Table 8

Mauchly's Test of Sphericity for IP Address Matches (N = 18)

Mauchly's Test of Sphericity[a]

Measure: MEASURE_1

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[b] Greenhouse-Geisser	Epsilon[b] Huynh-Feldt	Epsilon[b] Lower-bound
Subscale	.753	4.452	5	.487	.827	.980	.333
Time	1.000	.000	0	.	1.000	1.000	1.000
Subscale * Time	.711	5.367	5	.374	.855	1.000	.333

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept
Within Subjects Design: Subscale + Time + Subscale * Time

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Table 9

Mauchly's Test of Sphericity for Manually Matched Data (N=26)

Mauchly's Test of Sphericity[a]

Measure: MEASURE_1

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[b] Greenhouse-Geisser	Epsilon[b] Huynh-Feldt	Epsilon[b] Lower-bound
Subscale	.870	3.292	5	.655	.913	1.000	.333
Time	1.000	.000	0	.	1.000	1.000	1.000
Subscale * Time	.742	7.078	5	.215	.869	.980	.333

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept
Within Subjects Design: Subscale + Time + Subscale * Time

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Once the assumptions of sphericity were confirmed, a 4x2 repeated measures ANOVA was performed on IP address matched data (N = 18) and manually matched data based on demographics data obtained (N = 26) to answer the four questions proposed in this research study. The results of the ANOVA testing for the IP address matched data and the manually matched demographic data can be found in Table 8 and Table 9. Table 7 shows a comparison of the means scores of the subscales and 95% confidence intervals for the 18 matched dataset and the 26 matched data set. The 95% confidence interval is defined by 95% of the survey response averages falling between the lower and upper bound of the interval.

Research Question 1

Does a training session in telemedicine significantly change PA students' ability to define telehealth and cite examples of telehealth in practice?

Hypothesis H1. $H1_o$: There is no significant difference in PA students' ability to define telemedicine and cite examples of telemedicine in practice between the pre- and post-survey results.

$H1_a$: There is a significant difference in PA students' ability to define telemedicine and cite examples of telemedicine in practice between the pre- and post-survey results.

A repeated measures ANOVA test showed a statistically significant difference in the means between the delivery of the telemedicine visit and the time the survey was taken in both the IP address matched data and the manually matched data as seen in Table 10 and Table 11 ($df = 1, F = 46.211, p < 0.001$; $df = 1, F = 82.620, p < 0.001$). The average mean for the 18 IP address matched data of the three items for the subscale define telemedicine for pre-test surveys was 3.593 (95% CI, 3.213 to 3.972), which was statistically different than the average mean of the three items of the subscale for the post-test surveys, which was 4.500 (95% CI, 4.172 to

4.828). This statistically significant difference in means was also seen in the manually matched data where the average mean for the pre-test data for the three questions was 3.628 (95% CI, 3.366 and 3.890) and the average mean for the post-test data was 4.577 (95% CI, 4.347 and 4.807). In addition, there was a statistically significant difference in the means of the subscale define telemedicine and subscale virtual telehealth visit in the IP address matched data ($df = 1$, $F = 6.394$, $p = 0.022$). A similar observation was made with the 26 manually matched data with a statistically significant difference in the means of subscale of define telemedicine and subscale virtual telehealth visits ($df = 1$, $F = 12.817$, $p < 0.001$). Additionally, a partial eta squared showed a large effect as it was calculated to be 0.731.

Thus, the null hypothesis was rejected, and the alternative hypothesis was accepted, indicating that there is a significant difference in PA students' ability to define telehealth and cite examples of telehealth in practice between the pre- and post-survey results.

Table 10

ANOVA Comparison Results of IP Address Matched Data (N = 18)

Tests of Within-Subjects Contrasts

Measure: MEASURE_1

Source	Subscale	Time	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Subscale	Level 1 vs. Level 2		.870	1	.870	6.394	.022	.273
	Level 2 vs. Level 3		.147	1	.147	.810	.381	.045
	Level 3 vs. Level 4		.681	1	.681	3.015	.101	.151
Error(Subscale)	Level 1 vs. Level 2		2.314	17	.136			
	Level 2 vs. Level 3		3.080	17	.181			
	Level 3 vs. Level 4		3.837	17	.226			
Time		Level 1 vs. Level 2	18.928	1	18.928	46.211	.000	.731
Error(Time)		Level 1 vs. Level 2	6.963	17	.410			
Subscale * Time	Level 1 vs. Level 2	Level 1 vs. Level 2	2.113	1	2.113	4.700	.045	.217
	Level 2 vs. Level 3	Level 1 vs. Level 2	1.681	1	1.681	2.008	.175	.106
	Level 3 vs. Level 4	Level 1 vs. Level 2	.056	1	.056	.091	.767	.005
Error(Subscale*Time)	Level 1 vs. Level 2	Level 1 vs. Level 2	7.641	17	.449			
	Level 2 vs. Level 3	Level 1 vs. Level 2	14.226	17	.837			
	Level 3 vs. Level 4	Level 1 vs. Level 2	10.403	17	.612			

Table 11

ANOVA Comparison Results of Manually Matched Data (N = 26)

Tests of Within-Subjects Contrasts

Measure: MEASURE_1

Source	Subscale	Time	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Subscale	Level 1 vs. Level 2		2.565	1	2.565	12.817	.001	.339
	Level 2 vs. Level 3		1.060	1	1.060	4.265	.049	.146
	Level 3 vs. Level 4		.641	1	.641	3.635	.068	.127
Error(Subscale)	Level 1 vs. Level 2		5.003	25	.200			
	Level 2 vs. Level 3		6.213	25	.249			
	Level 3 vs. Level 4		4.411	25	.176			
Time		Level 1 vs. Level 2	26.755	1	26.755	82.620	.000	.768
Error(Time)		Level 1 vs. Level 2	8.096	25	.324			
Subscale * Time	Level 1 vs. Level 2	Level 1 vs. Level 2	1.543	1	1.543	3.636	.068	.127
	Level 2 vs. Level 3	Level 1 vs. Level 2	2.163	1	2.163	3.148	.088	.112
	Level 3 vs. Level 4	Level 1 vs. Level 2	.309	1	.309	.691	.414	.027
Error(Subscale*Time)	Level 1 vs. Level 2	Level 1 vs. Level 2	10.607	25	.424			
	Level 2 vs. Level 3	Level 1 vs. Level 2	17.180	25	.687			
	Level 3 vs. Level 4	Level 1 vs. Level 2	11.177	25	.447			

Research Question 2. Does a training session in telemedicine significantly change PA students' perception of their ability to conduct a virtual healthcare visit?

Hypothesis H2. $H2_o$: There is no significant difference in student perception of their ability to conduct a telemedicine encounter after completing the telemedicine training between the pre- and post-survey results.

$H2_a$: There is a significant difference in students' perception of their ability to conduct a telemedicine encounter after completing the telemedicine training between the pre- and post-survey results.

There is a significant difference in students' perception of their ability to conduct a telemedicine encounter after completing the telemedicine training between the pre- and post-survey results. A repeated measures ANOVA test showed a statistically significant difference in the means between the delivery of the telemedicine visit and the time, whether before or after, the survey was taken in both the IP address matched data and the manually matched data as seen

in Table 10 and Table 11 ($df = 1$, $F = 46.211$, $p < 0.001$; $df = 1$, $F = 82.620$, $p < 0.001$). The average mean for the 18 IP address matched data of the eight items for the subscale virtual health visits for pre-test surveys was 3.201 (95% CI, 2.928 to 3.475), which was statistically different than the average mean of the three items of the subscale for the post-test surveys, which was 4.451 (95% CI, 4.157 to 4.745). This statistically significant difference in means was also seen in the manually matched data where the average mean for the pre-test data for the eight questions was 3.192 (95% CI, 2.962 and 3.423) and the average mean for the post-test data was 4.385 (95% CI, 4.153 and 4.616). In addition, there was a statistically significant difference in the means of the subscale define virtual telehealth visit and subscale telemedicine utilization in the manually matched data ($df = 1$, $F = 4.265$, $p = 0.049$). Thus, again the null hypothesis was rejected, and the alternative hypothesis was accepted, indicating that there was a significant difference observed in students' perception of their ability to conduct a telemedicine encounter after completing the telemedicine training between the pre- and post-survey results.

Research Question 3. Does a training session in telemedicine significantly change PA students' perception of self-efficacy utilizing telemedicine in their future practice (i.e., optimizing technical aspects, utilizing a video interface, and comfort with appropriate computer etiquette)?

Hypothesis H3. $H3_o$: There is no significant difference in PA students' perception of self-efficacy utilizing telemedicine in their future practice between the pre- and post-survey results.

$H3_a$: There is a significant difference in PA students' perception of self-efficacy utilizing telemedicine in their future practice between the pre- and post-survey results.

There was a significant difference in PA students' perception of self-efficacy utilizing telemedicine in their future practice between the pre- and post-survey results. A repeated measures ANOVA test showed a statistically significant difference in the means between the delivery of the telemedicine visit and the time, whether before or after, the survey was taken in both the IP address matched data and the manually matched data as seen in Table 10 and Table 11 ($df = 1$, $F = 46.211$, $p < 0.001$; $df = 1$, $F = 82.620$, $p < 0.001$). The average mean for the 18 IP address matched data of the four items for the subscale telemedicine utilization for pre-test surveys was 3.444 (95% CI, 2.998 to 3.901), which was statistically different from the average mean of the four items of the subscale for the post-test surveys, which was 4.389 (95% CI, 4.075 o 4.703). This statistically significant difference in means was also seen in the manually matched data where the average mean for the pre-test data for the four questions was 3.538 (95% CI, 3.193 and 3.884) and the average mean for the post-test data was 4.442 (95% CI, 4.211 and 4.673). Based on the IP address matched data and the manually matched data, there was no statistically significant difference in the means of the subscale telemedicine utilization and subscale quality of care ($p > 0.05$). However, the null hypothesis was rejected, and the alternative hypothesis was accepted, indicating that there was significant difference observed in PA students' perception of self-efficacy utilizing telemedicine in their future practice between the pre- and post-survey results.

Research Question 4. Does a training session in telemedicine significantly change PA students' perception of telemedicine's impact on quality of care?

Hypothesis H4. $H4_o$: There is no significant difference in PA students' perception of telemedicine's impact on quality of care between the pre- and post-survey results.

$H4_a$: There is a significant difference in PA students' perception of telemedicine's impact on quality of care between the pre- and post-survey results.

There is a significant difference in PA students' perception of telemedicine's impact on quality of care between the pre- and post-survey results. A repeated measures ANOVA test showed a statistically significant difference in the means between the delivery of the telemedicine visit and the time, whether before or after, the survey was taken in both the IP address matched data and the manually matched data as seen in Table 10 and Table 11 ($df = 1, F = 46.211, p < 0.001$; $df = 1, F = 82.620, p < 0.001$). The average mean for the 18 IP address matched data of the four items for the subscale telemedicine utilization for pre-test surveys was 3.611 (95% CI, 3.229 to 3.994), which was statistically different from the average mean of the four items of the subscale for the post-test surveys, which was 4.611 (95% CI, 4.331 and 4.891). This statistically significant difference in means was also seen in the manually matched data where the average mean for the pre-test data for the four questions was 3.641 (95% CI, 3.351 and 3.931) and the average mean for the post-test data was 4.654 (95% CI, 4.458 and 4.850). Based on the IP address matched data and the manually matched data, there was no statistically significant difference in the means of the subscale telemedicine utilization and subscale quality of care ($p > 0.05$). Thus, again the null hypothesis was rejected, and the alternative hypothesis was accepted, indicating that there was significant difference observed in PA students' perception of self-efficacy utilizing telemedicine in their future practice between the pre- and post-survey results.

Lastly, Figures 12a and 12b show the subscale data in comparison of the pre-test survey and post-test survey results for each of the matched datasets. In these figures, time 1 indicates pre-test survey, time 2 indicates post-test survey, subscale 1 indicates subscale define

telemedicine, subscale 2 indicates subscale virtual healthcare visit, subscale 3 indicates subscale telemedicine utilization, and subscale 4 indicates subscale quality of care.

Figure 12a is a graphical depiction of the IP address matched dataset including the data from Table 11. Overall, there was a significant difference in the average of the means for pre-test and post-test values. Additionally, the mean average ranked lowest to highest include virtual telemedicine visit, telemedicine utilization, defining telemedicine, and quality of care. Figure 12b is a graphical representation of the manually matched data, which also includes data from Table 7. The trends noticed in the IP address matched data were similar to that of the manually matched data.

Figure 12a

Comparison of Subscales and Pre- and Post-Tests amongst the IP Address Matched Dataset

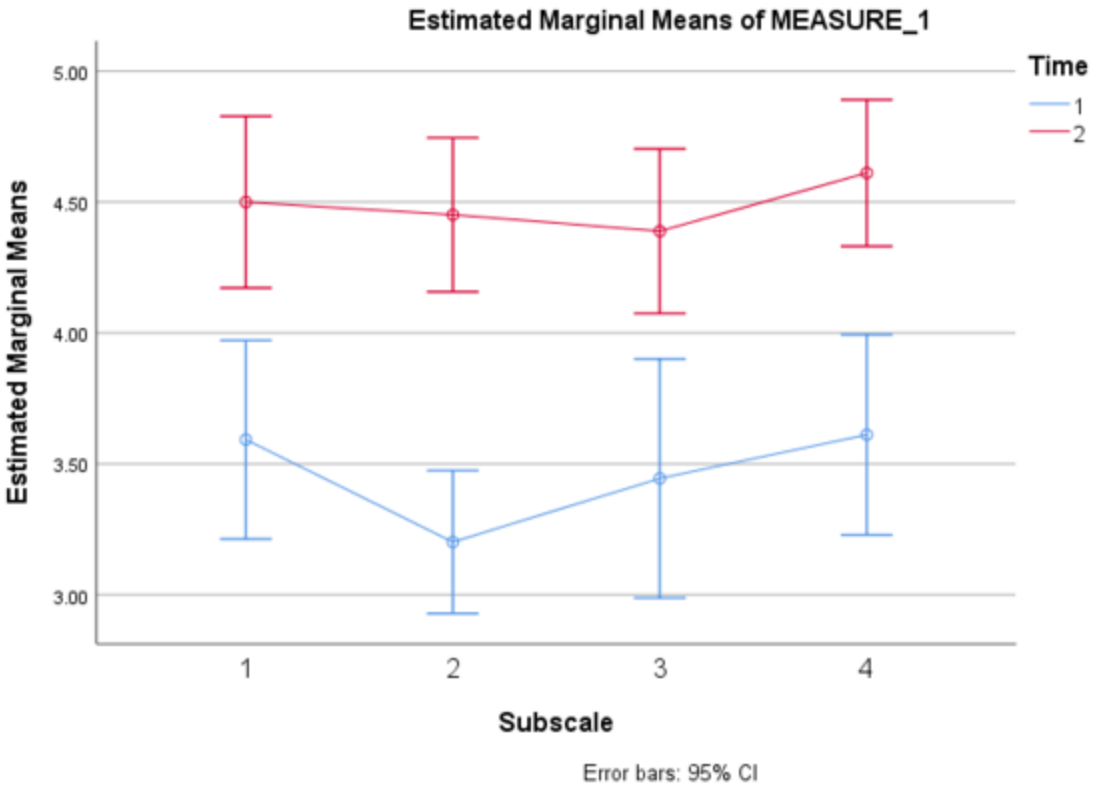
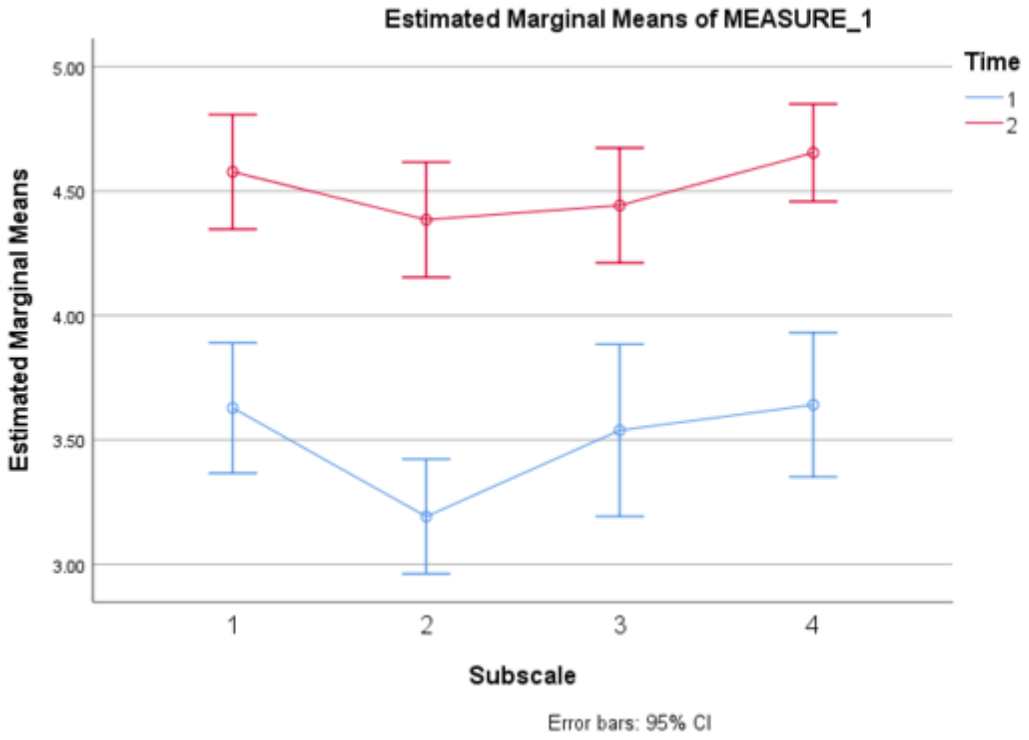


Figure 12b

Comparison of Subscales and Pre- and Post-Tests amongst the Manually Matched Dataset



Conclusion

The results of this study indicated that incorporating a telemedicine training program in PA students' curriculum does have impact on PA students' ability to define telemedicine, perception of performing a virtual telehealth visit, perception of utilizing telemedicine in future practice, and quality of care during a telemedicine visit. All of the subscales improved over time. The manufact of time was statistically significant with the partial eta squared showing that the telemedicine program had a large effect. Thus, all four null hypotheses were rejected for the four research questions proposed in this study.

This observation was seen in the primary results with the IP address matched dataset

(N = 18) and manually matched dataset (N = 26). A better way of matching the data would be to assign random numbers to students so that additional matches could have been identified as 10 post-test surveys were not matched to a pre-test survey. However, that being said, based on the repeated measures ANOVA tests that were utilized on data obtained solely on IP address matching and data obtained with age, gender, and hometown matching were consistent. The subscale that had the lowest average mean was virtual healthcare visit followed by the subscale telemedicine utilization. Overall, the increase of means over time effected all the subscales about the same based on the data analysis while analyzing subscale by time. An analysis of these results will be provided in the next chapter.

Chapter Five

Discussion and Conclusion

The purpose of this study was to develop and evaluate a telemedicine curriculum for PA students at RUC. Through the pre-test and post-test evaluation surveys, specific topics were identified to cover what students felt was most beneficial to learn about telemedicine. In addition, the pre-test and post-test evaluation surveys were based on self-efficacy measures so that students have the ability to rate themselves on their competencies based on providing care via telemedicine.

With the rise of telemedicine during the COVID-19 pandemic, it is important for PA programs to include telemedicine as part of the curriculum. As indicated by Zimiles (2020), telemedicine will be incorporated in practice post pandemic as more individuals stated they are less likely to reschedule a telemedicine visit and are more likely to follow up with their provider regarding long-term medication follow-up.

Legislature involving telemedicine is rapidly changing. As of March 30, 2020, Medicare expanded the telehealth services for providers to establish provider-patient relationships via telemedicine. Additionally, any geographic location qualified for telemedicine services was added. Overall, the results of this study supported the integration of a telemedicine program amongst PA curriculum based on self-efficacy pre-test and post-test evaluation surveys.

Overall Analysis

Survey participants reported a higher level of agreement with the 18 statements regarding telemedicine after the delivery of a telemedicine program. There was statistically significant improvement seen across the means of all four subscales while comparing the pre-test survey data and the post-test survey data. Additionally, there was internal consistency and reliability

amongst the data for each subscale. The research questions of this study looked to identify whether there was change in students' ability and perception of various aspects of a telemedicine visit. This is highly important to apply to clinical settings, so that future providers develop the skillset to provide care through a virtual platform with the rapid rise in the utilization of telemedicine.

Strengths and Weaknesses of Curriculum Design and Delivery

Overall, the curriculum delivery went very well. The participants were actively participating in the telemedicine program through open-ended questions asked during the presentation, Poll Everywhere participation as discussed in a prior section, group activities on nonverbal communication, and preparing and presenting rapid-fire presentations. Students were able to learn from each other and discuss how they would perform various aspects of a physical examination through the rapid-fire presentations. Some observations made during the preparation of the rapid-fire presentations included active participation, debates regarding the topic, and cooperation amongst team members. For student participation and engagement, it was important to embed activities into the modules to incorporate bidirectional learning.

In regard to the curriculum delivery, several topics students wanted to cover in the telemedicine program were incorporated in the learning objectives of the curriculum. These topics included how to perform a comprehensive physical examination via telemedicine, billing aspects of telemedicine, limitations of telemedicine versus an in-person visit, defining telemedicine and its utilization, and reviewing applications utilized with telemedicine care delivery. These topics were incorporated into the three modules of the telemedicine program, which had 5- to 10-minute breaks embedded after each module to reduce "Zoom fatigue" amongst the students.

A few things I would change to the curriculum delivery is splitting the program into multiple sessions instead of one 4-hour session. Once we reached module three, student participation reduced significantly. The reduced engagement of students may have been due to Zoom fatigue and being in a virtual classroom setting for over 3 hours. Additionally, I would like to have shown some videos on how to perform a physical exam via telemedicine. Since a majority of the responses received regarding topics covered during the telemedicine curriculum focused on the physical examination, I would also include a few OSCEs in future delivery of this curriculum so that students can practice how to perform a physical examination via telemedicine.

Strengths and Weaknesses of Data Collection

The strengths of the data collection process were the timing that the pre- and post-test evaluation surveys were released. Participants had the opportunity to complete the pre-test evaluation survey 1 week prior to the telemedicine program. In addition, students were given 10 to 15 minutes to complete the pre-test evaluation survey at the beginning of the telemedicine program prior to information delivery. Students had access to the post-test evaluation survey right after the telemedicine training program. There was approximately a 68% survey return right after the telemedicine training program was delivered. With additional weekly reminders for 2 weeks after the telemedicine program was delivered, the survey returns increased to approximately 88%. Another strength of the data collection was utilization of SPSS software for data consolidation and statistical testing.

Limitations of Data Analysis

There were 18 matches when IP address was utilized to match the data and 26 matches when demographic data was utilized to manually match the data; thus, the sample size for the ANOVA tests was relatively small. An improvement with data collection would be to assign the

students random numbers so that all the surveys returned could have been matched easily and included in the data analysis. Another limitation of this study was with the use of Cronbach's alpha to test for reliability amongst subscales. The alpha value could be skewed due to the small number of items associated with each subscale. Thus, a smaller alpha may have been observed due to the small number of items associated to the subscale seen in the pre-test data of subscale quality of care. Additional questions or items could be added to the subscales to improve any issues with the Cronbach's alphas score. Additionally, if the alpha value is high, it may be due to the fact that the items may be redundant within a subscale. Although a few limitations were observed in the data, there was a statistical significance amongst the means seen in the pre-test and post-test evaluation surveys.

Relationship of the Findings to Prior Research

This section focuses on the relationships from prior research to the research findings of this study. Aspects of the theories utilized for curriculum design and developing the pre- and post-test evaluation tools, comparison of curriculum topics that have been identified in previous research and what topics were covered in the telemedicine program offered to PA students, best practices in teaching in a virtual platform that were utilized in the delivery of the telemedicine program, and a comparison of data with the use of the validated survey tools, which were incorporated in the combined evaluation tool for this research, will be covered in this section.

Comparison of Data

Chike-Harris et al. (2020) concluded that although telemedicine was a requirement for medical schools to consider, the data available regarding effective approaches to deliver this content was minimal. A study looking at telemedicine concepts integrated in PA curriculum was first introduced at the University of Iowa in 2001 (Asprey et al., 2001). Asprey et al. (2001)

delivered four 2-hour didactic training sessions compared to the one 4-hour training session utilized in the telemedicine program developed for this research study. Aspects of the training sessions that Asprey et al. (2001) included were history of telemedicine, digitizing the patient record, observation of a teleconsultation, and demonstrating usefulness of a telemedicine visit. In comparison, the topics focused on in the telemedicine program for this research study included introduction to telemedicine and its application, reviewing several care models to provide high quality care via telemedicine, how to perform a physical examination, and the billing aspects of telemedicine. A key finding in the Asprey et al. (2001) study was that 15 out of 18 students said that they had no to poor knowledge of the concept of telemedicine. This data varied from the data obtained in this research study as the mean average of the pre-test survey results were around a 3 on a 5-point rating scale, indicating that students neither agree nor disagree to the survey statements regarding elements of a telemedicine visit. However, there was a statistically significant difference observed in the means of the pre-test and post-test data for this study, indicating that students felt more capable of handling a telemedicine training after the delivery of a telemedicine program. Additionally, students were engaged in providing feedback on how to make the telemedicine program better to best serve them.

Theories and the Telemedicine Curriculum

The curriculum design and evaluation process were based off of the theories of cognitivism and utilization focused approach. The theory of cognitivism states that students learn through study and application (Knowles et al., 2015). This theory was utilized in various aspects of the curriculum design, including short activities on nonverbal cues where concepts of nonverbal cues were reviewed and applied during two activities. Additionally, the theory of cognitivism was also utilized during the rapid-fire presentation for the physical exam

components and case-based scenarios reviewed in module three of the training program. Lastly, the theory of cognitivism also formed the basis of the pre-test and post-test evaluation survey as students were asked to rank their self-efficacy in various skills of telemedicine.

The utilization focused approach was also a guiding principle to evaluate whether the program met the needs of the students training. Additionally, through the utilization focused approach, aspects of a program improvement can be identified (Patton, 2008). In this study, the open-ended question utilized in the post-test evaluation survey provided students the opportunity to give input on how they think the telemedicine program could be more effective and successful. Not only do evaluation tools based on the utilization focused approach theory help identify gaps in the curriculum, but they also help define students' comfort levels with utilizing telemedicine in the clinical setting, which was seen through the statistical analysis of this study (Vassar et al., 2010).

Curriculum Design

A logic model was utilized to design the curriculum, which provided a snapshot of the curriculum (Balmer et al., 2019). Rhone et al. (2020) identified that performing a physical examination and learning about "webside" manner are key components of any training program to provide care through a virtual setting. This was in congruence with the topics that students wanted to cover identified in the pre-test survey. About 65% of students responded that they wanted to cover how to perform a comprehensive physical examination via telemedicine in the pre-test survey. Thus, one module was devoted to the physical examination process via a virtual platform.

Additional topics that were covered based on research findings include quality of care and continuity of care via telemedicine. Abel et al. (2018) discussed the importance of providing

high standard of care via telemedicine so that patients develop trust in the virtual system and are more willing to participate in telemedicine visits. Thus, it is critical to empower students with techniques and models that will better serve them and their patient during a telemedicine visit such as the C-I-CARE model and Presence 5 model. Lunney et al. (2018) discussed the importance of continuity of care via telemedicine. From the post-test survey results, the students were also interested in learning how to distinguish when to bring a patient in for an in-person visit compared to continuing the visit via telemedicine based on the sensitivity of the information the provider will be giving to the patient. Additionally, Wu et al. (2018) concluded that telehealth services provided more follow-up for patients who have hypertension and diabetes and helped lower blood pressure and A1C levels with additional follow-up. Case-based scenarios were created to mimic the use of telemedicine in patients who have chronic illnesses to provide examples of how telemedicine can be utilized during care continuation for patients.

Lastly, Jumeroenvong et al. (2020) concluded that not only should students prepare to utilize telemedicine technology, but they should understand the limitations to ensure patients are getting adequate care through the virtual platform. This was very interesting as one of the statements received in the open-ended questions of the post-test evaluation survey was the need for additional training in identifying limitations.

Best Practice of Teaching

A backwards curriculum and modular design were utilized to develop the telemedicine training program composed of three modules. Richards (2013) defined a backward curriculum design as starting off with specifying learning outcomes and then defining the methodology. Additionally, the telemedicine curriculum was based on a modular format. Martin et al. (2019)

described how a meaningful modular based format helps students identify what they should be learning from each module and compartmentalize the information.

At the beginning of the virtual telemedicine program, housekeeping rules were discussed, which included critical links that would be utilized throughout the presentation and how to ask questions. Identifying expectations on an online platform has been identified on several checklists developed by universities in the United States on how to host a successful virtual learning environment (Columbia Center for Teaching and Learning, 2020).

Additionally, breakout sessions were utilized to foster active participation during the telemedicine program. Chandler (2016) concluded that breakout sessions are beneficial to build a collaborative learning environment in an online setting. Overall, the students were interacting with each other to discuss specific topics assigned and it was a very interactive session. Lastly, case-based scenarios were utilized in module three to provide students with the opportunity to learn from each other while acquiring medical knowledge (Van Rhee et al., 2003).

Validated Evaluation Tools

While developing the curriculum, it was important to understand what evaluation method should be utilized to evaluate specific telemedicine skillsets. Raupach et al. (2019) defined analyzing teaching effectiveness through comparative pre- and post-self-assessments. The next few paragraphs discuss a comparison of the data obtained from the validated tools utilized in the combined pre- and post-test evaluation survey for this research study. Additionally, a comparison of the results of this study compared to the results of the previous surveys was analyzed.

List et al. (2019) developed a training session for telemedicine amongst nursing students. Overall, they looked at measures defining telemedicine, how telemedicine can improve patient outcomes, citing examples of telemedicine, and how telemedicine technology is utilized in the

healthcare environment. All measures showed a statistically significant difference in all four measures ($p < 0.001$) (List et al., 2019).

The results of research question one of this study demonstrated that a training session in telemedicine had a significant difference in PA students' ability to define telemedicine and cite examples of telemedicine in practice based on the IP address matched data and the manually matched data ($df = 1$, $F = 46.211$, $p < 0.001$; $df = 1$, $F = 82.620$, $p < 0.001$). This result furthered the understanding that components of defining telemedicine in practice increased the PA students' ability after completing the telemedicine training program.

Sartori et al. (2020) developed an OSCE case to assess telemedicine-specific skills amongst residents. A specific weak domain that was identified while utilizing telemedicine was performing a virtual physical examination where only 18% of research participants scored "well done" out of a 3-point rating scale (Sartori et al., 2020). In addition, 17% of research participants scored "well done" for leveraging video to augment history gathering (Sartori et al., 2020).

The results of research question two of this study demonstrated that a training session in telemedicine had a significant difference in students' perception of their ability to conduct a telemedicine encounter amongst both data sets ($df = 1$, $F = 46.211$, $p < 0.001$; $df = 1$, $F = 82.620$, $p < 0.001$). This result furthered the understanding that physical examination training in a virtual setting increased the PA students' perception after completing of their ability to conduct a telemedicine visit.

Kirkland et al. (2019) defined a 3-year longitudinal curriculum for internal medicine residents to cover topics including history of telemedicine, how to communicate to a patient on a virtual platform, and how to perform a physical examination virtually. Overall, there was a 39%

increase in ratings by the residents in regard to ability to utilize telemedicine in their future practice after completing the online telemedicine training ($p < 0.01$) (Kirkland et al., 2019).

The results of research questions three and four of this study demonstrated that a training session in telemedicine had a significant difference in PA students' perception of self-efficacy utilizing telemedicine in their future practice and perception of telemedicine's impact on quality of care based on the IP address matched data and the manually matched data ($df = 1$, $F = 46.211$, $p < 0.001$; $df = 1$, $F = 82.620$, $p < 0.001$). This result furthered the understanding that components of utilization of telemedicine in practice and quality of care increased the PA students' perception after completing the telemedicine training program.

Implications for Future Curriculum Integration

Overall, this study showed that PA students are interested in learning about telemedicine topics during their training. In addition, with a statistical difference seen in the means of the pre-test and post-test evaluation surveys, the telemedicine program helped prepare PA students to be able to conduct healthcare visits via telemedicine. Lastly, this study serves as a pilot for other PA programs to integrate this telemedicine program for further identification of topics that students would like to cover during training. The next step would be to utilize the same telemedicine program and evaluation tools in other PA programs to identify trends in a larger population.

Incorporation of Telemedicine in PA Curriculum

Recently, the AMA released a policy stating that telemedicine training should be incorporated into the medical school curriculum (AMA, 2020). Additionally, there is a focus on teaching "webside" manner so students can provide high quality care to patients on a virtual platform (Barthelemy, 2019). Based on this study's findings, PA students were interested in learning various aspects of providing care via telemedicine based on the open-ended responses

regarding topics on the pre-test and post-test surveys. Additionally, there was a significant different in self-efficacy ratings of PA students on 18 aspects of telemedicine amongst the participants of this research study. Although additional PA programs should pilot the telemedicine program with the pre-test and post-test evaluation surveys, the accrediting body should consider incorporating aspects of telemedicine in PA curriculum through standardized practice. As the accrediting body requires a certain number of OSCEs to take place in a PA student's career, there should be telemedicine OSCEs for students to prepare themselves for a telemedicine visit. In addition, introducing elective rotations in telemedicine or having hybrid clinical rotations with in-person visits and telemedicine visits would be beneficial to students to prepare them as future clinicians as the utilization of telemedicine is on a rise. Overall, it is not only important for the legislature around telemedicine to change, but also for education models to change to incorporate telemedicine training in PA programs.

Conclusion

Overall, there was a significant difference seen in students' perception of their ability to define telemedicine and cite examples of telemedicine in practice, their ability to conduct a virtual healthcare visit, their ability of utilizing telemedicine in future practice, and their perception of how telemedicine impacts quality of care. The four objectives of helping students learn how telemedicine can be utilized in PA practice, preparing students to conduct a healthcare visit via telemedicine, identifying gaps in the telemedicine training program within the PA curriculum, and providing an example of a telemedicine program to incorporate in PA programs were met. Based on the open-ended question responses in the pre-test evaluation survey, students thought it was necessary to learn about telemedicine focusing on the physical exam techniques, billing, and etiquette of providing care via telemedicine. Best practice methods were utilized to

develop and deliver the curriculum. There was a statistically significant difference seen amongst the means of the subscales in the pre-test evaluation survey and post-test evaluation survey. This study identified that integration of a telemedicine program helps improve the self-efficacy scores on various telemedicine skill sets amongst PA students. Additionally, this study identified a combined survey tool that can be utilized to measure telemedicine program effectiveness amongst PA programs. Future studies can look at a wider impact of integrating variations of the developed telemedicine program with utilization of the combined evaluation survey tool. Lastly, it is critical for accrediting agencies to look at integrating telemedicine skillsets in the PA curriculum as students overall felt more competent in delivering care through the use of telemedicine after completing a telemedicine training program.

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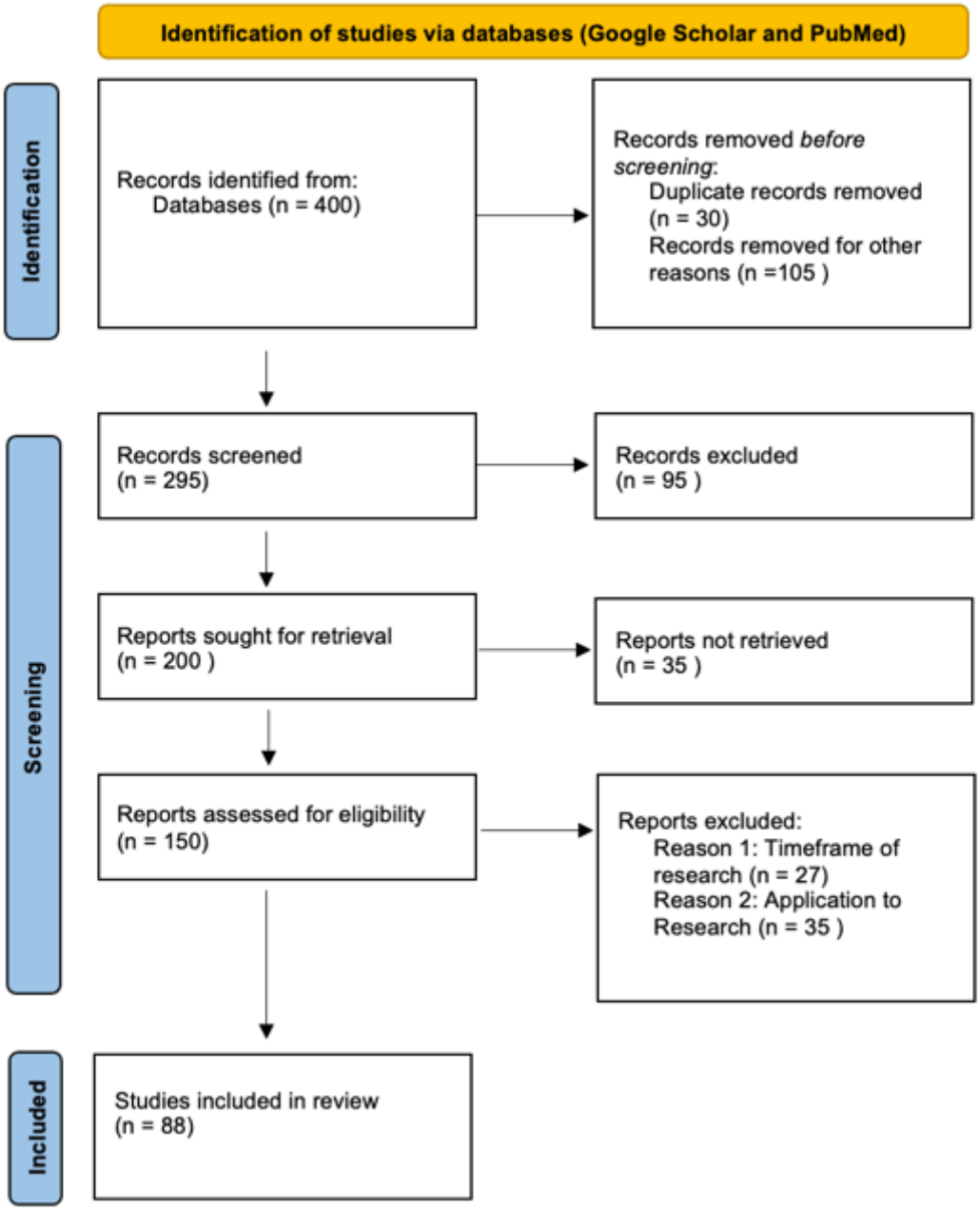
Appendix A

PRISMA Diagram



Appendix B

Telemedicine Program Outcomes and Learning Objectives

The telemedicine curriculum is designed to provide PA students with the knowledge and ability to feel comfortable will providing care via telemedicine through lectures, group-based work, and a case base analysis. Specific program outcomes include:

1. Ability to define telemedicine and cite examples of telemedicine in practice.
2. Ability to conduct a virtual healthcare visit.
3. Demonstrate comfortable utilizing telemedicine in their future practice.
4. Demonstrate understanding telemedicine's impact on quality of care.

The learning objectives will be based on the program outcomes of medical knowledge, interpersonal and communication skills, patient care, professionalism, practice-based learning, and systems-based practice. The learning outcomes of the training program include:

1. Develop understanding of telehealth and how telemedicine is utilized in the healthcare industry.
2. Identify how telehealth may improve patient outcomes.
3. Develop fundamental skills to provide high quality medical care using telemedicine.
4. Develop physical examination skills via a virtual mode.
5. Describe when to see patients in-person versus continuing the visit via telemedicine.
6. Develop communication skills to aid the conversation in a virtual setting.
7. Describe how to bill for telemedicine visits.

Appendix C

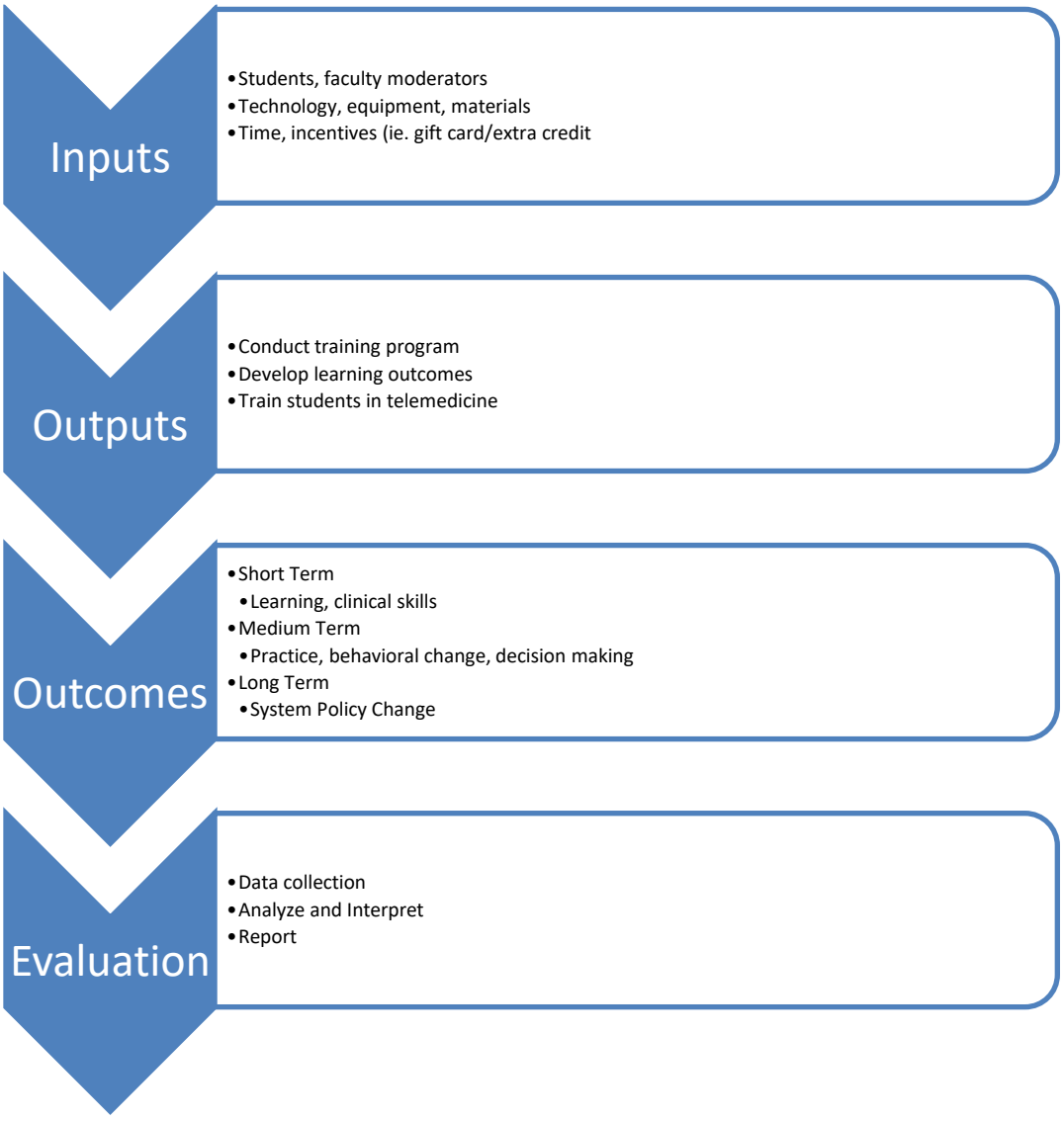
Mapping of Course Objectives to Program Outcomes

Program Outcomes	Learning Objectives
1	1,2,5
2	3,4,6
3	1,2,3,4,5,6,7
4	2,3

Appendix D

Logic Model

Situation: Developing and Evaluating a 4-hour telemedicine programs structured for PA students at RUC. Priorities include inclusion of program mission, vision and values and collaboration amongst faculty and students.



Appendix E

Four-Hour Preliminary Outline of Telemedicine Curriculum

Module 1: Introduction to Telemedicine and the PA Profession (30-45 minutes)

- Defining telemedicine from telehealth
- Telemedicine and the PA Profession
- Subspecialities and Telemedicine
- Telemedicine and the healthcare industry

Module 2: Physical Examination via Telemedicine (45-60 minutes)

- Breakout into groups of 4-6
- Teams will develop a 2-minute presentation on how to perform a physical exam based on organ system
- Teams will identify a team lead to present the material
- Teams will identify a team member to be a patient
- Teams will have 15-20 minutes to develop a 2-minute presentation
- 10 groups will present on the 10 organ systems for 2 minutes

Module 3: Other things to know about a Telemedicine as a PA provider (45-60 minutes)

- How to identify nonverbal cues in a patient
- Billing for Telemedicine visits
- How to augment the virtual visit

End of Program and Feedback

Appendix F

Letter to Research Participants

Title of Email: You have been selected to participate in a research study

Body of Email:

Dear RUC PA Student,

As part of your curriculum, you will complete a telemedicine training program that will take place on a virtual platform. A Zoom link to the meeting will be shared with all participants via email one week prior to the training session. The training session is tentatively scheduled for **June 25th from 1:00 – 5:00 pm**.

You have been selected to participate in a research study titled, "Efficacy of a Telemedicine Training Program for PAs," to evaluate the effectiveness of this training. The time commitment required from each participant for this study is less than one hour. The purpose of this research is to develop and evaluate the effectiveness of a telemedicine curriculum in a PA program.

As a research participant you will have the opportunity to complete a pre-test survey with is 19 questions in length and should not take longer than 20 minutes for you to complete. A link to the pre-test survey will be sent to you 1 week prior to the telemedicine training date.

After completion of the telemedicine training session, you will be asked to complete a post-test evaluation survey within 30 minutes of completion of the training. You will also have the opportunity to identify additional areas that you would like to see in a future program. The post-evaluation survey should take no longer than 20 minutes to complete.

[Based on IRB approval] Participants who complete both surveys and provide a contact email will be entered into a drawing for a $50 Amazon gift card and will be emailed to participants within 1 week of completion of the research project.

Thank you for taking the time to participate in this research study. Looking forward to meeting you all virtually on June 25th. Please be watchful for another email from me soon with the link to the pre-test survey.

If you have any questions, please feel free to contact me via email at (insert email).

Sincerely,

The Research Team

Appendix G

Email from RUC IRB

Hello Sunny,

Good morning and thank you for your note. With the information provided, it sounds like it may be able to be reviewed under an expedited review category. You will need to submit an IRB application using IRBManager, accessible using One Campus. I do not know if you have used IRBManager before, but I wanted to share a couple of tips.

Once you have logged into IRBManager, you will be taken to what is known as your dashboard. That is the starting point and where you will start forms, check the progress of applications, etc. If you get to a different screen and want to go back to your dashboard (home), there is a "Home" button at the top of any page which will bring you back to your dashboard.

An interesting note for me, as my prior institutions did not utilize this particular software for IRB, is that "xForm" is the name of the IRB application form. So when you look at your dashboard and see xForms, you will see what is processed as well as those in various stages of the application and review process.

To begin a new application, click on "Start a xForm" under the "Actions" menu on the tool bar located on the left-side of your dashboard.

Your professor (Dr. Allison-Jones?) would be PI (Principal Investigator) on the project. If/when you begin the IRB application, I would suggest that in addition to making your professor PI, you also add as a Collaborator, giving edit/manage/submit capabilities. Otherwise, it would not be accessible for them until you officially submitted the application for their PI sign-off and submission to the IRB.

To navigate pages within the IRB application and skip to different application pages, use the drop-down box at the top of the page and select the page you want to access. Your changes will be automatically saved when you jump to a new page. If you do not address all of the required sections, the system will not allow you to move to the next page and will give show you sections that are missing information in red text.

You will find the link for “Collaborators” right next to this drop-down menu.

That ought to get you started. I hope that helps.

I look forward to hearing from you.

Best regards,

Anna Marie

Anna Marie Lee, MHA, CPIA

Research Compliance Manager

Radford University

540.831.5290

Appendix H

Emails for Approval of Validated Tool Utilization

Copy of Email Approval 1:

Sunayana,

Thank you for reaching out about the telehealth evaluation. You are welcome to use the questions with citation. Please check with your advisor about the degree to which your changes might change the survey's use as a validated tool. If I or the rest of the author team can assist further, please let us know. Best of wishes with your scholarship – we look forward to seeing the results.

Ragan

___

Ragan DuBose-Morris, PhD
Telehealth Education Manager, Center for Telehealth
Associate Professor, Academic Affairs Faculty
Medical University of South Carolina
169 Ashley Avenue
Charleston, SC 29425
843-792-9429
duboser@musc.edu
http://www.muschealth.org/telehealth

Copy of Email Approval 2:

Sunayana,

I received your email request. Yes, you may use the tool and reword the questions to fit your study. I appreciate the citation credit.

Best wishes on your research project!

Dr. List

BETSY A. LIST, PhD, MPH, RN
Assistant Professor
College of Nursing
listb1@xavier.edu
T 513-745-3690
F 513-745-1087
www.xavier.edu/nursing/
Xavier University
3800 Victory Pkwy, Cincinnati, OH 45207

Copy of Email Approval 3:

Sunayana,

Thanks for your email. Yes, you are welcome to use the questions on our telemedicine checklist. Just make sure to cite the paper! Let me know if I can be of any help. Good luck!

Dan

Daniel Sartori, MD

Assistant Professor of Medicine

Associate Director, Internal Medicine Residency Program

NYU Grossman School of Medicine

NYU Langone Hospital - Brooklyn

Appendix I

IRB Approval Email

Dear Lisa and Sunayana,

Good morning. Your new IRB protocol, 2021-223, is approved. The IRB approval package with the approval letter and copy of the approved corresponding documents is attached for your records and use in the research project.

Thank you and good luck with your project!

Anna Marie

Anna Marie Lee, MHA, CPIA

Research Compliance Manager

Whitt Hall

Radford University

alee16@radford.edu

Appendix J

Draft of Email for Post-test Evaluation Survey Reminder

Dear [Participant Name],

Thank you for participating in the study titled, "Efficacy of a Telemedicine Training Program for PAs."

To complete your entry in the $50 Amazon gift card drawing, you must submit the post-test evaluation survey. The post-test evaluation survey should take no longer than 10 minutes to complete. Below is a link to the post-test evaluation survey. Once you complete the post-test evaluation survey, please send a screenshot of the completed survey screen to spydah1@radford.edu.

Link to post-test evaluation survey: https://radford.co1.qualtrics.com/jfe/form/SV_40zH7aMI6HK8258

Thank you for taking the time to complete the post-test evaluation survey.

If you have any questions, please feel free to contact me via email at spydah1@radford.edu.

Regards,

Sunayana C. Pydah, MBA, MHA, MPAM, PA-C

Appendix K

Pre-Test Evaluation Form

Demographic Information: Answer the questions below.

What is your age?

Enter 2-digit number: ____

What is your gender?

____ Female

____Male

How would you classify your hometown based on population?

_____Urban

_____Suburban

_____Rural

How much telemedicine experience have you had in the past?

Enter number of weeks:_____

Questions: Answer the questions below based on a five-point Likert scale. Select the answer that best represents your thoughts.

1. I can define telehealth.

_____ 5: Strongly Agree

_____ 4: Agree

_____ 3: Neither Agree or Disagree

_____ 2: Disagree

_____ 1: Strongly Disagree

2. I understand how telemedicine is utilized in the healthcare industry.

_____ 5: Strongly Agree

_____ 4: Agree

_____ 3: Neither Agree or Disagree

_____ 2: Disagree

_____ 1: Strongly Disagree

3. I can identify how telehealth may improve patient outcomes.

_____ 5: Strongly Agree

_____ 4: Agree

_____ 3: Neither Agree or Disagree

_____ 2: Disagree

_____ 1: Strongly Disagree

4. I feel comfortable with confirming patient identifiers.

_____ 5: Strongly Agree

_____ 4: Agree

_____ 3: Neither Agree or Disagree

_____ 2: Disagree

_____ 1: Strongly Disagree

5. I feel comfortable with identifying nonverbal communication to enrich communication via camera.

   _____ 5: Strongly Agree

   _____ 4: Agree

   _____ 3: Neither Agree or Disagree

   _____ 2: Disagree

   _____ 1: Strongly Disagree

6. I feel comfortable with optimizing technical aspects of the virtual encounter.

   _____ 5: Strongly Agree

   _____ 4: Agree

   _____ 3: Neither Agree or Disagree

   _____ 2: Disagree

   _____ 1: Strongly Disagree

7. I feel confident with utilizing video interface.

   _____ 5: Strongly Agree

   _____ 4: Agree

   _____ 3: Neither Agree or Disagree

   _____ 2: Disagree

   _____ 1: Strongly Disagree

8. I feel comfortable utilizing live video to augment information gathering.

_____ 5: Strongly Agree

_____ 4: Agree

_____ 3: Neither Agree or Disagree

_____ 2: Disagree

_____ 1: Strongly Disagree

9. I am comfortable reviewing consents with a patient via telemedicine.

_____ 5: Strongly Agree

_____ 4: Agree

_____ 3: Neither Agree or Disagree

_____ 2: Disagree

_____ 1: Strongly Disagree

10. I feel comfortable with developing a partnership with the patient to perform a physical examination.

_____ 5: Strongly Agree

_____ 4: Agree

_____ 3: Neither Agree or Disagree

_____ 2: Disagree

_____ 1: Strongly Disagree

11. I feel comfortable with appropriate computer etiquette during the video encounter.

_____ 5: Strongly Agree

_____ 4: Agree

_____ 3: Neither Agree or Disagree

_____ 2: Disagree

_____ 1: Strongly Disagree

12. I have the ability to utilize telehealth in future practice.

_____ 5: Strongly Agree

_____ 4: Agree

_____ 3: Neither Agree or Disagree

_____ 2: Disagree

_____ 1: Strongly Disagree

13. I have the ability to explain how telehealth applications have contributed to healthcare.

_____ 5: Strongly Agree

_____ 4: Agree

_____ 3: Neither Agree or Disagree

_____ 2: Disagree

_____ 1: Strongly Disagree

14. I understand how telehealth is essential to future practice.

_____ 5: Strongly Agree

_____ 4: Agree

_____ 3: Neither Agree or Disagree

_____ 2: Disagree

_____ 1: Strongly Disagree

15. I am comfortable performing a telemedicine visit as a future clinician.

_____ 5: Strongly Agree

_____ 4: Agree

_____ 3: Neither Agree or Disagree

_____ 2: Disagree

_____ 1: Strongly Disagree

16. I understand how to bill for telemedicine visits.

_____ 5: Strongly Agree

_____ 4: Agree

_____3: Neither Agree or Disagree

_____ 2: Disagree

_____ 1: Strongly Disagree

17. I am comfortable performing a physical exam through the use of telemedicine.

_____ 5: Strongly Agree

_____ 4: Agree

_____ 3: Neither Agree or Disagree

_____ 2: Disagree

_____ 1: Strongly Disagree

18. Overall, I think having telemedicine integrated in the PA curriculum is beneficial.

_____ 5: Strongly Agree

_____ 4: Agree

_____ 3: Neither Agree or Disagree

_____ 2: Disagree

_____ 1: Strongly Disagree

Open Ended Question: Please type you answer below.

What topics would you like to see covered in the telemedicine program?

_____

Appendix L

Post-test Evaluation Form

Demographic Information: Answer the questions below.

What is your age?

Enter 2-digit number: ____

What is your gender?

____ Female

____Male

How would you classify your hometown based on population?

_____Urban

_____Suburban

_____Rural

How much telemedicine experience have you had in the past?

Enter number of weeks:_____

Questions: Answer the questions below based on a five-point Likert scale. Select the answer that best represents your thoughts.

1. I can define telehealth.

_____ 5: Strongly Agree

_____ 4: Agree

_____ 3: Neither Agree or Disagree

_____ 2: Disagree

_____ 1: Strongly Disagree

2. I understand how telemedicine is utilized in the healthcare industry.

_____ 5: Strongly Agree

_____ 4: Agree

_____ 3: Neither Agree or Disagree

_____ 2: Disagree

_____ 1: Strongly Disagree

3. I can identify how telehealth may improve patient outcomes.

_____ 5: Strongly Agree

_____ 4: Agree

_____ 3: Neither Agree or Disagree

_____ 2: Disagree

_____ 1: Strongly Disagree

4. I feel comfortable with confirming patient identifiers.

_____ 5: Strongly Agree

_____ 4: Agree

_____ 3: Neither Agree or Disagree

_____ 2: Disagree

_____ 1: Strongly Disagree

5. I feel comfortable with identifying nonverbal communication to enrich communication via camera.

   _____ 5: Strongly Agree

   _____ 4: Agree

   _____ 3: Neither Agree or Disagree

   _____ 2: Disagree

   _____ 1: Strongly Disagree

6. I feel comfortable with optimizing technical aspects of the virtual encounter.

   _____ 5: Strongly Agree

   _____ 4: Agree

   _____ 3: Neither Agree or Disagree

   _____ 2: Disagree

   _____ 1: Strongly Disagree

7. I feel confident with utilizing video interface.

   _____ 5: Strongly Agree

   _____ 4: Agree

   _____ 3: Neither Agree or Disagree

   _____ 2: Disagree

   _____ 1: Strongly Disagree

8. I feel comfortable utilizing live video to augment information gathering.

_____ 5: Strongly Agree

_____ 4: Agree

_____ 3: Neither Agree or Disagree

_____ 2: Disagree

_____ 1: Strongly Disagree

9. I am comfortable reviewing consents with a patient via telemedicine.

_____ 5: Strongly Agree

_____ 4: Agree

_____ 3: Neither Agree or Disagree

_____ 2: Disagree

_____ 1: Strongly Disagree

10. I feel comfortable with developing a partnership with the patient to perform a physical examination.

_____ 5: Strongly Agree

_____ 4: Agree

_____ 3: Neither Agree or Disagree

_____ 2: Disagree

_____ 1: Strongly Disagree

11. I feel comfortable with appropriate computer etiquette during the video encounter.

_____ 5: Strongly Agree

_____ 4: Agree

_____ 3: Neither Agree or Disagree

_____ 2: Disagree

_____ 1: Strongly Disagree

12. I have the ability to utilize telehealth in future practice.

_____ 5: Strongly Agree

_____ 4: Agree

_____ 3: Neither Agree or Disagree

_____ 2: Disagree

_____ 1: Strongly Disagree

13. I have the ability to explain how telehealth applications have contributed to healthcare.

_____ 5: Strongly Agree

_____ 4: Agree

_____ 3: Neither Agree or Disagree

_____ 2: Disagree

_____ 1: Strongly Disagree

14. I understand how telehealth is essential to future practice.

_____ 5: Strongly Agree

_____ 4: Agree

_____ 3: Neither Agree or Disagree

_____ 2: Disagree

_____ 1: Strongly Disagree

15. I am comfortable performing a telemedicine visit as a future clinician.

_____ 5: Strongly Agree

_____ 4: Agree

_____ 3: Neither Agree or Disagree

_____ 2: Disagree

_____ 1: Strongly Disagree

16. I understand how to bill for telemedicine visits.

_____ 5: Strongly Agree

_____ 4: Agree

_____ 3: Neither Agree or Disagree

_____ 2: Disagree

_____ 1: Strongly Disagree

17. I am comfortable performing a physical exam through the use of telemedicine.

_____ 5: Strongly Agree

_____ 4: Agree

_____ 3: Neither Agree or Disagree

_____ 2: Disagree

_____ 1: Strongly Disagree

18. Overall, I think having telemedicine integrated in the PA curriculum is beneficial.

_____ 5: Strongly Agree

_____ 4: Agree

_____ 3: Neither Agree or Disagree

_____ 2: Disagree

_____ 1: Strongly Disagree

Open Ended Question: Please type you answer below.

19. What topics would you like to see covered in future telemedicine programs?

_____

Appendix M

Research Project Codebook

Question on Instrument	Variable Name	Values	Data Type
What is your gender?	GENDER	1: Female 2: Male	Independent, Categorical
What is your age?	AGE	0 to N	Independent, Continuous
How would you classify your hometown that you grew up in?	HOMETOWN	1: Urban 2: Suburban 3: Rural	Independent, Categorical
How many weeks have you been exposed to telehealth during clinical rotations?	WEEKS	0 to N	Independent, Continuous
What topics would you like to see covered in the telemedicine program?	TOPICS	1: Written 2: Unwritten	Independent, Categorical
I can define telehealth.	DEFINE	1: Strongly Disagree 2: Slightly Disagree 3: Neither Agree or Disagree 4: Slightly Agree	Dependent, Categorical

		5: Strongly Agree	
I understand how telemedicine is utilized in the healthcare industry	UTILIZE	1: Strongly Disagree 2: Slightly Disagree 3: Neither Agree or Disagree 4: Slightly Agree 5: Strongly Agree	Dependent, Categorical
I can identify how telehealth may improve patient outcomes.	IMPROVEHLTH	1: Strongly Disagree 2: Slightly Disagree 3: Neither Agree or Disagree 4: Slightly Agree 5: Strongly Agree	Dependent, Categorical
I feel comfortable with confirming patient identifiers.	PATIENT_IDEN	1: Strongly Disagree 2: Slightly Disagree 3: Neither Agree or Disagree 4: Slightly Agree 5: Strongly Agree	Dependent, Categorical
I feel comfortable with identifying nonverbal communication to enrich communication via camera.	COMMUNICATION	1: Strongly Disagree 2: Slightly Disagree 3: Neither Agree or Disagree 4: Slightly Agree 5: Strongly Agree	Dependent, Categorical
I feel comfortable with optimizing technical aspects of the virtual encounter.	VIRTUAL	1: Strongly Disagree 2: Slightly Disagree 3: Neither Agree or Disagree 4: Slightly Agree 5: Strongly Agree	Dependent, Categorical
I feel confident with utilizing video interface.	VIDEO	1: Strongly Disagree	Dependent, Categorical

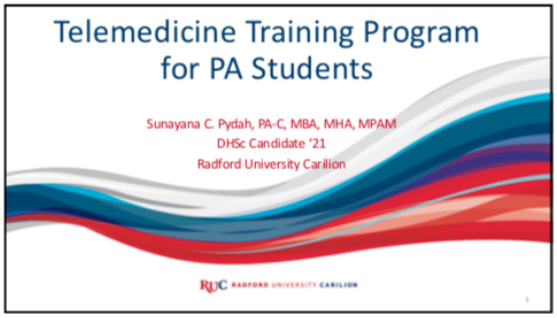
		2: Slightly Disagree 3: Neither Agree or Disagree 4: Slightly Agree 5: Strongly Agree	
I feel comfortable utilizing live video to augment information gathering.	AUGMENT	1: Strongly Disagree 2: Slightly Disagree 3: Neither Agree or Disagree 4: Slightly Agree 5: Strongly Agree	Dependent, Categorical
I am comfortable reviewing consents with a patient via telemedicine.	CONSENTS	1: Strongly Disagree 2: Slightly Disagree 3: Neither Agree or Disagree 4: Slightly Agree 5: Strongly Agree	Dependent, Categorical
I feel comfortable with developing a partnership with patient to perform physical examination.	PARTNERSHIP	1: Strongly Disagree 2: Slightly Disagree 3: Neither Agree or Disagree 4: Slightly Agree 5: Strongly Agree	Dependent, Categorical
I feel comfortable with appropriate computer etiquette during the video encounter.	ETIQUETTE	1: Strongly Disagree 2: Slightly Disagree 3: Neither Agree or Disagree 4: Slightly Agree 5: Strongly Agree	Dependent, Categorical
I have the ability to utilize telehealth in future practice.	FUTURE	1: Strongly Disagree 2: Slightly Disagree 3: Neither Agree or Disagree 4: Slightly Agree 5: Strongly Agree	Dependent, Categorical

I have the ability to explain how telehealth applications have contributed to healthcare.	CONTRIBUTION	1: Strongly Disagree 2: Slightly Disagree 3: Neither Agree or Disagree 4: Slightly Agree 5: Strongly Agree	Dependent, Categorical
I understand how telehealth is essential to future practice.	ESSENTIAL	1: Strongly Disagree 2: Slightly Disagree 3: Neither Agree or Disagree 4: Slightly Agree 5: Strongly Agree	Dependent, Categorical
I am comfortable performing a telemedicine visit as a future clinician.	COMFORT	1: Strongly Disagree 2: Slightly Disagree 3: Neither Agree or Disagree 4: Slightly Agree 5: Strongly Agree	Dependent, Categorical
I understand how to bill for telemedicine visits.	BILL	1: Strongly Disagree 2: Slightly Disagree 3: Neither Agree or Disagree 4: Slightly Agree 5: Strongly Agree	Dependent, Categorical
I am comfortable performing a physical exam through the use of telemedicine.	PHYSICALEXAM	1: Strongly Disagree 2: Slightly Disagree 3: Neither Agree or Disagree 4: Slightly Agree 5: Strongly Agree	Dependent, Categorical
Overall, I think having telemedicine integrated in the PA curriculum is beneficial.	BENEFIT	1: Strongly Disagree 2: Slightly Disagree	Dependent, Categorical

		3: Neither Agree or Disagree 4: Slightly Agree 5: Strongly Agree	

Appendix N

Telemedicine Program Slides



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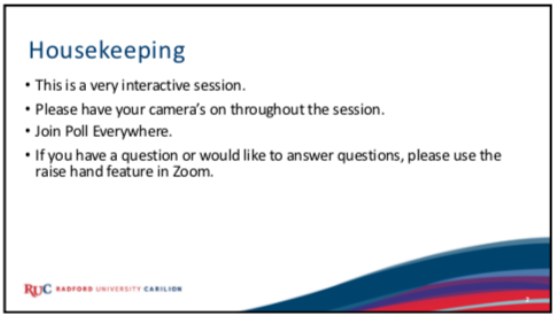

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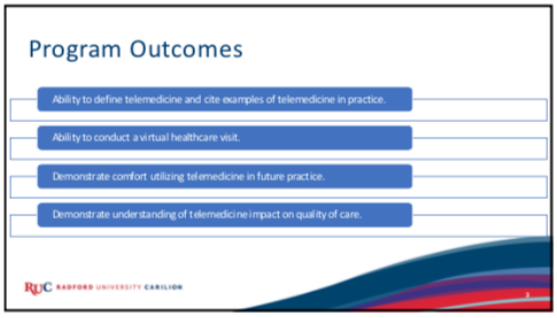

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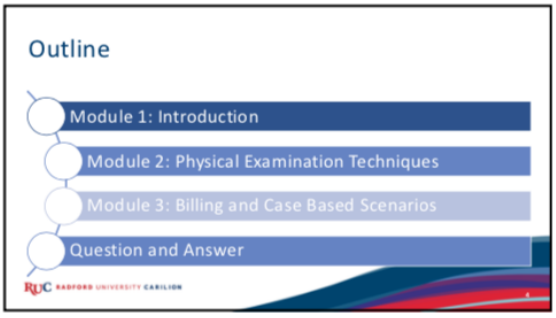

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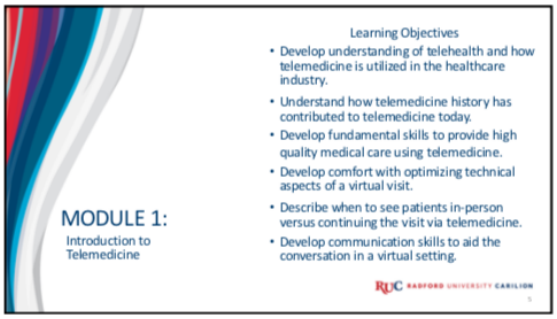

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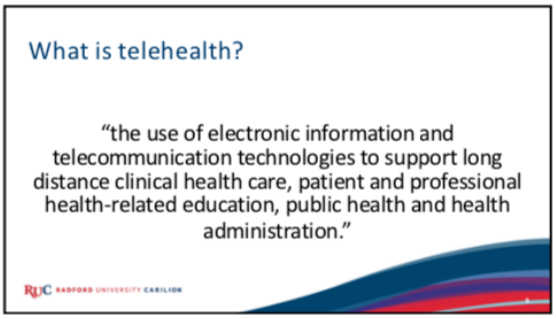

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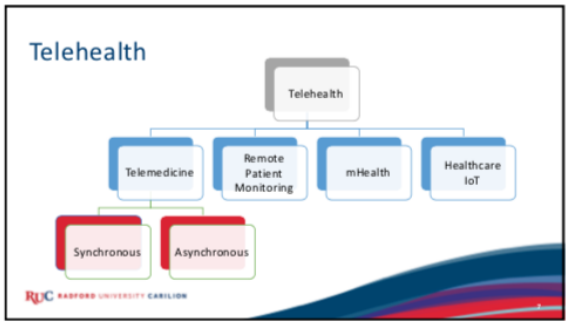
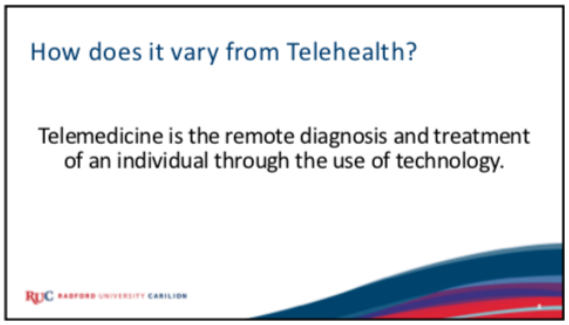
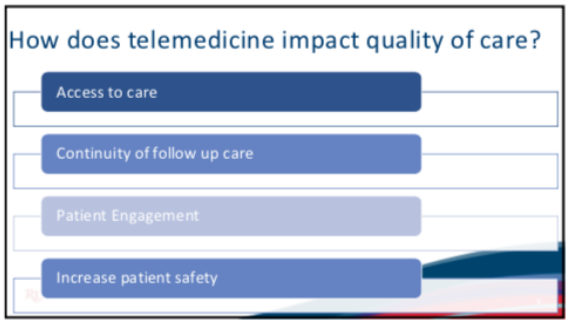

Telehealth
Telehealth
Telemedicine
Remote Patient Monitoring
mHealth
Healthcare IoT
Synchronous
Asynchronous

7


How does it vary from Telehealth?
Telemedicine is the remote diagnosis and treatment of an individual through the use of technology.

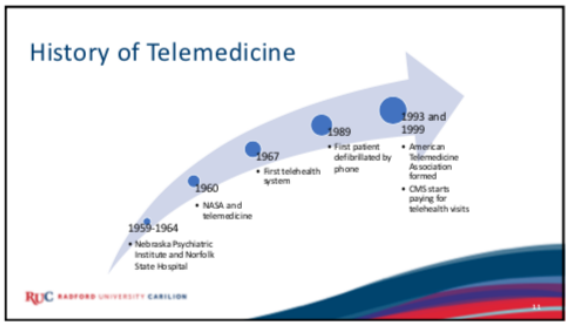
8


How does telemedicine impact quality of care?
Access to care
Continuity of follow up care
Patient Engagement
Increase patient safety

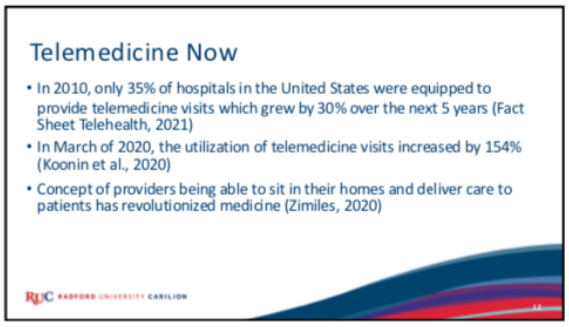
9


History of Telemedicine and the PA Profession

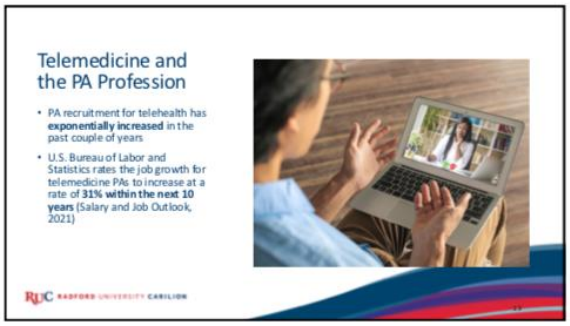
10


History of Telemedicine
1959-1964
• Nebraska Psychiatric Institute and Norfolk State Hospital
1960
• NASA and telemedicine
1967
• first telehealth system
1989
• First patient defibrillated by phone
1993 and 1999
• American Telemedicine Association formed
• CMS starts paying for telehealth visits

11


Telemedicine Now
• In 2010, only 35% of hospitals in the United States were equipped to provide telemedicine visits which grew by 30% over the next 5 years (Fact Sheet Telehealth, 2021)
• In March of 2020, the utilization of telemedicine visits increased by 154% (Koonin et al., 2020)
• Concept of providers being able to sit in their homes and deliver care to patients has revolutionized medicine (Zimiles, 2020)

12



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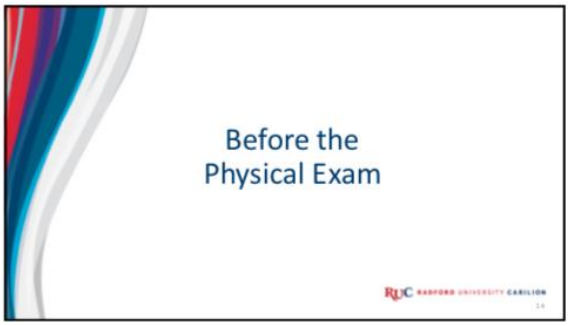

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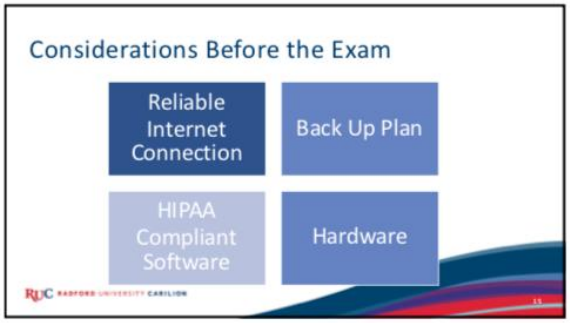

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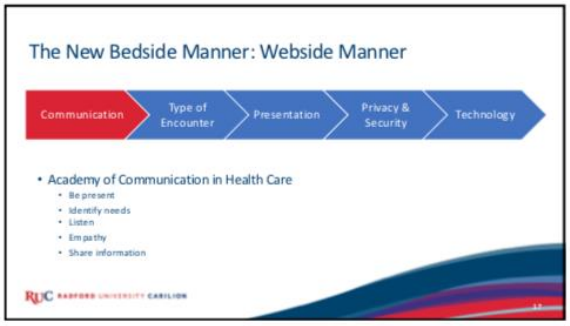

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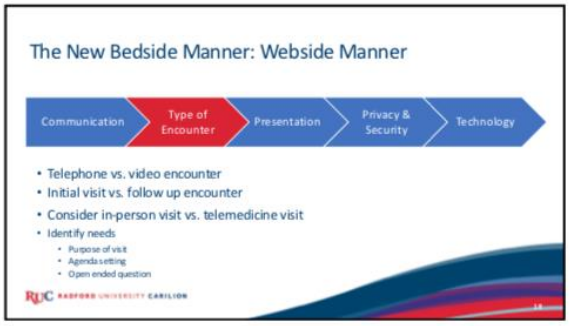

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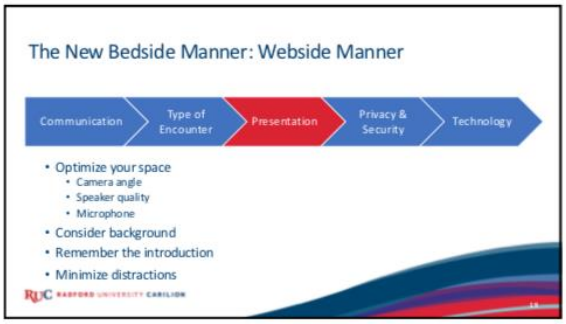

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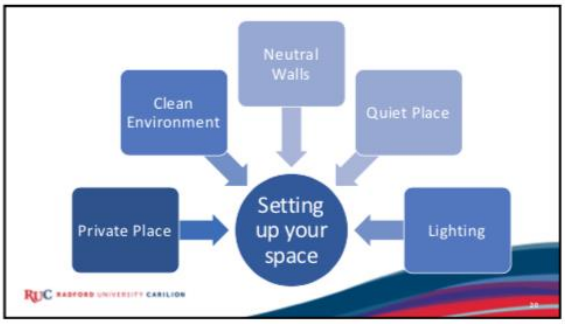

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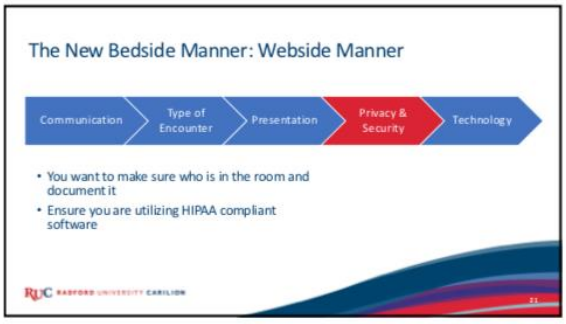

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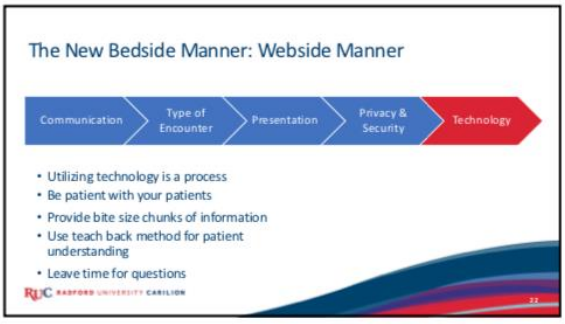

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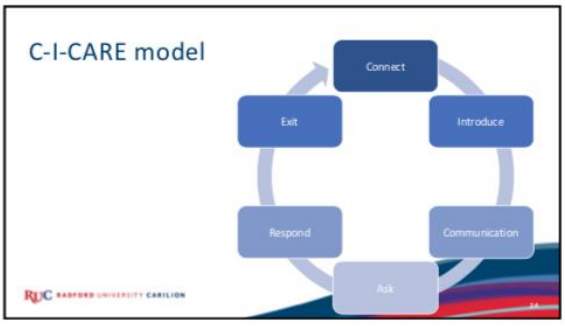

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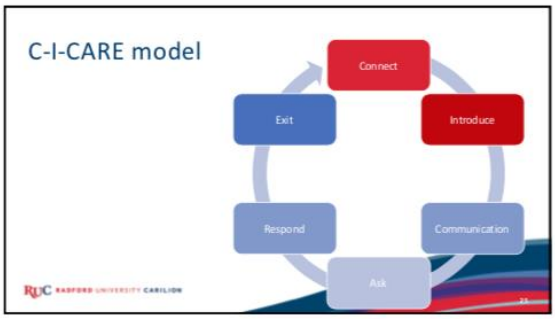

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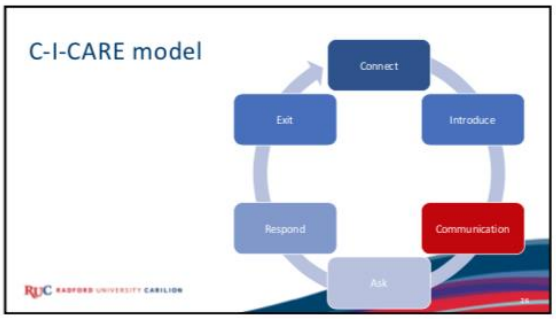

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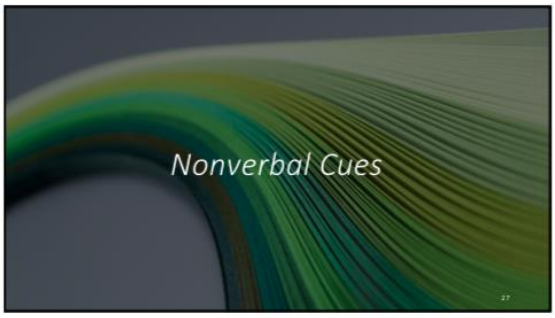

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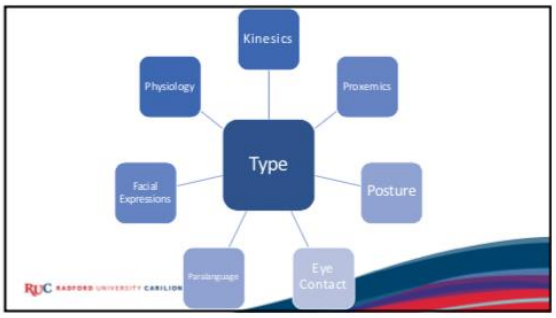

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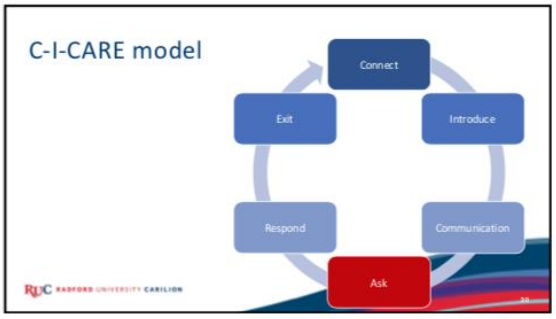

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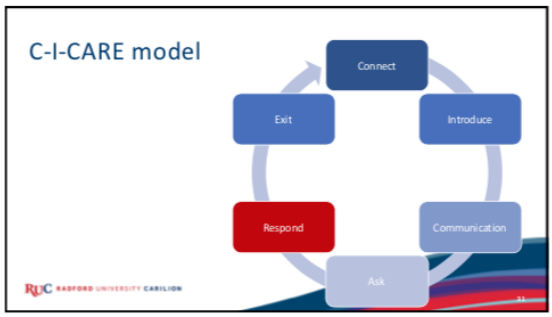

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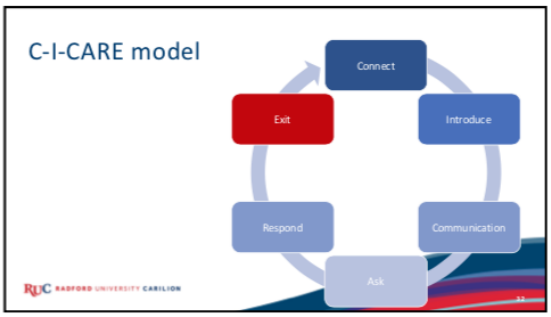

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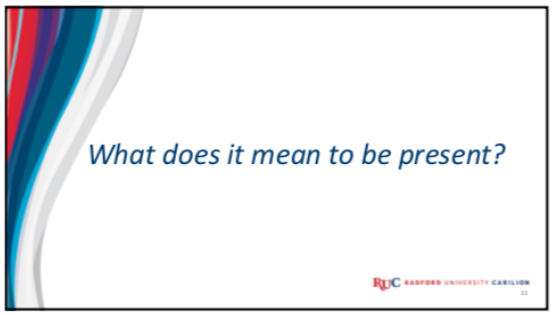

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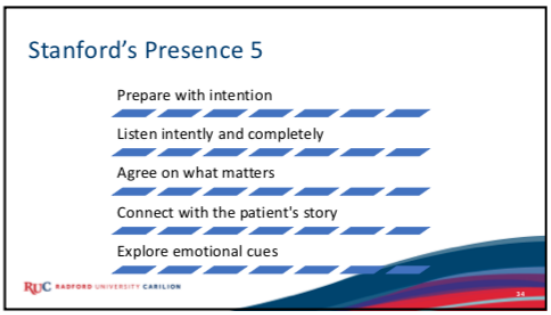

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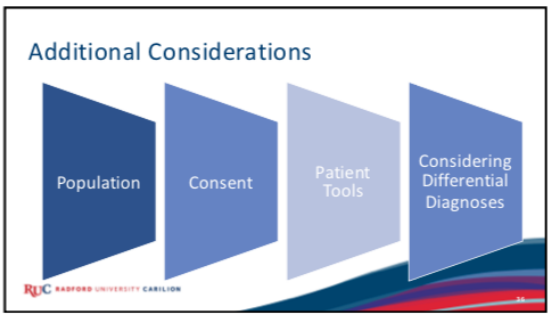

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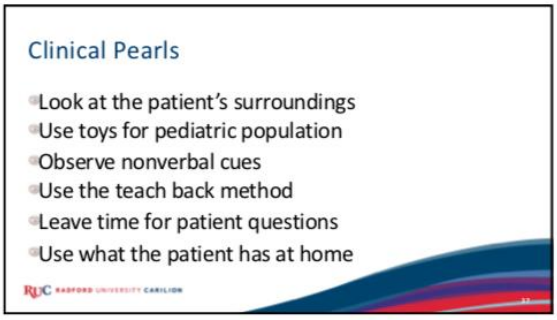

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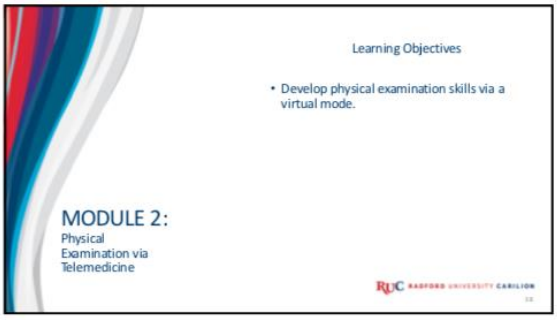

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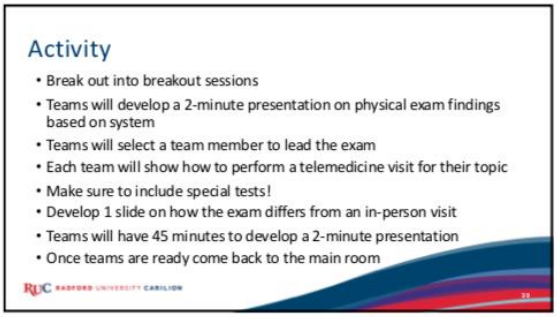

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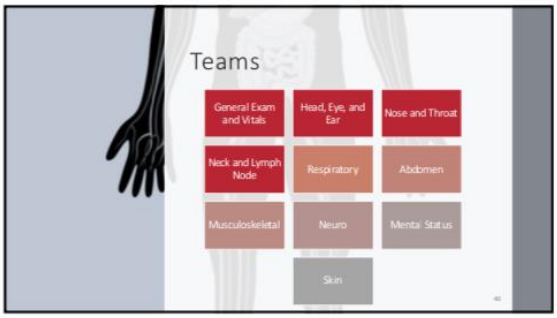

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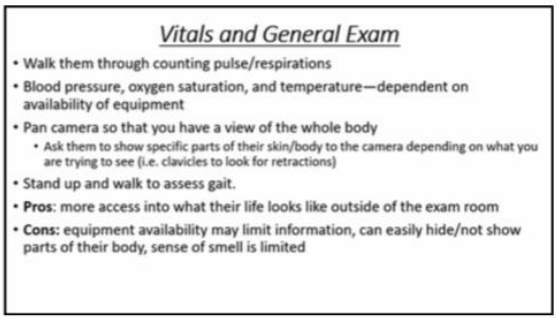

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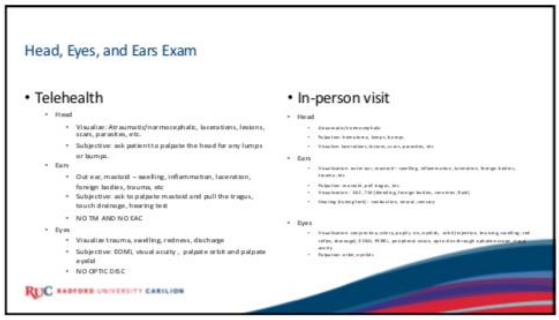

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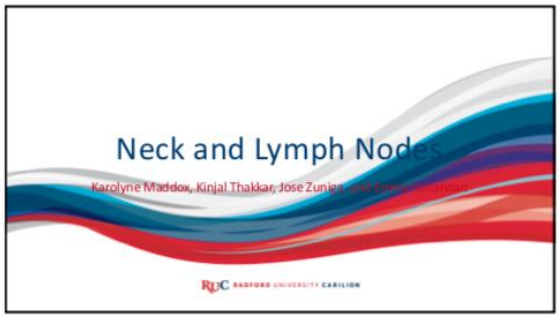

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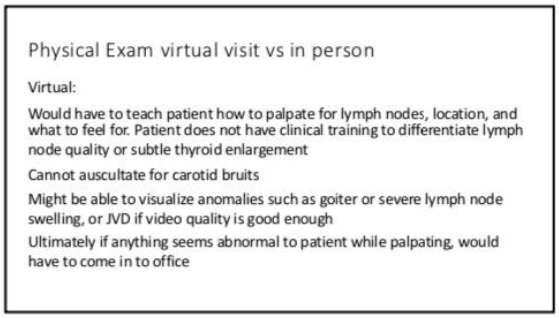

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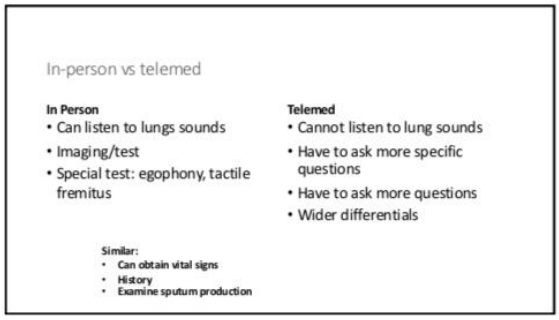

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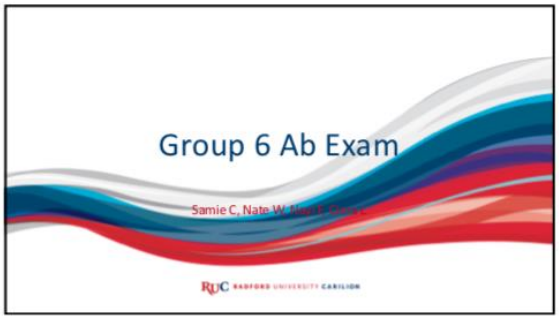


48

Telemed Abdominal Exam Explained to Patient:

- Ask if they are comfortable exposing their abdomen(anterior and lateral views), ask them to lay flat but still visible by the camera
- Explain 4 quadrants of Abdomen → explain light and deep palpation
- Explain OLDCARTS for pain
- Based on complaint: may have to describe rebound tenderness, mcburney's and Rovsign's sign, or valsalva maneuver.

49

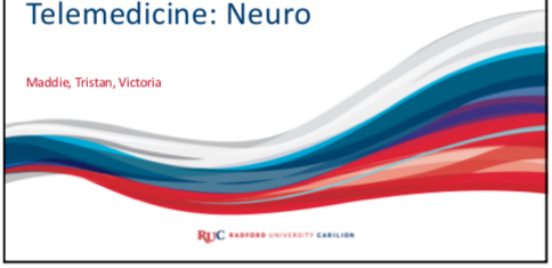
Musculoskeletal:
- ensure there is enough room for full range of the joints in all planes
- position camera so the area of concern is visible
- patient should be comfortably clothed but wearing tank top and shorts if possible.

Not to obscure anatomy
- Look for symmetry
- look at different angles; anterior, posterior, medial, lateral
- Palpation; self palpation and report pain, swelling, boggy
- Range of motion, flexion, abduction, rotation; possible showing patient what movement is needed
- Strength; able to bear weight, is right stronger than left; Can use resistance against wall, door frames, etc.
- Special tests; possibly elicit the help of anther family member. Demonstrate maneuver.

50

Telemedicine: Neuro

Maddie, Tristan, Victoria



51

Tele-Physical Exam Findings

- Mental Status
  - Orientation→ date, time, place, person
  - Language and recent memory
  - Fluency of speech and attention
    - Serial 7's
- Cranial Nerves
  - III, IV, VI: extraocular movements
  - V (motor): open jaw and bite down
  - VII: eyebrow raise, close eyes, puff out cheeks, smile
  - IX, X: swallow, open mouth
  - XII: stick out your tongue
- Motor
  - Visual assessment→ atrophy or fasciculations
  - Range of motion testing, gross motor skills
  - Body weight squats, unilateral heel raises
  - Pronator drift
- Sensory
  - Compare light touch and cold with fingers and toes (difficult without partner)

52

Tele-Physical Exam Findings

- Coordination
  - Rapid-alternating, heel to shin
  - Finger-nose-finger
- Gait
  - Walk across room (tandem walk)
  - Stance
- Cognition
  - Mini Mental Status Exam telehealth friendly
- Unified Parkinson's Disease Rating Scale can be conducted remotely
- NIH stroke scale can be done remotely

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Difference: Telemedicine vs. In-Person

- Inability to assess muscle strength, DTRs
- Utilization of a partner→ (XI), muscle strength
  - Dependent on partner's medical knowledge
  - More subjective
- Inability to assess olfactory nerve (I), vestibulocochlear (VIII), spinal accessory (XI)
- Proprioception→ liability
- Visual cues versus objective data (e.g. tremor)
- Modifications
  - Rubber band/hair tie for upper motor strength
  - Flashlight on phone for pupillary response

Good resource:
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2677215/

54

Mental Status Exam

- Differences between in-person and telemedicine visit
  - Vulnerable population that may be distrusting of technology or prefer an in-person visit
  - Unable to observe patient in a natural environment
  - Can only see patient from waist up
  - Conducting the exam is similar to in-person, but the information you receive from the exam is different
  - Having a pencil and paper ready

55

Skin Exam

In Person	Telemedicine
• Take good history	• Take very detailed history
• Patient has full privacy and patient ability/functionality review of problem	• Limited to patient willingness, privacy concerns, patient ability/functionality
• Visual inspection w/ Eyes	• Utilization of cameras or sending pictures via patient portal (may need extra light source)
• Using hands to feel for texture	• Can tell patient to use markers/rulers/home objects to mark rate of spread and size
• Can see rate of spread if patient is in office/inpatient	• Ask patient to describe texture with descriptions
• Can better discern need for emergent attention	• Lower threshold to sending to ED or urgent care
• Ability for treatment options like for laying sutures, I&D	• No ability for treatment options at time of visit; can send in prescriptions
• Can tell patient to return under certain circumstances	• Decreased ability to have return precautions

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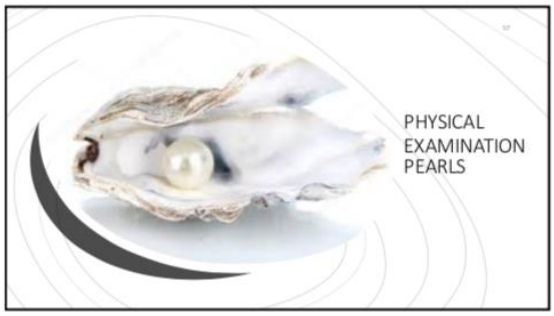

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Vital Signs

- Thermometer
- Blood pressure cuff
- Pulse oximeter
- Weighing scales
- Glucose monitors
- Self pulse check and counting out loud
- Have patient show reading

58

General and Skin

- General appearance
- Have the patient stand up
- Have the patient show arms and legs
- Ask about any skin rash, lesions, or birth marks
- Place a common object for size approximation

59

Head, Eyes, Ears, Nose, and Throat

- Hold phone horizontal to capture both eyes
- Have the patient look up/down/side to side
- Walk fingers across eyelids to evaluate for pain
- Use light on phone to illuminate oropharynx
- Ask the patient to yawn to evaluate for fluid in the ears
- Look for battle signs
- Ask patient to pull and push on the ear lobe and tragus to evaluate for tenderness
- Lean forward and lean backward to evaluate for sinus pressure and congestion

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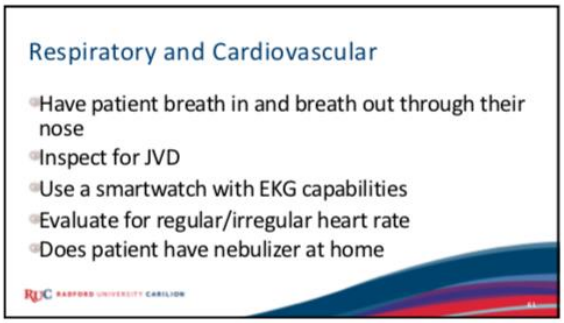

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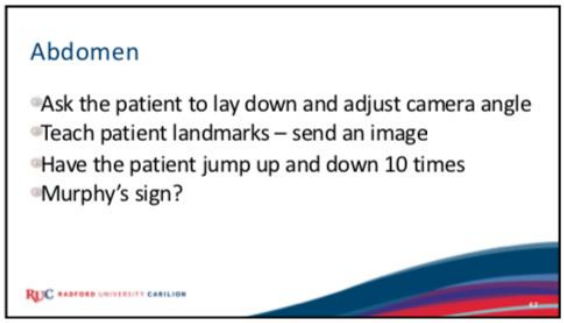

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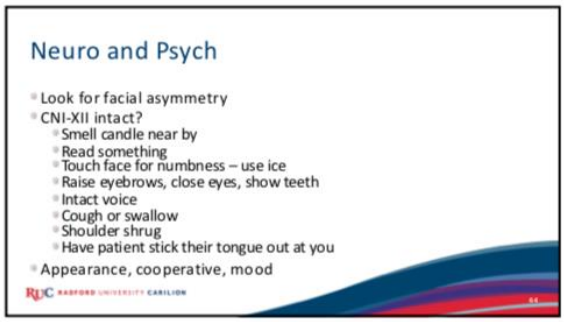

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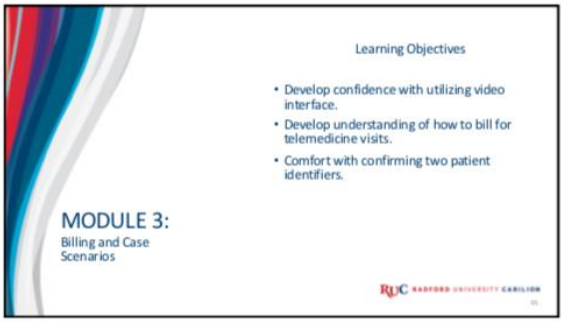

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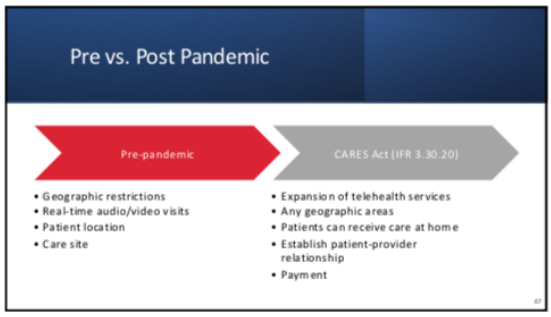

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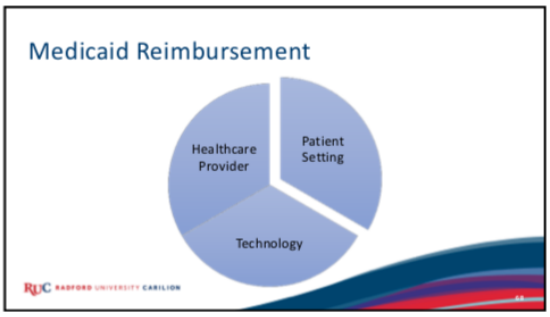

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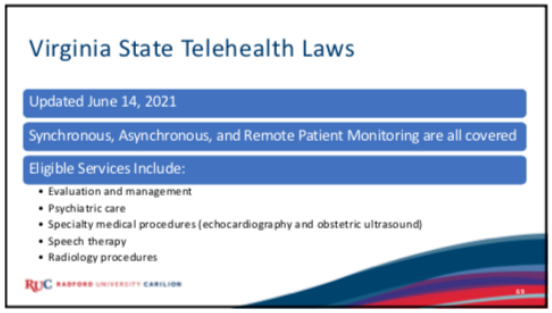

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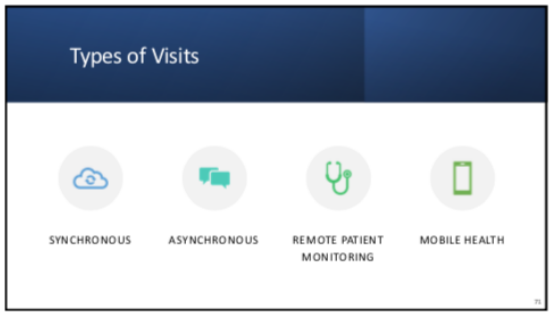

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Type of Visit	Code	Description
Established	99211	10-minute visit
	99212	15-minute visit
	99213	25-minute visit
	99214	40-minute visit
	99215	60-minute visit
New Patient	99201	10-minute visit
	99202	15-minute visit
	99203	25-minute visit
	99204	40-minute visit
	99205	60-minute visit
Asynchronous	99452	Interprofessional telephone/electronic referral service provided by a treating provider; 30 mins
	99451	Interprofessional telephone/electronic assessment with written report; 5 mins or more
	9944X	Interprofessional telephone/electronic assessment with verbal and written report
Remote Monitoring	99453	Initial set up of remote monitoring with patient education
	99454	Follow up of remote monitoring for every 30 days
	99457	20 minutes or more of clinical staff time in a month requiring interactive communication
Pre-Consultation	99358	Prolonged evaluation/management service before and/or after direct patient care (>30 mins)

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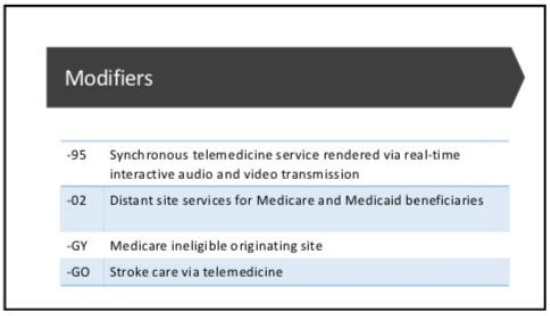

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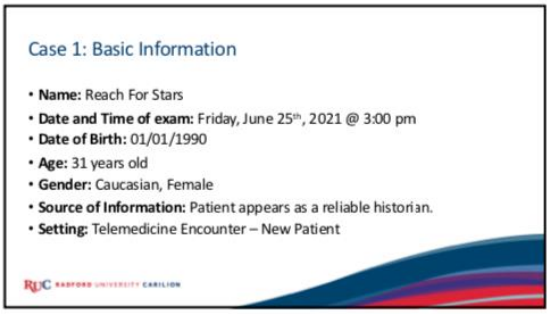

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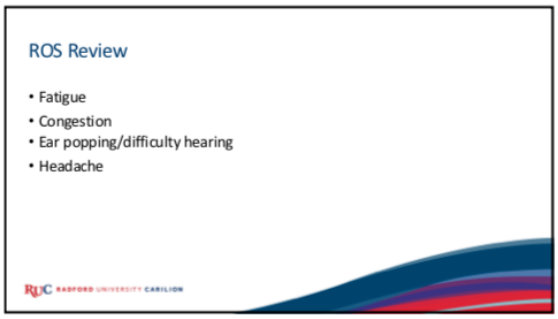

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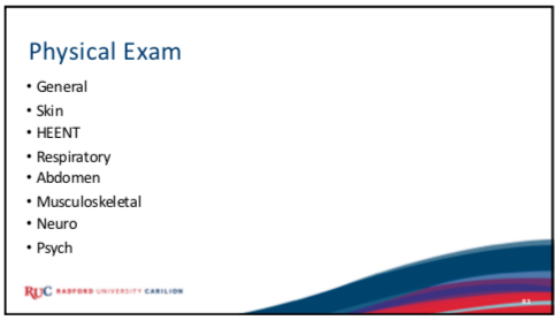

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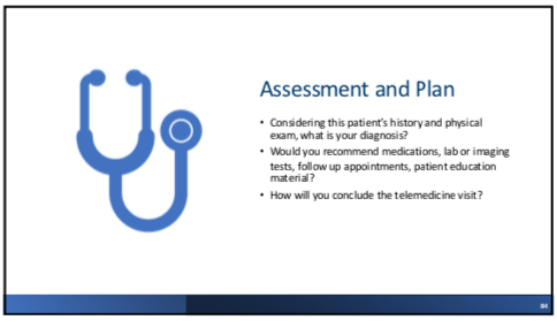

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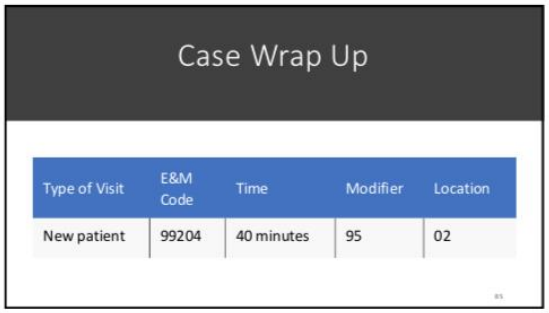

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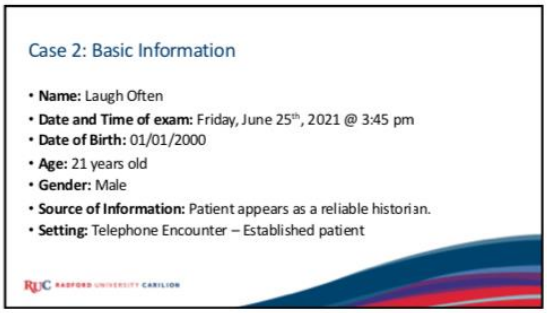

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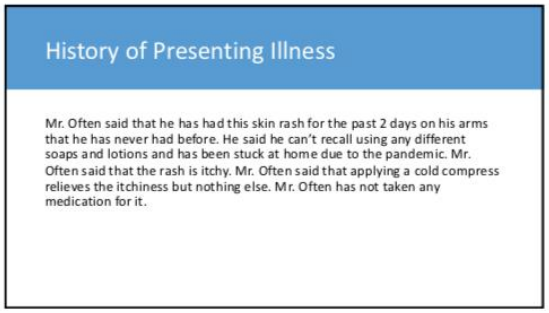

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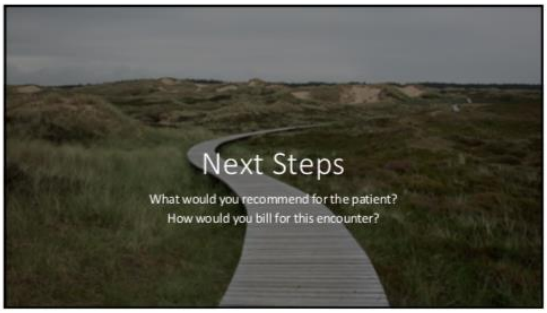

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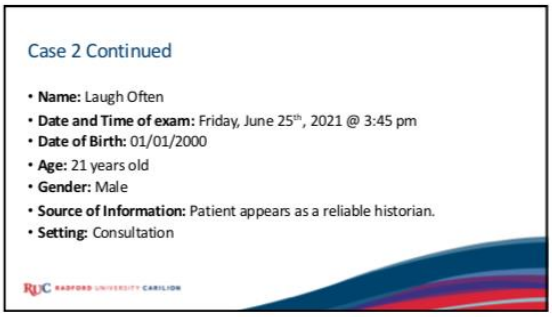

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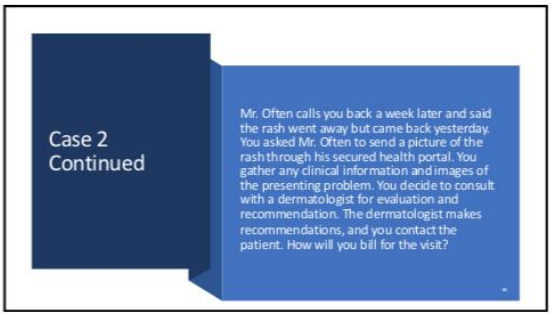

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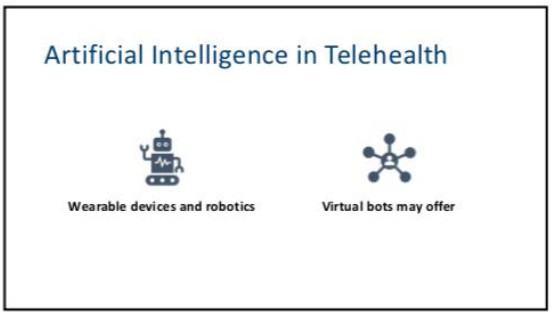

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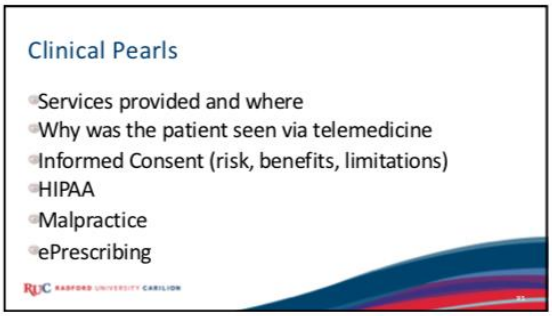

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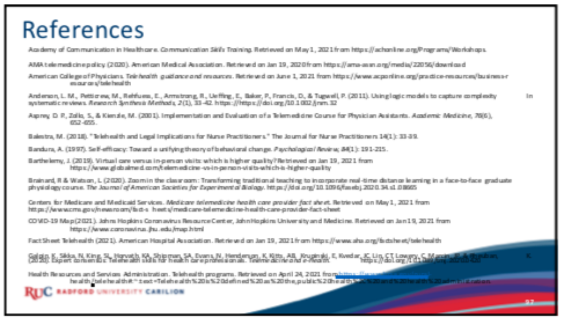
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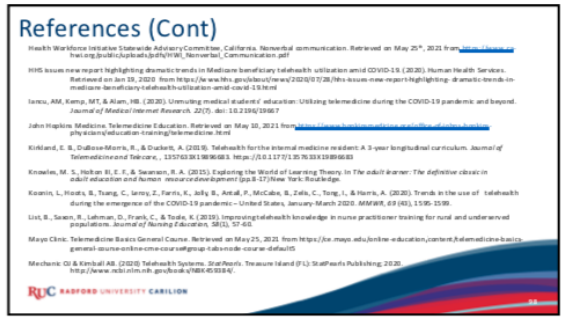
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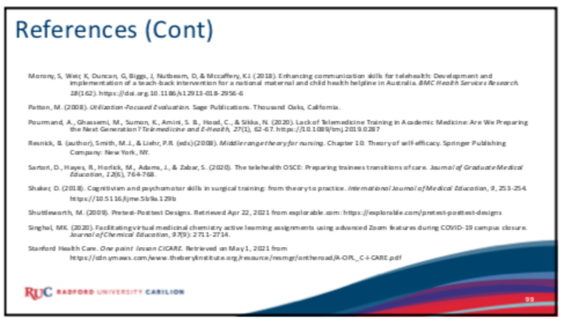
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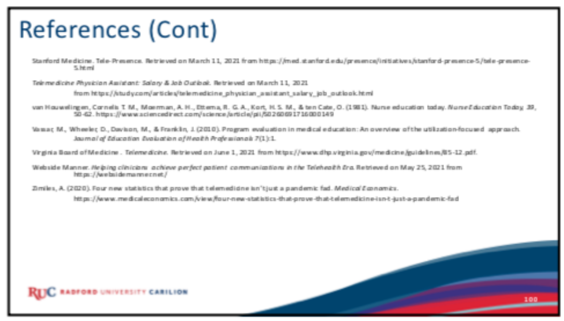
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