Measuring the Perception of Readiness with an EHR Training: A Look into Primary Care

QUANTITATIVE METHODS

by

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ABSTRACT

This study applied quantitative methods in surveying primary care physicians to identify when EHR training was introduced during medical education and measure the ease of use once beginning clinical practice. The physicians were graduates from allopathic and Osteopathic medical programs. Survey questions included 5 demographic questions and twelve designed with TAM. Eighty-three primary care physicians participated in this study by completing a survey sent out in the Ohio State Medical Association's newsletter and through Centiment. Descriptive statistics were used to analyze survey results. Excel and Statistical Analysis Software was used for analysis. Analysis was done using chi-square analysis to determine the year of graduation and the number of EHR courses in school. Measurement of perception from TAM included weighing each question out of eighty-two. Most of the osteopathic participants scored 70 or higher out of 84 in their responses indicating a moderately high level of readiness. In contrast, 37 allopathic physicians score 70 or higher which is slightly higher than half of the allopathic participants would have a strong level of readiness with EHRs. Results from this study showed no correlation between an increased amount of EHR courses taken in medical school and years of graduation.

DEDICATION

I first would like to dedicate this dissertation to my family. From a young age, you have instilled a strong work ethic and supported my dedication towards my work. Sincere gratitude to my parents, Maria and Gerardo, whose words of encouragement carried me throughout this journey and to Andres, my brother, who has always been by my side in my successes and failures. I also dedicate this to my husband, Cory. Thank you for your persistent loving support. I am grateful for your gentle nudges to get work done on a weeknight or the weekend and for your push to see me succeed.

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Chapter 1

Introduction

For years paper charts were the primary method of documentation physicians used for patients. It was common to find healthcare offices with rows of files filled with folders with color-coordinated folders. Healthcare offices are now equipped with computers and tablet devices that use an electronic health record (EHR) as the primary method of documentation. As the use of an EHR continues to rise and advance, there is a concern when an EHR system is introduced during a medical student's education and training. This research aimed to address the level of readiness physicians, specifically primary care physicians, have when using an EHR upon graduation or during their clinical career by measuring ease of use or level of readiness. To receive the most information from primary care physicians, both allopathic and osteopathic physicians will be included in this study.

Background of the Problem

As paper charting is transitioning to being obsolete, EHRs are becoming the driving force of medical documentation. It is important to distinguish the difference between an electronic medical record (EMR) and an electronic health record. Garets and Davis (2006) define EMRs as an environment that stores clinical information, and order entries, and can be used for inpatient and outpatient services. EHRs on the other hand are a section of EMR but allow users to exchange information. According to Garets and Davis (2006), EHRs rely on EMRs, but the ability of interoperability would not have been achieved without an EHR.

The introduction and implementation of EHRs from the 1990s to the present have changed the way documentation is done and formatted, therefore, EHRs have changed health care (Evans, 2016). As the uses and advancements of EHR have continued, Evans (2016) states

that medical schools are incorporating EHR use into the lectures for medical students. The author points out the concern that physicians are still creating workarounds and relying on paper-chart thinking. Therefore, one possible way of creating an EHR environment with fewer workarounds and less paper-chart mentality could be by introducing EHRs in medical education. A workaround is defined as an action that does not follow the common workflow or fulfill the intentions of the product designers. Flanagan et al. (2013) describe an example of an EHR workaround by copying and pasting notes from a previous visit and adding them to the current visit. This workaround would be used for time efficiency. Workarounds exemplify the effect the transition from paper-chart to EHRs had on physicians who have been practicing prior to the electronic format. Rajaram et al. (2020) identified 11 studies from their systematic review that focused on EHR training for undergraduate and postgraduate medical learners. From the information obtained from Rajaram et al's (2020) review, the majority of EHR training was for clinical clerks and not first and second-year medical students. Clinical clerks are medical students who are in their final year of study and can practice medicine during their rotation while being supervised. Medical students can incorporate hands-on learning while developing patient interaction skills and using EHR. It is possible to include introductory courses to EHR for first and second-year students.

Problem Statement

Physicians who have been practicing medicine for several years were accustomed to their day-to-day workflow. With the transition to EHRs, those physicians had to ween off relying on paper charts and alter their routines. With more medical students having the opportunity to learn EHRs and use them, there is a chance they would have a higher level of readiness than current practicing physicians. Sources such as Rajaram et al. (2020) have identified that there are

differences in some medical programs when students are introduced to or trained in EHR. In addition to measuring the level of readiness for EHR training, participants for this study will be asked to indicate if they graduated from an allopathic or osteopathic program. Determining where a physician went to medical school will provide information on which type of program is offering EHR training to medical students.

There has been concern about the usefulness of medical students' notes while using EHRs. Hammoud et al. (2012) expressed that medical school leaders should ensure that students are skilled in the technologies they will use to care for patients. Hammoud et al. (2012) also noted that the Liaison Committee on Medical Education states that the curriculum should include communication skills that involves medical documentation. In 2018, the Centers for Medicare and Medicaid Services changed their process of reviewing claims that allow notes from medical students to be processed for billing if the documentation is verified by an attending (Tsai et al., 2020). The survey that Tsai et al. (2020) conducted indicated that medical students felt they were more prepared for residency and felt integrated with the clinical team.

Purpose of the Study

The method for this study was quantitative and data collection was done by surveying primary care physicians that graduated from allopathic or osteopathic programs. The survey questions took on a design from the technology acceptance model (TAM) which is measured with perceived ease of use and perceived usefulness (Charness & Boot, 2016). The survey consists of seventeen questions; five ask demographics from participants and twelve are from the technology acceptance model (TAM). TAM measures someone's acceptance by identifying perceived ease of use and perceived usefulness. The focus of the study was to identify when

EHR training was introduced during medical education and measure the ease of use once beginning clinical practice.

The primary goal of this study was to identify the ease of use and level of readiness physicians have for EHR training during their medical education, regardless of allopathic or osteopathic or on the job. Habboush et al. (2018) stated that medical trainees should be exposed to health information technology such as an EHR as early as possible. Lastly, the location of the study focuses on primary care physicians across the United States. A participant who agrees to participate in the survey must have graduated from an allopathic or osteopathic program. The Ohio State Medical Association agreed to run the survey URL in the monthly newsletter and large hospital systems in Ohio have agreed to distribute the survey. Additionally, Centiment, a research platform that assists academics in building surveys and helping reach their audiences, distributed the survey to all licensed primary care physicians across the nation.

Population and Sample

The selected 83 participants ranging from different medical school programs and those in primary care practice as participants for the survey. The minimum sample size will be 60. Participants were selected using simple random sampling which permits the target population to have an equal chance of being selected. The sampling unit for the study included allopathic or osteopathic medical programs, EHR training during their education, and primary care as the field of specialty.

Significance of the Study

Health information technology such as EHRs has continued to advance and has developed a leading role in health care. Such advancements require proper and adequate training to allow users to apply the technology with small learning curves. The American Medical

Association (AMA) and the Regenstrief Institute (RI) have acknowledged the importance of EHR training and are working on ensuring medical students and trainees have hands-on experience with EHRs (Rhode Island Medical Journal, 2017). The Center for Health Services Research at Regenstrief Institute provides outcomes of health care through communication and health technology (Anonymous, 2020). RI researchers conduct research in domains such as applied health informatics, patient safety, and implementation science. The significance of this study identified if allopathic and osteopathic programs offer or include EHR courses and/or training and determine the level of readiness physicians have post EHR training. This study could benefit medical programs by encouraging the incorporation of more EHR training into their curriculum and more physicians entering the clinical world with more EHR preparedness. Findings from the current study could allow other researchers an opportunity to address training in other health information technology.

Nature of the Study

This study applied quantitative methods for collecting data through surveys and used descriptive statistics to summarize the results from the surveys. The results will indicate what level of readiness primary care physicians have after having EHR training in medical school or on the job. Participants will be asked to complete a survey of 17 questions that could take at least 10-20 minutes.

Research Question

R1. What are the differences between allopathic and osteopathic EHR training and their perception readiness for their job after completing their medical training?

Conceptual Framework

The transition and implementation of EHRs created obstacles for organizations and providers. A common element regarding implementation and becoming familiar with an EHR is that it is a difficult and tedious process. As physicians overcame obstacles and barriers at their own pace, EHR training was needed. The researcher measured the ease of use of an EHR by examining when EHR training was introduced, during medical education or on the job. EHR training incorporated into the medical school curricula could allow students and trainees to be prepared for EHR use in a clinical setting.

Welcher et al. (2018) suggest that medical students should have consistent EHR training so that students can acquire proper documenting skills. According to a survey in Biagiolo et al. (2017) article, it was discussed that 27% of clerkship directors state medical students use an EHR to view a patient's record, write notes, and enter orders; 41% of students were able to write notes, and approximately 32% had view-access only. Wallach et al. (2019) state that internal medicine clerkship directors report between 78%-93% of medical students enters history, examination notes, and progress notes during internal medicine clerkship. The skills gained with health technology use in medical school could be beneficial as their medical careers advance.

Definition of Terms

EHR: An electronic health record (EHR) is an electronic format of a patient's medical history, and it is maintained over time (CMS, 2012).

EMR: An electronic medical record (EMR) is an electronic version of a patient's chart that contains medical and treatment history in one office (Garrett & Seidman, 2011).

Allopathic medical school: science-based, focuses on diagnosing and treatment.

Osteopathic: holistic-based, focuses on prevention.

Assumptions, Limitations, and Delimitations

The researcher assumed that participants would answer survey questions with honesty, and that they are practicing primary care physicians. Limitations for this study include sample size and recruitment. The Ohio State Medical Association sent out the URL to the survey in their monthly newsletter. However, it was uncertain how many individuals received and read the newsletter. Participation was slow using the Ohio State Medical Association, so Centiment was used to assist with data collection. Centiment is a platform that assists in reaching target audiences for studies.

Chapter Summary

This chapter introduced the topic of focus for this dissertation and a brief description of the statement of problem and purpose of the study. Chapter 2 contains an extensive literature review that goes into further detail about the historical and current content of EHRs in the medical school curricula.

Chapter 2

Literature Review

As the use of EHRs progresses, the method of paper charting is becoming less popular. More physicians are using an EHR system at their practice or hospital. With the increased use of EHRs training users has been a topic in academic institutions and EHR systems. It is unknown how many medical programs both allopathic and osteopathic include EHR courses in their curriculum. For those who had EHR training during their clinical career, the training would vary from EHR organization and hospital. This research aimed to address the level of readiness physicians have when using an EHR upon graduation or beginning their clinical career by measuring ease of use or level of satisfaction. The literature review for this research starts with literature on the beginnings of patient documentation. It discusses the methods used before technology and the development of electronic charts.

Title Searches and Documentation

The search strategy for this study started with creating an outline for a literature review that included each section in the chapters. The outline guided which source would be best suited in each section. Key words included but were not limited to *electronic health records, technology acceptance model, allopathic medical schools, osteopathic medical schools,* and *health information technology.* ProQuest, EBSCOHOST, and Google Scholar are a few of the databases and search engines that were used to search for sources.

Historical Content

Before discussing the importance of EHRs in medical education, it is significant to know the history of patient charting. Gillum (2013) explores the history of documenting clinical records first taking place for didactic purposes in an Egyptian case dating to 1600bc. By the late

1700s, patient records included admissions and discharges while the 19th century physicians began keeping loose paper files in Paris and Berlin (Gillum, 2013). Clinical records included family history, illness history, and examinations by the late 19th century in teaching hospitals in America. Quality improvement did not exist until 1918 when the American College of Surgery required hospitals to keep records on patients that would document a summary of care and outcomes (Gillum, 2013). Finally, Gillum (2013) mentions that EHRs were developed as solutions for the problems created by paper charts.

In contrast, EHRs still created problems of their own; one being doctor and patient relationships as Gillum (2013) identified. Similarly, Peled and Sagher's viewpoint on EHRs state that it hinders medical education (Peled et al., 2009). A Kansas medical school experienced medical education hindrance when EHRs were introduced to the program. One of the hindrances is that EHR use has changed the interaction and relationship between teachers and students. Peled and Sagher (2009) discussed that problem representation and answering questions are taken away when the attending breezes through a chart by clicking without challenging their trainees. Morrow and Dobbie's viewpoint state that EHRs could enhance education since they are a medium that providers use to deliver health care (Peled et al, 2009). Morrow and Dobbie (2009) surveyed third-year students in an ambulatory medicine clerkship which resulted in students asking more questions due to EHR prompts and improving their documentation. Additionally, teachers using EHRs, were able to provide more feedback to their students than using paper notes. Morrow and Dobbie (2009) recommended EHR education early on so that students may transfer their skills into a clinical setting. However, teachers were not EHR experts because they may have not received optimal training. While the effect EHRs have on medical

education could make a difference in doctor-patient relationships, proper EHR training is needed to correctly teach and train providers.

The American Medical Informatics Association (AMIA) in the early 2000s acknowledged that health care workers needed to obtain information technology (IT) skills. The AMIA had a goal to educate 10,000 health care workers by 2010 so that there would be at least one trained provider in every hospital (Bronsburg, 2011). Unfortunately, the goal was not achieved. Bronsburg's (2011) paper compared the IT skills of first-year osteopathic students to newly graduated osteopathic students. Osteopathic students lacked IT skills, even those who started their medical program with some IT skills. As a result, Bronsburg's (2011) findings indicate that osteopathic students need to be exposed to IT while in school so that they can be competent in their clinical work as physicians. Osteopathic students improved their information gathering skills and information analysis skills. These skills are important when obtaining patient information, communicating with patients, and piecing together a treatment plan for a patient. If osteopathic medical students are lacking the proper IT skills that are needed to use an EHR to its full potential, then they will have a steep learning curve once they begin their residency.

Clarke (2015) investigated usability-related and performance-related differences in the use of an EHR in primary care. Participants included novice primary care physicians and expert physicians. The characteristics were distinguished by years of using an EHR and clinical training level. There were three rounds in which novice physicians and expert physicians participated in the study. The last round had residents participate that ranged from the first year to third years. Clarke's (2015) study resulted in differences in efficiency between novice and expert physicians with experts being more efficient. Training or improving the EHR training physicians receive would lessen the learning curve of using EHRs or reduce the workarounds clinicians create to

keep up with information technology. Additionally, Clarke (2015) noted that some residents had difficulty using EHRs even with different levels of experience. This finding could improve EHR training and how early students should be exposed to it. If medical students have EHR experience while in school, then their efficiency will be better than a 'novice' user.

Current Content

While most providers have transitioned to using EHR, EHRs are constantly evolving so a question that rises is how are EHR users trained? Pirtle et al. (2019) conducted a study on the "specialist training the specialist" at an allopathic program. Peers train their peers in a classroom and web-based environment. Pirtle et al (2019) surveyed 40 residents, fellows, and attendings and focused on the perception of training effectiveness and the effect of the new EHR while comparing the similarities and differences of EHR systems. User experience varied among the providers, so workflow solutions were discovered. These workflow solutions could be the workarounds that were noted in Evans (2016) and Flanagan et al's (2013) studies.

Dastagir et al. (2012) developed an EHR training program that was led by physicians to teach their peers since physicians would turn to their colleagues for help. The surveys used were designed to measure the effect of physician efficiency, job satisfaction, and perception of how EHR use affects patient care. The training program took place off-site and some participants commented that it helped with the aim of the study. Dastagir et al's (2012) study indicated that there is a relationship between EHR proficiency and job satisfaction. If there are improvements in a physician's proficiency, then there was a high chance that job satisfaction improved as a result.

Although there have been studies that have focused on physician-to-physician training and have noted success in accomplishing EHR proficiency, there are gaps in identifying the

success in training medical students in EHR that would improve their EHR proficiency throughout their medical education. Literature has shown that EHR training while students are going through their education could be a beneficial skill that will be needed in residency and practice. Hammoud et al. (2012) evaluated the challenges in teaching students EHR in medical schools across the United States by surveying clerkship directors. One factor identified by residents that plays a role in the perception of the usefulness of EHRs is the ease of implementation. While schools across the country have tried implementing EHR education, it is not evenly distributed. Some organizations have recognized the importance of EHR implementation in allopathic medical school curricula and those include the Associations of American Medical College (AAMC), the Alliance for Clinical Education, and the Liaison Committee on Medical Education (Lander et al., 2020). Even though these organizations are recognizing the need for EHR education, the education itself varies among institutions. One example of this is timing of when medical students can use an EHR. One challenge that Hammoud et al. (2012) discovered is that most EHRs have a "copy & paste" option which hinders students' thinking and they "document" information they may have not obtained themselves. Another challenge was in-person teaching time was lessened because the teachers had to review documentation of the students. Although challenges were identified, it would be preferable that they happen while the student is in their education program instead of in residency or clinical practice.

One allopathic medical program allowed its students to use an EHR all four years. Silverman et al. (2014) studied second-year medical students in the allopathic program to evaluate an improvement in EHR use after involving more patient-provider interactions in their work. Patient-provider interactions are an important objective for medical students to learn and

continue to master. The study took place before the participants' clerkship began. There were three levels of EHR exposure and were assigned to their session for the entire academic year. Two control groups involved basic EHR training, no patient-provider training, and either no EHR use or some EHR use during a patient encounter (Silverman et al., 2014). As a result, the treatment group, who received EHR training, patient-provider training, and EHR encounter use felt they were able to apply EHR in patient encounters more effectively. For patient-provider improvement, at least three training sessions were needed to see an overall improvement. The results from Silverman et al.'s (2014) study show how a minimum of three training sessions could affect the use of EHR in a patient encounter. The authors also note how these techniques could be applied in allied health professions.

Wald et al. (2014) mentioned that some medical students have expressed concern about their ability to apply EHR use to patient encounters. Wald et al. (2014) used the term 'informed consumer' when it comes to allopathic medical students understanding the responsibilities using information technology such as EHR. The authors expressed that medical schools are now responsible for implementing EHR in their curriculum so that students are proficient with technology but can have successful physician-provider relationships. Lander et al (2020) surveyed medical students from two institutions to understand the self-perceptions of EHR readiness. The goal of this study was to identify any gaps that are in curriculum and training on EHRs. As a result, Lander et al's (2020) study identified that medical students felt more comfortable with tasks in EHR that were not very difficult, such as looking up existing information, and less comfortable with searching for new information. The authors also discussed the importance of allowing students to focus on information entry and decision making which could improve their comfort level. Literature has shown that there is a disconnect in how

to properly train and educate undergraduate medical students, yet there is an agreement that EHR should be taught while students are in medical school. Wald et al (2014) proposed four objectives; have a computer during the clinical encounter, train students on EHR skills, integrate and encourage patient-provider skills while documenting in the EHR, and encourage the appreciation students to have for using a computer during an encounter.

Hart et al. (2010) discussed an interprofessional curriculum of EHR adoption for students in the respective colleges. Each college identified what specific knowledge and skill sets regarding EHR and other medical informatics needed to accomplish. Like Wald et al's (2014) study, students would first be introduced to an EHR environment. The difference is that the EHR environment was through an interprofessional seminar that lasted one year. The curriculum design allows students from different clinical professions to become knowledgeable in what they would specifically need/use in their profession and creates insight into how EHRs affect other disciplines. For example, nurses and physicians working side-by-side would have to use the same EHR so it makes a job easier when all users are knowledgeable with the EHR. Bloom and Huntington (2010) conducted a study that included faculty, residents, nurses, laboratory, and office staff that evaluated the impact of EHR implementation on residents. Results from Bloom and Huntington's (2010) survey indicated that physicians and residents were not satisfied with the amount of time needed to document in EHRs. More non-physician clinical staff had a more overall better experience with the EHR while physicians had a more negative outlook. This could be due to the number of extra hours needed to complete tasks in an EHR.

When medical students have limited or little exposure to EHRs or EHR training, this hinders their chance of having a successful residency regardless of specialty is hindered. As with any onboarding and orientation in an academic or professional setting, there is always some sort

of learning curve. This learning curve decreases the amount of time a resident has on establishing medical training since their focus is on understanding EHR knowledge. Stroup et al. (2017) conducted a study at an academic pediatric practice whose participants involved PGY1 residents. They first received basic training from nonclinical personnel and once they go-live EHR deadline approached, EHR superusers, who were attendings with additional EHR training, conducted informal training sessions for the residents. The superusers noted deficiencies in basic EHR tasks and some superusers spent at least half an hour instructing residents on EHR tasks and correcting their errors. The amount of time providers spend either correcting EHR mistakes or closing/completing their charts after clinic hours has the possibility of increasing physician burnout which is an ongoing concern in the medical community for not only its learners but faculty as well. Anderson et al. (2020) measured the after-hours EHR use for residents and faculty in one family medicine residency program. The residents and faculty underwent EHR software, and hands-on and one-on-one EHR training. The EHR used in this residency program was Cerner and Cerner defined active EHR time as more than three clicks per minute, 15 or more keystrokes per minute, and calculated mouse miles (Anderson et al., 2020). After-hours was defined as time spent on EHR from 6 pm-6 am and on the weekends.

As a result, physicians spent a significant amount of time after-hours which varied regardless of the level of EHR training. The range of after-hours work was from zero to over thirty-three hours per month (Anderson et al., 2020). While some physicians may choose to work after-hours, like seeing an emergency patient, EHR training can have a significant role in decreasing the time spent on charting from just a normal day. This could lead to an improvement in physician burnout and physician satisfaction. Anderson et al. (2020) was able to conduct their study and train family medicine residents to use an EHR but having the ability to pull busy

residents for a study and to train in EHR use is not always easy. Kim et al. (2014) understands measuring residents' efficiency on EHR is a challenge but pursued assessing usability challenges and barriers with an EHR training program at an academic medical center. The evaluation of the program was broken down into three steps that included, discussing with physician champions and EHR specialists, analysis of current EHR training, and measuring the perceptions of EHR users following the study with a survey. First-year primary care residents must complete online EHR modules followed by an instructor-led course with training sessions and hands-on scenarios. The authors did note that there is a significant learning curve when residents did not have EHR training while in medical school. This has an impact on increasing the resources needed to train residents as they begin their post-graduate education. The literature the authors reviewed also noted that most physicians were not satisfied with EHR vendor training and while some hospitals are offering training to incoming residents, finding time for them to complete their training is a challenge.

Conceptual Framework Literature

Determining ease of use and perceived readiness regarding the use of EHRs is one step in lowering the learning curve in health information technology for providers. It is also important to note the application of EHR use in the clinical setting. Watterson et al. (2020) discuss relational coordination on primary care physicians' ease of use with EHR. Relational coordination is the reinforcement process of communication and relates to the purpose of task integration (Watterson et al., 2020). Relational coordination in health care could predict outcomes such as quality of care and patient/staff satisfaction. Watterson's study aimed to determine if improved relational coordination in primary care is a method by which EHR could produce greater patient outcomes. The authors applied TAM and the theory of adoption and diffusion, and the

coordination theory to identify ease of use with an EHR (Watterson et al, 2020). Their study resulted in primary care physicians experiencing less rational coordination benefits compared to non-primary care members which could be due to skills in learning EHR use.

Methodology Literature

Before discussing the methodologies, other studies have used, it is important to distinguish the topics this study is aiming to achieve. This study aimed to address the level of readiness physicians have when using an EHR upon graduation or during their clinical career by measuring ease of use or level of readiness. In doing so, a survey was used to attain this information from participants. Other studies have used surveys as a method of data collection regarding something similar. However, the difference lies that this study planned to compare the differences in allopathic and osteopathic medical programs. Whereas other studies focused on one or two medical schools, or the year medical students had EHR training.

After reviewing the methodologies used in other sources, they fell into two categories: identifying the gap medical education had regarding EHR training and the level of readiness or ease of use users had after some method of EHR training. For example, Rajaram et al. (2020) conducted a systematic review that evaluated 11 studies and applied quantitative and qualitative analysis. To be included in their review, studies had to have had an educational intervention to expose students to EHRs. As a result, the authors identified that most EHR training happened during clerkship through evaluation of teaching content and learning outcomes and reported their findings with descriptive statistics. Authors that were looking to identify and measure the level of readiness used surveying as a method of data collection. Dastagir et al. (2012) used a questionnaire designed from a five-point Likert scale to evaluate clinicians' self-perception of efficiency with EHR. Silverman et al. (2014) conducted pre and post-surveys that were used to

evaluate second-year medical student's ability to use an EHR to focus on patient-provider interactions.

TAM is a theory that measures someone's acceptance by identifying perceived ease of use and perceived usefulness. There are normally twelve questions that are involved in TAM with responses like a five-point Likert scale. TAM is a common and readily used application in measuring the acceptance of information systems (Lee et al., 2003). The use of TAM has been used by many researchers in a wide range of research projects. Sharp (2006) suggests the reason for the popularity of TAM as the focus on information technology, proven reliability and validity, application, and extensive research use. There are other variations of TAM, such as TAM2 and Parsimonious TAM that include different external variables (Sharp, 2006). These variables include the influence of others to use or not use the specific technology, maintaining favorable standing among others, the job field in the technology being used, and the results of the product (Sharp, 2006). The use of external variables and direct determinants, signifies the flexibility and adaptability in applying TAM to studies for information technologies. Holden and Karsh (2010) reviewed studies in the health care field that applied the technology acceptance model from a quantitative approach, large data sets, and non-physicians. Their review concluded that perceived use and actual use of health information technology are significant and to accept health information technology should be perceived to be useful (Holden & Karsh, 2010). While TAM has been successful in health IT research, Holden and Karsh (2010) concluded that more tests on relationships and better reporting of data is needed.

The use of TAM for this study was based on the research question; what are the differences between allopathic and osteopathic EHR training and their perception of readiness for their job after completing their medical training? With perception being the keyword, the

study applied TAM to determine the perception of readiness physicians had with EHR training in medical school or during their careers. Tubaishat (2018) discusses TAM being used to assess the perception users of health information technology have. The study involved nurses' perceptions of using EHR to report to Jordanian stakeholders. The results from TAM in Tubaishat's (2018) study indicated that nurses had positive correlations with increased perceptions of usefulness and ease of use. The significance of Tubaishat's findings is the measurement of perceived usefulness and ease of use on allied health professionals. Nurses use EHRs as often as physicians and may use different EHR functions than what physicians use. Their acceptance of health information technology, therefore, nurses should receive EHR training like physicians.

Research Design Literature

Surveying as a method of data collection was commonly found throughout the literature. The majority surveyed medical students or attendings that attend an allopathic medical program. Few surveyed osteopathic students. One of those sources included Bronsburg's (2011) study that surveyed first-year osteopathic students and osteopathic students who recently entered the workforce. The study addressed the lack of IT skills students experienced while in medical school. Lander et al. (2020) surveyed medical students from allopathic programs to ascertain their perception of EHR readiness and identify gaps in their curriculum to address EHR training. Hammoud et al. (2012) sent survey questions to clerkship directors asking about medical student use of EHRs and what their observations were.

Conclusions

Literature indicates that medical programs have recognized the importance of EHR education for medical students. However, the use of EHRs in medical schools varies across the nation. Not to mention that the literature mainly referred to allopathic schools and not

osteopathic ones. Other literature mentions that students had more comfort and a greater sense of readiness when using an EHR at an earlier time during medical school than during their clerkship. Even if EHR courses were not offered in medical school, students who scribed previously felt that it was provided some knowledge on how to use an EHR.

Chapter Summary

This chapter included information that confirmed that there is a gap in comparing medical education between allopathic and osteopathic programs regarding the EHR curriculum. But also, medical students should have the ability to have as much experience/training while in school with EHRs so that their residency and future experience with EHRs are not as negatively impacted. Chapter 3 will introduce the reason for selecting the method and design selected for this study and why applying TAM was an appropriate choice for question design.

Chapter 3

Research Methodology

The purpose of this study was to address the level of readiness primary care physicians have when using an EHR upon graduation or beginning their clinical career by measuring ease of use or level of satisfaction. This study applied quantitative methods and used descriptive statistics to analyze the data. The primary method of data collection involved surveying primary care physicians from across the United States who graduated from either an allopathic or osteopathic medical program. Analysis of data included Microsoft Excel and Statistical Analysis System (SAS).

Research Method and Design Appropriateness

Scientific research can be qualitative, quantitative, or a mix of both and is conducted by performing systemic and thorough investigation which would results in the discovery or interpretation of facts regarding a phenomenon (Queiros et al., 2017). Queiros et al. (2017) explained the advantages and disadvantages of qualitative and quantitative methodologies and their respective research design.

Qualitative research focuses on deepening the understanding of a phenomenon without numerical representation. Therefore, results from qualitative methodology are not quantified. The qualitative methodology has correlations between meanings, values, and attitudes, with relationships and processes (Queiros et al., 2017). The quantitative methodology allows for results to be quantified because population sizes are generally larger and provide a comprehensive view of the population (Queiros et al., 2017). Research designs in quantitative research have structured and formal instrumentation for data collection, and statistical analysis of data (Queiros et al., 2017).

Qualitative and mixed-method approaches were originally selected to be applied for this study. The data collection method for the qualitative design would have been completed by interviewing physicians. In January 2020 a pandemic of a coronavirus called SARS-CoV-2 spread globally. Interviewing physicians was already a difficult task, but face-to-face interviewing came to a halt when the pandemic hit. Mixed methods were considered so that surveying physicians and interviewing them could be completed. While conducting virtual interviews could have been completed, the validity and reliability of tools would have been extended under a mixed-methods approach.

Quantitative methodology through surveying was selected for this study. Surveying is a common technique used in quantitative research since information regarding the phenomenon is obtained through an organized set of questions (Queiros et al., 2017). This process allowed the researcher to gain information and knowledge directly from the participant in the study. Another reason why surveys are popular is that there is high representativeness from the population which increases the ability for results to be quantified and summarized for the population. Also, surveys are a low-cost method of data collection. When using surveys, reliability is an important aspect to keep in mind. Reliability depends on the structure and accuracy of participants. This study conducted data collection by using Qualtrics, an online survey platform that has validation measures built within.

Descriptive research was conducted as it allows for summarization of data collection to show the perception of readiness of EHR use. The survey questions for this study were designed from the technology acceptance model (TAM). TAM is based on the theory of reasoned action (TRA) which involves perceived ease of use (EU) and perceived usefulness (PU) (King & He,

2006). Over the years, TAM has become a common model due to its understandability and simplicity and has been the instrument to use for empirical studies (King & He, 2006).

The TAM is a well-known model used to measure and understand the use of new technologies that are used in the health care field. EHRs are an example of a task-related system that is designed to improve efficiency and performance. There were three contexts for applying TAM; telemedicine, EHRs, and mobile applications which were found because the author's review (Rahimi et al., 2018). Rahimi et al.'s (2018) review also identified that the TAM was originally used for task-related systems in communication technology such as EHRs. This was seen in an educational setting where learning about the system's effects on learning can influence the intention to use the system. Additionally, Rahimi et al. (2018) note that perceived usefulness related to learning can have a stronger effect on usage instead of perceived ease of use for EHRs. An important finding in Rahimi et al.'s (2018) systemic review is several articles used an extension of the original TAM. Meaning that there is still no version of TAM that has been established for the health care field. Jacobs et al. (2017) applied perceived usefulness and perceived ease of use to survey osteopathic students to identify their readiness in using health information technology (HIT). Many students did not have formal training in computer science, but those who had prior work or volunteer experience had a higher level of readiness. The students with HIT experience were more comfortable which led to a greater sense of acceptance with another HIT that would benefit their career.

Research Questions/Hypotheses

R1. What are the differences between allopathic and osteopathic EHR training and their perception of readiness for their job after completing their medical training?

Population and Sample

This study selected at least 83 participants that graduated from an allopathic or an osteopath medical school. The minimum sample size was 60. This study applied a 95% confidence interval allowing a minimum of 60 participants according to Taherdoost (2017). The control group for this study consisted of medical students that did not receive EHR training in medical school. The sampling plan consists of physicians with differing medical programs, any EHR training during medical education, and primary care. Simple random sampling was applied for this study which allowed for the target population to have an equal chance of being selected. Demographic data such as medical program graduation year and years of experience with an EHR are included in the survey questions.

Informed Consent and Confidentiality

The first question in the survey asked for consent from the participants and to approve/disapprove by answering 'yes' or 'no'. The consent was not embedded in the question as an attachment because Centiment does not allow respondents to download anything or view a different screen while in the survey. Participants were unable to move past this question until a response was given. If a participant did not consent, then they would be sent to the end of the survey. If the participant gave consent, then they would move on to the rest of the survey.

Instrumentation

Qualtrics was used as the survey platform which gave the researcher the capability to create research questions designed from TAM. Centiment was used to assist in reaching the target audience for participation. Microsoft and SAS were used for statistical analysis. Please refer to the survey questions in Appendix A.

Validity and Reliability

Charness and Boot (2016) describe TAM as an influential model that measures perceived ease of use and perceived usefulness. According to Hu et al. (1999), TAM was designed to explain user acceptance of computer technology. The intention-based model has been used to measure user acceptance while providing empirical support. Watterson et al. (2020) developed a model to guide their analysis if EHRs are easy to use, then primary care providers will use them more often. An interesting comment made by Watterson et al. (2020) is that non-primary care providers are likely to gain more and use EHRs more compared to primary care providers due to an increase in information and decision-making. The authors list non-primary care providers as medical assistants, nurses, and other clinical staff. Both hypotheses were supported by the ease of EHR use has increase relational coordination, and that ease of use was stronger for non-physicians. These findings illustrate the importance of training all users of EHR and identifying the ease of use for their role. Different roles will lead to different barriers that are experienced and workarounds that are created. Venkatesh (2000) developed a theoretical framework that describes the determinants of an individual's ease of use for a specific system throughout stages of experience by analyzing TAM. Venkatesh's (2000) findings suggest that system-specific ease of use is based on individual differences and the effect of the differences increase with experience. Increasing the experiences of the system drives the perceived ease of use which could adjust the overall beliefs of the specific system long-term. Therefore, if users of EHRs can enhance and improve their experience it could change the perspectives and general concerns about using them. Additionally, it could enhance the notion Watterson et al. (2020) discussed that primary care physicians are not inclined to use EHRs based on ease of use.

Data Collection

IRB approval from Franklin University was obtained to acquire data. Qualtrics, an internet survey program, was used to collect data for this study. The researcher collaborated with the Ohio State Medical Association (OSMA) which shared the Qualtrics URL in their monthly newsletter from April – July 2021. Participation was difficult to obtain through this method of collection so a collaboration with Centiment was created to assist with reaching the target audience. IRB modification was obtained for this change in data collection. Centiment is a research platform that collaborates with academic institutions and other industries and provides research services, creates surveys, or assists in reaching target audiences.

Primary care physicians were asked to complete the survey by answering some generic questions such as year of medical program graduation and TAM-designed questions. Participants would first need to read and agree to consent before moving forward in the survey. If a participant did not consent to the survey, then they would be taken to the end of the survey. After consenting, participants would answer 5 generic questions and 12 TAM-designed questions, and 1 inattention question. The inattention question was added to ensure participants answered thoughtfully and honestly. The goal is to have 60-83 participants for this study.

Data Analysis

Descriptive data and simple statistics were used to analyze the results from the quantitative data collected. Such measurements included means, medians, and standard deviation (Story & Tait, 2019). Descriptive statistics were used to summarize a large amount of information (Mishra et al., 2019). Nick (2007) states that descriptive statistics estimate the characteristics of a population, and these characteristics are referred to as variables. To accomplish basic descriptive analysis, chi-square tests and t-tests were used to test for correlation and assessment of readiness from TAM results. Measures of central tendency and dispersion or

variation were used to analyze the data from survey results. Measurements of central tendency include mean, median, and mode, and dispersion measurements include variance, standard deviation, and range (Mishra et al., 2019).

This study assessed normality through graphical or numerical representation. Numerical or statistical testing can make an objective judgment on the normality of the results but varies in sensitivity depending on sample size. Graphical representation still provides a good judgment on normality when numerical test sensitivity fluctuates but requires enough skill to provide correct interpretations. For this study, numerical tests of normality were used. Data management for this study involved steps of protecting and ensuring participant anonymity, confidentiality, and trustworthiness. Participant identification information was not used for or during the study and de-identifying techniques were used to analyze survey results.

Summary

Collecting data through surveying was the appropriate method given the purpose and research question of this study. However, the data collection process took longer than originally anticipated. Using questions designed from TAM also was appropriate given that it is already a validated method and measures perceived ease of use and perceived usefulness. Chapter 4 will discuss and elaborate on findings from the Qualtrics survey.

Chapter 4

Analysis and Results

The purpose of this study was to identify if EHR training was introduced during medical education and measure the ease of use once beginning clinical practice. Ease of use was measured for primary care physicians that graduated from either an allopathic or osteopathic program using TAM. TAM measures someone's acceptance by identifying perceived ease of use and perceived usefulness. Twelve questions are the normal number of questions with TAM with responses like a five-point Likert scale. This chapter provides the method of data collection and an analysis of the results from the Qualtrics survey. The Qualtrics survey began with informed consent as the first question. Depending on the participant's response, the survey would continue to the next section or would be skipped towards the end if the participant did not consent. The next five questions consisted of generic information about the participant. Participants were asked the year of graduation from a medical program, what type of program (allopathic or osteopathic) they graduated from, etc. The remainder of the survey consisted of TAM-based questions. There are 12 TAM questions split into two categories, perceived usefulness, and perceived ease of use.

Research Questions/Hypotheses

R1. What are the differences between allopathic and osteopathic EHR training and their perception of readiness for their job after completing their medical training?

Data Collection

Data collection was done by surveying potential participants using Qualtrics. The data collection took place between April 2021 to November 2021. Originally, the consent form was attached to the first question a participant would read. However, after November 15, 2021, the

first question requested consent. This change was done due to the use of a research platform, Centiment, that assists with the target audience for studies; it is described in the following paragraph. After consent was obtained, advancing to the next question was not permissible until the participant answered the question. Between April and July 2021, the Ohio State Medical Association (OSMA) agreed to send the URL for the Qualtrics survey in their newsletter to their listserv. Each month an email would be sent requesting for the Qualtrics link to be placed in the monthly newsletter. Responses trickled in, but the rate was not quick enough to achieve the goal of the sample size needed. Therefore, the process of data collection needed to be redesigned. The next method of data collection was to contact graduate medical education (GME) offices and credentialing offices of hospital systems across Ohio. The researcher contacted the GME and credentialing offices inquiring if the offices could share the URL with their faculty. Unfortunately, the GME and credentialing office did not respond to the initial email request, so no responses were obtained during that period.

By September 2021, the researcher had learned about Centiment. Centiment is a research platform that provides research services to different organizations. A virtual meeting took place with a representative from Centiment to answer questions and assist in the process of using this company for research. Centiment sends out surveys through a database of previous study participants. If the participants fit the criteria for the target audience, then the survey is sent to them to reach the population size. The Centiment representative then reviewed the survey used for this study and suggested some edits to be made to enhance and improve respondent rates. Some of the recommendations included the consent being written within the first question of the study rather than being viewed as an attachment. Other recommendations included splitting a question into two and adding an inattention question to ensure validity and thoughtfulness in

responses. Centiment also provides compensation to their participants which are controlled by the system to drive participants in and the compensation itself varies. Before approving a soft launch with Centiment, IRB modification was done to obtain the correct approvals for the changes that Centiment advised. Centiment advised splitting some questions into two and adding an inattention question at the end of the survey. Data collection with Centiment lasted approximately two weeks which included a soft launch to the respondents that determined the rate of response. Additionally, Centiment was unable to connect with physicians only in Ohio, so during November 2021, participants responded from across the country.

Demographics

Participants for this study were allopathic or osteopathic graduates who specialized in primary care. Participation included primary care physicians from across the country and was not specific to a state. Demographics such as gender, ethnicity, and age were not obtained for this study. Participants were asked to indicate the year of completion of their medical program. Graduation years ranged from 1968 – 2020. There were 67 graduates from an allopathic program and fifteen from an osteopathic program. Of the 82 participants, 39 had 0-10 hours of EHR exposure, 20 had more than 31 hours, 14 had 11-20 hours of exposure, and 9 had 21-30 hours. These hours would have been before EHR use in medical school. When asked how many EHR courses were required in their program, 29 said all were required, 14 had some courses required, 3 said none were required, and 2 could not remember. However, 34 respondents indicated that 0 courses involved EHRs, therefore, there were 34 blank responses to the question about EHR requirement courses. The questions used for Table 1 (below) include the following: Did you have any previous EHR experience in medical school, Were these courses involving EHR required, and What medical program did you graduate from, MD or DO?

Table 1

Row Labels	Count of Q22
0-10 hours	**39**
DO	7
MD	32
11-20 hours	**14**
DO	4
MD	10
21-30 hours	**9**
MD	9
31+ hours	**20**
DO	4
MD	16
Grand Total	**82**

Data Analysis

The original data from Centiment included a lot of information that was redacted for this study such as IP address was removed before uploading data for statistical analysis. Other redacted information from the data included start and end dates, response type, survey progress, record date, response ID, and recipient name and email. This information likely originated from the software Centiment uses for its respondents. While the information could be useful to Centiment, this information could have revealed a respondent's private information. Therefore, any possibly identifiable information was removed from the date used for analysis. There was a total of 83 responses. However, one response was completely removed from the data. The participant did not indicate whether they were a graduate of an allopathic or osteopathic program, therefore, analysis of the response would not be beneficial. Eighty-two responses were analyzed using Microsoft Excel and Statistical Analysis System (SAS). Analysis was done by

creating a pivot chart for each demographic question (non-TAM), to visualize the answers in a clean view for only that question. Once each question was reviewed, additional information was filtered for further analysis. Each question was coded in Excel from 0-4 or 0-7 (for TAM questions) to run analysis in SAS. SAS was first used to generate bar charts that visualized the responses to the TAM questions in comparison to allopathic and osteopathic graduates. To run basic descriptive analysis, the coded TAM was uploaded to SAS to run a chi-square test to compare questions 4 and 5 and to run t-tests for each TAM question.

Results

Survey completion was measured in seconds and took participants 50 seconds – 33 minutes to complete the survey. Out of the 82 participants, 67 participants answered they were graduates of an allopathic program and 15 were graduates from osteopathic programs. The year of medical school completion ranged from 1968-2020 and the average graduation year was 2004 with the mode being 2020. Thirty-four participants responded to having zero courses involving EHRs in their medical program. Followed by 20 participants having at least one to three courses while in school. From this question, only three participants had 11 or more courses. The same 34 answers resulted in a blank response to the question of the courses were a requirement. 29 participants answered that the EHR courses were required and 2 could not remember. Regarding any additional EHR experience before medical school, 39 participants answered 0-10 hours and 20 responded more than 31 hours.

Table 2.

Statistics for Table of Q4 by Q5

Statistic	DF	Value	Prob
Chi-Square	156	141.8124	0.7855
Likelihood Ratio Chi-Square	156	131.3492	0.9248
Mantel-Haenszel Chi-Square	1	9.9659	0.0016
Phi Coefficient		1.3151	
Contingency Coefficient		0.7960	
Cramer's V		0.6575	

Table 2 shows questions 4 and 5 were used to run the chi-square tests which resulted in 156 degrees of freedom, the test statistic is 142 and p-value of .78. Since the p-value is high, the result is not significant. The questions for the chi-square above include the following: What year did you complete your medical program and How many courses in your medical program involved electronic health records (EHR)? These questions were selected for the chi-square analysis to answer part of the research question about the year of graduation and how many EHR courses were required in school.

Osteopathic medicine

Graduation years ranged from 1990-2020. Six participants answered they had 0 EHR courses in medical school and had 0-10 hours of previous EHR experience. The remaining nine participants indicated that either some or all their EHR courses were required. Although there were only 15 osteopathic participants, more than half had some EHR courses during their medical program. These participants could have a higher perception of readiness due to some exposure to EHRs while in school.

Allopathic medicine

Twenty-eight out of the 67 allopathic physicians recorded 0 EHR courses while in medical school which accounts for 28 ‘blank’ responses if EHR courses were or were not

required. Twenty-six participants noted that the EHR courses were required, and all had differing hours of previous EHR exposure. Less than half of the allopathic physicians were required to take EHR courses but had previous EHR exposure. This significance indicated that most allopathic physicians did not have some previous EHR exposure or EHR courses which could have a lower perception of readiness to use EHRs after graduation.

Table 3.

Row Labels	Count of Q22
0-10 hours	**39**
DO	7
MD	32
11-20 hours	**14**
DO	4
MD	10
21-30 hours	**9**
MD	9
31+ hours	**20**
DO	4
MD	16
Grand Total	**82**

Table 3 (above) shows the number of hours of previous EHR experience and the count between allopathic and osteopathic participants. In each section of hours on the left, those who graduated from an allopathic program had more previous EHR experience than osteopathic graduates.

TAM

Each TAM question was analyzed with a pivot table in Excel that had the medical degree filter so each response could be filtered by the participant. The first six TAM questions evaluated perceived usefulness and the last six questions evaluated perceived ease of use. Reviewing each question's pivot table individually, most participants answered 'extremely likely' to the

perceived usefulness questions. From those answers, allopathic physicians had the highest response (30-35). The second highest response in this section was ‘quite likely’ with allopathic physicians leading the count. Next, the number of required EHR courses was filtered in the pivot table to determine the number of courses taken in each response. In the higher response sections (extremely likely) more respondents that noted three courses or less and few selected more than 4 courses. Among those who answered ‘extremely unlikely’ to the questions, the answers were either 0 or greater than 8 courses. Regarding perceived ease of use, most of the questions were answered ‘quite likely’ and a couple of questions were answered ‘extremely likely.’ As expected, allopathic physicians had the higher count in responses for the perceived ease of use section.

SAS was then used to create a bar chart for each question to compare the two medical degrees. Doing this assisted in separating the two medical degrees and color-coordinating the answers to visualize the frequency of responses tallied for each answer choice. The perceived usefulness charts were then reviewed together. The osteopathic participants answered ‘quite likely’ to most of the questions. Only two out of six answered ‘extremely likely’ which matched the responses from the allopathic participants. The perceived ease of use questions showed most osteopathic participants selected ‘quite likely’ and the allopathic participants were split between ‘quite likely’ and ‘extremely likely.’

The research question for this study was as follows: what are the differences between allopathic and osteopathic EHR training and their perception readiness for their job after completing their medical training? Each TAM question was created into a pivot table and the number of courses in the medical program and what degree the participants had were filtered to evaluate the comparison of medical programs. Almost all TAM questions were answered in

favor of ‘extremely likely’ in the responses with the majority coming from respondents who graduated from an allopathic program.

Of the 15 osteopathic graduates, two had 8-10 EHR courses and some of them were required, and roughly half of the participants had 0-10 hours of previous EHR experience. Only three of the participants noted that their EHR courses were required, and the graduation years were 2000, 2014, and 2020. Whereas the 67 who graduated from an allopathic program, 26 answered that their EHR courses were required with most of the participants having more than 10 hours of previous EHR experience. Although there were more allopathic graduates in comparison to the osteopathic graduates, there were more participants that had a higher amount of previous EHR experience.

Analysis of the TAM questions using SAS involved running two sampled t-tests. T-tests measure the significance of the differences between groups. For this study, the groups are the answers to the TAM questions and question 3, which asked participants what medical degree they have. Questions 8-13 are Perceived Usefulness and questions 15-20 are Perceived Ease of Use. Note, there is no true question 14 as that was labeled as the next section in Qualtrics. Below are tables that show the t-tests analysis for all twelve questions. Question 8 had a negative t-value of -1.21 and the corresponding p-value is 0.2280 which is greater than the critical value of .05. This means that it would fail to reject the null hypothesis stating the result is not significant. Therefore, there is no relationship between MDs or DOs and their perception of use. The t-values for questions 9-12 are negative with values of -1.07, -0.77, -0.78, and -0.42 respectively, all with p-values larger than .05. There is no relationship between allopathic and osteopathic physicians and their perceived usefulness. Question 13 had a t-value of .04 and a p-value of .96, which is larger than .05. The p-value for question 15 was .01, smaller than the critical value. Indicating

that there is a relationship between allopathic and osteopathic physicians and the ease of use to learning to operate an EHR would be ease. Questions 16-17 had negative t-values and p-values that are larger than .05. Therefore, there is no relationship between allopathic and osteopathic physicians and their perceived ease of use. Question 18 had a positive t-value, but the p-value was still larger than .05 indicating no relationship. Lastly, questions 19 and 20 had negative t-values and p-values larger than the critical value resulting in no relationship.

Q3	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
DO		5.4667	4.7159	6.2175	1.3558	0.9926	2.1382
MD		5.9552	5.6091	6.3013	1.4188	1.2127	1.7101
Diff (1-2)	Pooled	-0.4886	-1.2889	0.3118	1.4080	1.2196	1.6658
Diff (1-2)	Satterthwaite	-0.4886	-1.2999	0.3228			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	80	-1.21	0.2280
Satterthwaite	Unequal	21.434	-1.25	0.2245

Question 8. Using an EHR in my job would enable me to accomplish tasks more quickly. The mean for the osteopathic physicians was 5.4667 and 5.9552 for the allopathic physicians. The difference in standard deviation between the two is .06300.

Q3	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
DO		5.3333	4.4788	6.1878	1.5430	1.1297	2.4335
MD		5.8209	5.4296	6.2122	1.6042	1.3711	1.9336
Diff (1-2)	Pooled	-0.4876	-1.3935	0.4184	1.5937	1.3804	1.8855
Diff (1-2)	Satterthwaite	-0.4876	-1.4101	0.4349			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	80	-1.07	0.2874
Satterthwaite	Unequal	21.33	-1.10	0.2844

Question 9. Using an EHR in my job would increase my productivity. Allopathic physicians have a higher mean and confidence level compared to osteopathic physicians.

Q3	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
DO		5.4667	4.6872	6.2461	1.4075	1.0304	2.2197
MD		5.8060	5.4233	6.1887	1.5690	1.3410	1.8911
Diff (1-2)	Pooled	-0.3393	-1.2158	0.5372	1.5420	1.3356	1.8243
Diff (1-2)	Satterthwaite	-0.3393	-1.1903	0.5117			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	80	-0.77	0.4434
Satterthwaite	Unequal	22.504	-0.83	0.4176

Question 10. Using an EHR would improve my job performance. From this analysis, allopathic physicians had a higher mean, confidence level, and standard deviation.

Q3	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
DO		5.4667	4.6071	6.3263	1.5523	1.1365	2.4481
MD		5.8209	5.4319	6.2099	1.5947	1.3630	1.9221
Diff (1-2)	Pooled	-0.3542	-1.2566	0.5481	1.5874	1.3750	1.8781
Diff (1-2)	Satterthwaite	-0.3542	-1.2806	0.5721			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	80	-0.78	0.4370
Satterthwaite	Unequal	21.148	-0.79	0.4355

Question 11. Using an EHR would enhance my effectiveness on the job. The difference between the means for this question is .35420 and the difference between the standard deviation is .45820.

Q3	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
DO		5.4667	4.5337	6.3996	1.6847	1.2334	2.6569
MD		5.6716	5.2569	6.0863	1.7002	1.4531	2.0492
Diff (1-2)	Pooled	-0.2050	-1.1699	0.7599	1.6975	1.4703	2.0083
Diff (1-2)	Satterthwaite	-0.2050	-1.2077	0.7978			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	80	-0.42	0.6736
Satterthwaite	Unequal	20.882	-0.43	0.6750

Question 12. Using an EHR would make it easier to do my job. The allopathic physicians scored higher in mean, confidence level and standard deviation compared to the osteopathic physicians.

Q3	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
DO		6.0000	5.3721	6.6279	1.1339	0.8302	1.7883
MD		5.9851	5.6414	6.3287	1.4088	1.2041	1.6980
Diff (1-2)	Pooled	0.0149	-0.7608	0.7907	1.3647	1.1820	1.6145
Diff (1-2)	Satterthwaite	0.0149	-0.6849	0.7148			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	80	0.04	0.9696
Satterthwaite	Unequal	24.722	0.04	0.9653

Question 13. I would find an EHR useful in my job. The osteopathic physicians had a higher mean of .01490 and the t-value is positive compared to the previous 5 questions.

Q3	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
DO		5.2000	4.5315	5.8685	1.2071	0.8838	1.9038
MD		5.9701	5.7051	6.2352	1.0867	0.9288	1.3098
Diff (1-2)	Pooled	-0.7701	-1.4004	-0.1399	1.1087	0.9603	1.3117
Diff (1-2)	Satterthwaite	-0.7701	-1.4782	-0.0621			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	80	-2.43	0.0173
Satterthwaite	Unequal	19.406	-2.27	0.0345

Question 15. Learning to operate an EHR would be easy for me. The allopathic physicians had higher scores in mean, confidence level, but the osteopathic physicians had a higher standard deviation of 1.2071.

Q3	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
DO		4.9333	4.0586	5.8081	1.5796	1.1565	2.4912
MD		5.6716	5.3309	6.0124	1.3968	1.1939	1.6836
Diff (1-2)	Pooled	-0.7383	-1.5515	0.0749	1.4305	1.2391	1.6925
Diff (1-2)	Satterthwaite	-0.7383	-1.6630	0.1864			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	80	-1.81	0.0745
Satterthwaite	Unequal	19.206	-1.67	0.1112

Question 16. I would find it easy to get an EHR to do what I want it to do. The osteopathic physicians had a standard deviation of 1.5796 and the allopathic physician's standard deviation was 1.3968.

Q3	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
DO		5.3333	4.6184	6.0483	1.2910	0.9452	2.0360
MD		5.7463	5.4304	6.0621	1.2950	1.1068	1.5609
Diff (1-2)	Pooled	-0.4129	-1.1487	0.3228	1.2943	1.1211	1.5313
Diff (1-2)	Satterthwaite	-0.4129	-1.1807	0.3549			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	80	-1.12	0.2674
Satterthwaite	Unequal	20.794	-1.12	0.2758

Question 17. My interaction with an EHR would be clear and understandable. The difference in standard deviation between the two physicians was .00400.

Q3	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
DO		5.7333	5.1614	6.3053	1.0328	0.7561	1.6288
MD		5.6866	5.3463	6.0268	1.3949	1.1922	1.6813
Diff (1-2)	Pooled	0.0468	-0.7142	0.8077	1.3386	1.1595	1.5837
Diff (1-2)	Satterthwaite	0.0468	-0.6028	0.6963			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	80	0.12	0.9030
Satterthwaite	Unequal	26.821	0.15	0.8836

Question 18 asks I would find an EHR to be clear and understandable. Allopathic physicians had a higher standard deviation, and the t-value was 0.12.

Q3	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
DO		5.6000	4.7680	6.4320	1.5024	1.0999	2.3694
MD		6.1045	5.8224	6.3866	1.1565	0.9884	1.3939
Diff (1-2)	Pooled	-0.5045	-1.2003	0.1913	1.2241	1.0603	1.4482
Diff (1-2)	Satterthwaite	-0.5045	-1.3722	0.3632			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	80	-1.44	0.1530
Satterthwaite	Unequal	17.894	-1.22	0.2376

Question 19. It would be easy for me to become skillful at using an EHR. The osteopathic physicians had a higher standard deviation of 1.5024 but a lower confidence level of 4.7680.

Q3	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
DO		5.3333	4.5595	6.1071	1.3973	1.0230	2.2036
MD		5.8657	5.5343	6.1970	1.3584	1.1610	1.6373
Diff (1-2)	Pooled	-0.5323	-1.3084	0.2438	1.3653	1.1826	1.6153
Diff (1-2)	Satterthwaite	-0.5323	-1.3598	0.2951			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	80	-1.37	0.1761
Satterthwaite	Unequal	20.358	-1.34	0.1948

Question 20. I would find an EHR easy to use. While the mean of osteopathic physicians was less than the allopathic, osteopathic physicians had a slightly higher standard deviation of .003890.

Perception

The last section for analysis included the perception of readiness the participants felt. The TAM questions had a Likert scale of one to seven, with one being extremely unlikely and seven being extremely likely. The number correlated with each response was added to create a baseline. The baseline score was 84. The lowest score was a total of 15 which came from an allopathic physician that graduated from medical school in 2006. This participant had 0 EHR courses in medical school and 0-10 hours of previous EHR experience. This participant would appear to not have a strong perception of readiness with EHRs. Eleven participants who scored 84 which would correlate with a strong perception of readiness with EHRs. All 11 participants were allopathic physicians. The lowest score that an osteopathic physician scored was 37. Indicating this participant would not have a strong perception of readiness. The highest score from an osteopathic physician was 80 which is still a strong perception of readiness. If the results were to be broken down in intervals of 10; 2 physicians scored 33 and 37, 7 scored 40-49, 6 scored 52-58, 14 scored between 60-69, 29 scored 70-79, and 23 scored between 80-84. Of the 29 physicians that scored between 70-79, there were only 8 osteopathic physicians.

Summary

Chapter 4 discussed the analysis of the data from the survey collection. There were 82 participants, 67 were allopathic physicians and 15 were osteopathic physicians. Graduation years for the study population ranged from 1968 – 2020. Reviewing the analysis from Excel, the respondents had differing amounts of EHR courses ranging from at least three to about eight or more. However, there was no correlation between increasing the amount of EHR courses as the years progressed. 8 participants that graduated in 2020 with only one from an osteopathic program. Half of these participants had one to three EHR courses including the osteopathic graduate and only two had 11 or more courses. The analysis from SAS provided the statistical

aspect of running two sampled t-tests. Most of the t-test results had negative values with p-values greater than the critical value. This indicates there is no relationship between allopathic and osteopathic physicians and their perceived ease of use. Question 15 had a negative t-value, but a p-value smaller than the critical value. While question 18 had a positive t-value, but a large p-value indicated no relationship between the physicians and their ease of use. Chapter 5 will discuss the findings from this data and will conclude what further research would have an impact on EHR training for physicians.

Chapter 5

Conclusions and Recommendations

This study attempted to identify when EHR training was introduced during medical education and measure the ease of use once beginning clinical practice using a survey that used TAM-designed questions. This study's significance was to identify if both allopathic and osteopathic programs offer or include EHR courses and/or training and to determine the level of readiness physicians have post EHR training. There was one research question for this study which was as follows: what are the differences between allopathic and osteopathic EHR training and their perception readiness for their job after completing their medical training.

Research Questions/Hypotheses

R1. What are the differences between allopathic and osteopathic EHR training and their perception of readiness for their job after completing their medical training?

Discussion of Findings

Methods of patient documentation have been an evolving process and it was not until the early 2000s the importance of EHR training was discussed. Clarke (2015) discussed training osteopathic physicians in EHRs between novice and expert primary care physicians would lessen the learning curve. Most of the osteopathic participants scored 70 or higher out of 84 in their responses indicating a moderately high level of readiness. In contrast, 37 allopathic physicians scored 70 or higher which is slightly higher than half of the allopathic participants, which would have a strong level of readiness with EHRs. Silverman et al. (2014) addressed the challenge of providing more opportunities for medical students to interact with EHRs. The participants that applied EHR more effectively with patient encounters received the most training in Silverman et al.'s (2014) study. This study asked how many EHR courses were provided in medical school

and how many of them were required. 34 participants answered they had 0 EHR courses while in medical school and 20 had at least 1-3 courses. Only 29 participants answered that all EHR courses were required and 14 answered that some were required. Because 34 participants answered that 0 EHR courses were taken, there were 34 blank questions regarding the requirement. Organizations such as the Associations of American Medical College should consider having more EHR courses a requirement.

Lander et al.'s (2020) study identified gaps in the curriculum on training medical students to use EHRs and their level of readiness. Those students were more comfortable with easier tasks and EHR training should focus on information entry and decision making. The TAM questions for this study were weighted using a method like a 5-point Likert scale. In this case, 7 was the highest score to achieve. The scores were added for a result from 12-84; with 84 being the highest. Only 11 participants scored a total of 84. All of those were allopathic physicians. The highest score an osteopathic physician scored was 80. The lowest score an allopathic physician scored was 15 and it was 37 for an osteopathic physician. The year of graduation of the 11 participants were 1970, 1994, 1985, 1998(2), 2002, 2006, 2019, and 2020(3). Looking at these graduation years, not many primary care physicians feel they have a strong level of readiness. Twenty-nine physicians had a score between 70-79 and only 8 were osteopathic physicians. From the scores among the 82 participants, it could be assumed that most had a strong level of readiness when it came to using EHRs. Once the results were analyzed by intervals of 10 and degree, not many participants appeared to have a strong level of perception. Fewer osteopathic physicians had a good level of readiness, but it is difficult to determine whether it is related to having 15 participants out of 82, or if osteopathic physicians, in general, do not feel as prepared.

Limitations

After analyzing the data from the surveys, one limitation that emerged was the unequal number of allopathic and osteopathic respondents. It would have been interesting to have had the same number of allopathic and osteopathic respondents. This would have provided more information on the difference between medical programs and their EHR training. Having the same number of each degree could account for older osteopathic participants. The oldest graduation year in the osteopathic results was 1990, whereas the oldest allopathic date was 1968. Both respondents had 0 EHR courses and 0-10 hours of previous EHR experience, but their TAM responses were entirely different. The osteopathic had less perceived ease of use and level of preparedness than the allopathic graduate. Analysis and interpretation of the results were skewed when comparing the number of allopathic and osteopathic physicians because there were so few osteopathic participants. Another limitation resulted from surveying only primary care physicians. It would be interesting to compare the perception of readiness of a primary care physician to a general surgeon or another specific sub-specialist. It is possible to consider the perception of readiness varies among fields in medicine and how detailed and painstaking documentation could be in EHRs. One final limitation was the geographic location of this studies participants. Since the survey was distributed by Centiment, it is unknown what the geographic area is for each participant. The geographical location could have a significant impact on the type of EHR. The EHR could be complex and serve many functions or it could be simple and achieve basic documentation. It was also unknown if the participant was a hospital employee or part of private practice. Hospital or private practice office sizes varies and could have a great effect on what EHR is used, but also the type/amount of training that is provided given sufficient funding

or staffing. A potential study in the future would be to review EHR perception of readiness at several hospital systems, preferably those that use different EHRs.

Recommendations for Future Research

A good recommendation for future research would be to consider having an equal number of allopathic and osteopathic physicians if comparing the two. The population for this study needed to be primary care physicians and a graduate from either type of medical program, so the data analysis was not easy to compare because of the unequal respondents. Even if it were to prolong data collection having an equal number could provide significant insight for comparison. Another recommendation would be to survey physicians from different services that work at the same hospital. This could determine the perception of readiness physicians have while using the same EHR system but could have had different EHR courses in medical school or were trained by an EHR representative. Further research could consider other health professionals and the training they receive throughout their education.

For all these recommendations, it would be best to collect data by surveying the participants. One of the original methods for data collection for this study was to conduct interviews with primary care physicians. While the COVID-19 pandemic made face-to-face contact difficult, asking physicians to take time out of their busy day to be interviewed is a tough ask. Surveys offer the flexibility of completing the information at any given time and provide the ability of privacy and anonymity. Other methods of data collection could be through observation. If this approach was done, a mixed-methods research design would be an appropriate selection. Observations provide the opportunity to see the experiences with EHR taking place in real time. Future researchers could observe clinical and non-clinical staff on the day-to-day operations of using EHRs.

Summary

The research question of this study was as follows: what are the differences between allopathic and osteopathic EHR training and their perception readiness for their job after completing their medical training? The main difference between allopathic and osteopathic physicians is the allopathic participants had a higher perception of readiness than their osteopathic counterparts. Eleven allopathic physicians had a total score of 84 from TAM and the highest osteopathic score was 80. Overall, the perception of readiness among the participants was not as high as anticipated. Only 11 participants out of 82 had the strongest perception of EHR readiness. Perception of readiness varied across the physicians and the year of graduation. There was no correlation between increased EHR courses and increased graduation years. This indicates EHR courses are introduced during medical school, but the number of courses varies across programs. There is still a gap in EHR courses during medical education. There is no question that EHR training has improved over the years, but it is not where it could be.

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Appendix A

Informed Consent

Hello, my name is Elizeba Saldivar and you are invited to take part in a research study. I am a graduate student in the Doctorate of Healthcare Administration program at Franklin University in Columbus, Ohio. As part of the requirements for earning my doctorate, I am doing a research project.

What am I being asked to do?

If you participate in this project, you will complete a survey.

Taking part in this study is your choice.

Your participation in this project is completely voluntary. You may stop participating at any time. If you stop being in the study, there will be no penalty or loss of benefits you would normally have.

Why is this study being done?

The purpose of my project is to measure the perception of readiness between allopathic and osteopathic electronic health records (EHR) training in primary care. I am inviting you to participate in my project because you are a primary care physician that has graduated from either an allopathic or osteopathic medical program.

What will happen if I decide to take part in this study?

The survey consists of 19 questions. Six questions will ask for general information, twelve will be designed from the technology acceptance model (TAM) and one inattention question. It will take at least 10 to 20 minutes to complete. The survey includes questions like, “What medical program did you graduate from” and “Using an EHR in my job would enable me to accomplish more tasks quickly”.

What are the risks and benefits of taking part in this study?

I believe there is little risk to you for participating in this research project. You can stop taking the survey at any time.

There will be no direct benefit to you for participating in this survey. The results of this project may lead to an increase in incorporating EHR training in medical school.

Confidentiality and Privacy:

I will not ask you for any personal information, such as your name or address. I will not collect your email or IP address; the survey is completely anonymous. I will keep all study data encrypted. Only my Franklin University dissertation chair and I will have access to the information. Other agencies that have legal permission have the right to review research records. The Franklin University IRB has the right to review research records for this study.

Questions:

If you have any questions about this study, please email me at saldiv02@email.franklin.edu. You may also contact my dissertation chair, Dr. Alyncia Bowen, at alyncia.bowen@franklin.edu. If you have any questions regarding your rights as a research participant, please contact the Franklin University IRB Office at 614-947-6037 or irb@franklin.edu.

To Access the Survey: Please click the button below to proceed and participate in this study. If you do not wish to participate, please close out your browser window.

General Information

1. What medical program did you graduate from, MD or DO?
2. What year did you complete your medical program?
3. How many courses in your medical program involved EHR?

4. Were these courses involving EHR required?
5. Did you have any previous EHR experience in medical school (0-10, 11-20, 21-30, 31+ hours)?

Technology Acceptance Model

Perceived Usefulness (PU)

	Extremely Likely	Quite	Slightly	Neither	Slightly	Quite	Extremely Unlikely
Using an EHR in my job would enable me to accomplish tasks more quickly.							
Using and EHR in my job would increase my productivity.							
Using and EHR would improve my job performance.							
Using an EHR would enhance my effectiveness on the job.							

Using an EHR would make it easier to do my job.							
I would find an EHR useful in my job.							

Perceived Ease-of-Use (PEU)

	Extremely Likely	Quite	Slightly	Neither	Slightly	Quite	Extremely Unlikely
Learning to operate an EHR would be easy for me.							
I would find it easy to get an EHR to do what I want it to do.							
My interaction with an EHR would be clear and understandable.							

I would find an EHR to be clear and understandable.							
It would be easy for me to become skillful at using an EHR.							
I would find an EHR easy to use.							