EFFECTS OF EMR ON COMMUNITY HEALTH CENTER COMMUNICATION

by

John M. Boyke

Liberty University

A Dissertation Presented in Partial Fulfillment

of the Requirements for the Degree

Doctor of Philosophy in Strategic Media

School of Communication and the Arts

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ABSTRACT

Electronic medical record (EMR) systems impact healthcare communication in a significant number of ways. The physical presence of the EMR in the examination room can negatively impacts patient-provider communication. This research examined the impact of EMR on patient-provider communication within the microcosm of the community health center. The data for this research was collected via a quantitative survey using a random sample of 513 (10%) of the 5,101 patients of the Northwest Community Health Center (August 2021 to August 2022). These participants were at least 18 years of age and had seen their medical provider in the previous 12 months. Many themes arose from the research participants who were uncomfortable with the EMR or the use of technology in the exam room. Understanding the benefits or even the general functionality of the EMR allows the patient to feel more comfortable with its use and to become more tolerant of the presence and use of technology during the physician encounter. Furthermore, as the possession and use of current technologies diminishes amongst the study's participants, so does their preference for their provider to use an EMR. To comprehend the impact EMR knowledge has on the patients' perception of its utilization, a crosstabulation between staff and non-staff patients underlined the fundamental difference. When asked what type of chart they would prefer their medical provider to use, a quarter of non-staff patients preferred electronic medical records, whereas two-thirds of the staff, who are also patients of the community health center, preferred the same. These findings indicate a need to educate patients about the benefits of the EMR and the advantage of accessing the EMR in the exam room. Furthermore, enhancing the providers' communication skills will help them comprehend the prevalent communication barriers created by accessing the EMR in the exam room. The quality of the interaction between the patient and provider is critical to the patient's health outcomes.

Improved communication leads to better emotional and physiological health, compliance with treatment recommendations, pain management, and symptom resolution.

Keywords: electronic medical records, community health center, patient-provider communication, distributed cognition theory, actor-network theory, diffusion of innovations, cybernetics

Dedication

To my dearest wife Pamela, without whom none of this could have ever become reality.

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I would like to express my deepest gratitude to my dissertation chair, Dr. Robert Mott, and to my dissertation committee members, Dr. Erin Black, Dr. Crystal Sears, and Dr. Wesley Hartley, forever known from this day forward as the "The Dream Team," for their continued encouragement and expertise. I would also like to give my heartfelt appreciation to Liberty University and its extraordinary professors, too many to list here, that made and continue to make an immense difference in my life. "Now the Lord is the Spirit and where the Spirit of the Lord is, there is Liberty" (2 Corinthians 3:17).

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Traumatic Brain Injury (TBI)

CHAPTER ONE: INTRODUCTION

Background

The electronic medical record (EMR) system, and its technological backbone, affect healthcare communication in a significant number of ways, some positive, and some negative. Although patient-physician communication is considered the most relevant in healthcare, patient, provider, healthcare facility, emergency room physician, primary care physician, inpatient, outpatient, and pharmacy communication can all be affected by the EMR. Without effective communication throughout the whole healthcare system, correct patient diagnosis and treatment come into question. A break in communication anywhere throughout the care-provider chain can be, and most often is, detrimental to the patient's health, resulting in poor patient outcomes.

The physical presence of the EMR or other technological devices in the examination room can negatively impact patient-provider communication. Street et al. (2017) investigated how physicians interact with computer systems during patient visits, including entering data into and retrieving data from personal health records in the EMR, and its effect on physician-patient communication during the visit. Alkureishi et al. (2016) also examined the impact of technology and EMRs on patient-provider communication and analyzed the negative connotation of accessing the EMR during provider consultations. Research has discovered that even though the EMR is becoming a requirement for most health centers across the United States, the initial reaction of many providers and care teams towards the implementation of an EMR system can be adverse, at best. Barrett (2018) examined the resistance to the EMR through the healthcare profession, examining organizational experience and communication quality. Furthermore, once the EMR is implemented, the ability of the patient to understand the medical record created for their use can be challenging. Root et al. (2016) examined the characteristics and health behaviors of patients who reported confusion while reading the physician notes in the online medical

record. These patients were found to be less likely to report benefits in health behaviors, further diminishing the vital patient-provider commination.

The effect of the EMR on patient-provider communication has evolved from the early implementation of EMR systems. To determine feasibility, Corbie-Smith et al. (2019) scrutinized the disparity of healthcare centers implementing scalable EMR solutions, meeting the requirements of the patient and the medical care facility. Along with the feasibility of an EMR system, understanding the catalysts and obstacles to implementing an EMR is significant. The Ngugi et al. (2018) research successfully analyzed and categorized facilitators and barriers to implementing EMRs in resource-constrained settings gaining insight required for a successful EMR implementation. However, providers and care teams must also be satiated with the EMR implementation to mitigate possible EMR implementation issues. Research measuring nurses' satisfaction with continuation of care, levels of comfort using information technology, and overall satisfaction with the EMR tool were conducted by Chapman (2016). Nevertheless, without the possibility of patient access and availability, medical records lose value. Additionally, Leroy and Dupuis (2014) analyzed the impact of patients accessing their electronic medical records by utilizing the Internet and patient portals. The successful implementation and utilization of EMR systems create an immense amount of health-related data that can be difficult to navigate, much less analyze. Therefore, Costea (2020) examined how artificial intelligence can analyze health data, mirroring human thought operations and diagnosis of patient illnesses.

EMR systems are highly complex, distributed information systems that, with the proper design, implementation, and utilization, have the potential to improve the quality of healthcare significantly. The lack of essential design principles and considerations can make the EMR very difficult to understand, master, and use properly, causing a disparity in care and further reducing patient-provider communication. Care teams must process information derived from human

agents, artificial agents, and groups of agents. This interwoven processing of the available health information generates intelligent behavior required for the proper diagnosis and care (Zhang & Patel, 2006). Distributed cognition (DCog) considers human and artificial agents as indispensable components of a single distributed system, in this case, the care teams, the EMR, and its associated technologies (Zhang & Patel, 2006). Distributed clinical cognition functions during interactions between care teams, providers, and patients (Lippa & Shalin, 2016). EMR technologies transform how care teams work and think, and should not merely augment, enhance, or accelerate the provider's performance (Horsky et al., 2003).

Problem Statement

EMR systems are implemented to improve healthcare communication between the patient and physician, and physician and care teams; however, healthcare professionals report that the EMR often creates communication barriers. However, more research needs to be conducted to understand the effects of the EMR on the whole of the community health center communication structure, or even the whole healthcare industry. With EMR implementation being a relatively new phenomenon in community health centers, but one that will continue to be a requirement to meet government patient-centered healthcare mandates in the future, understanding the effects of the EMR on community health center communication is essential. This research specifically examined the effects of the EMR on patient-provider communication within the community health center.

This study, examining the effects of the EMR on community health center communication, is essential to understanding communication within the healthcare industry. EMR infrastructure and systems continue to be implemented at a record pace with little or no concern about how they will affect overall communication. Bringing the EMR and its associated technologies into the exam room creates a new environment for the patient, the physicians, and

the healthcare teams. Although the EMR is designed to document and maintain a multitude of records, spanning many years of healthcare records for the patient, the ability of the provider to instantly access the relevant data without disrupting the already delicate communication with the patient is essential.

Purpose Statement

The purpose of this research was to explore the effects of the EMR on community health center communication by examining patient-provider communication. The study's participants included patients of the Northwest Community Health Center (N=5,101) (August 2021 to August 2022) who were 18 years or older and had seen their primary physician within the last 12 months. A random sample was used to identify at least 510 (10%) patient participants. Independent variables can be considered the cause, and therefore their value is independent of other variables of the study (Thomas, 2020). The dependent variable can be considered the effect, with its value being variant upon the independent variable (Thomas, 2020). In this study, the independent variable is the EMR and the use of the EMR in the community health center. The dependent variable will be healthcare communication, consisting of patient-provider, patient-care team, and inter-professional communication.

Significance of the Study

This significance of this study was to better understand the impact the EMR has on patient-provider communication within the community health center. Communication between the patient and the physician is crucial to shaping the professional relationship while generating better patient outcomes. Physicians use diagnostic tests and physical exams to assess the health of their patients, and these records are documented electronically within the EMR. The utilization of the EMR, and the ability of the provider to interact with the patient while doing so, is necessary to properly diagnose and adequately communicate the medical options to the patient.

The quality of this interaction between patient and provider is critical to the patient's health outcomes, while improved communication leads to better emotional and physiological health, compliance with treatment recommendations, pain management, and symptom resolution.

Community health centers are most often small but complex healthcare facilities incorporating many of the stand-alone healthcare systems available throughout the whole of healthcare. The community healthcare centers are most often comprised of primary care physicians, healthcare teams, behavioral health providers, dental care professionals, pharmacists, enrollment and outreach professionals, and healthcare administration. Although current literature examines the effects of the EMR on healthcare communication, it does so only for the individualized segments of the healthcare system. The current literature does not adequately examine the intricacies of the delicate communication channels within the community health center or the multiple types of communication within the community health center that is affected by the implementation of the EMR or the use of the EMR in examination rooms. This study examined the effects of the EMR on patient-provider communication by evaluating the healthcare microcosm known as the community health center.

Research Questions

Multiple research questions were created for the research topic, effects of electronic medical records (EMR) on community health center communication. The study was designed to answer the following:

RQ1. How does the utilization of the EMR affect patient-provider communication within the community health center?

RQ2. What communication barriers are created when bringing technology, and the EMR, into the physician encounter?

Definition of Terms

Artificial Intelligence (AI)

Artificial Intelligence is software or algorithms used by computers or machines to mimic aspects of human intelligence (NewScientist, 2023).

Clinical Adoption (CA)

Clinical Adoption cycles around meeting the needs of clinicians and physicians when implementing new technology, such as an EMR, maximizing the efficiency and value gained (HCI Group, 2015).

Community Health Center (CHC)

The first community health center in the United States opened in 1965. The current expansion of the federally supported community health center system to over 1,400 organizations has created an affordable health care option for more than 29 million people (NACHC, 2020). Community health centers increase access to crucial primary care by reducing barriers such as cost, lack of insurance, distance, and language for their patients, providing substantial benefits to the country and the national health care system (NACHC, 2020).

Distributed Cognition Theory (DCog)

Distributed Cognition Theory includes cognition being performed by the collective, an organized group, and that which an individual could not physically carry out. Furthermore, Hutchins' conception goes beyond the collective, the organized group, and includes instruments and artifacts as part of the cognitive system (Giere, 2007).

Electronic Health Record (EHR)

An Electronic Health Record is a real-time, patient-centered digital version of a patient's paper chart, allowing patient medical information to be available instantly and securely to authorized users (Health IT, 2019).

Electronic Medical Record (EMR)

Electronic Medical Records are digital versions of paper charts in clinician offices, clinics, and hospitals, containing notes and information collected by and for the clinicians in that office, clinic, or hospital, and are mostly used by providers for diagnosis and treatment (HealthIT.gov, 2020). EMRs are more valuable than paper records, as they enable providers and the healthcare facility to easily track patient data over time, identify patients for preventive visits and screenings, monitor patients, improve healthcare quality, and create patient-centered healthcare (HealthIT.gov, 2020).

Electronic Prehospital Medical Record (ePMR)

Electronic Prehospital Medical Records are a mobile version of medical EMRs that are modified for ambulance technician use and transfer of care (Jensen et al., 2021).

Family Educational Rights and Privacy Act (FERPA)

The Family Educational Rights and Privacy Act, a federal law, protects the privacy of student education records (U.S. Department of Education, 2021). FERPA applies to all schools that receive funds under an applicable program of the U.S. Department of Education (U.S. Department of Education, 2021).

Health Insurance Portability and Accountability Act of 1996 (HIPAA)

The Health Insurance Portability and Accountability Act of 1996 is a federal law requiring national standards to protect sensitive patient health information from being disclosed without the patient's consent or knowledge (CDC, 2021a). The HIPAA Privacy Rule was issued by the US Department of Health and Human Services (HHS) to implement the requirements of HIPAA (CDC, 2021a)

Health Literacy (HL)

Health Literacy is the patient's ability to obtain, read, understand, and use healthcare information to make appropriate health decisions and follow treatment instructions (NIDA, 2021).

Health Risk Appraisal (HRA)

A Health Risk Appraisal (HRA), also known as a health risk assessment, is a questionnaire that evaluates an individual's lifestyle factors and health risks (Wellsource, 2021).

Internet of Things (IoT)

The Internet of Things is the network of physical objects embedded with sensors, software, and other technologies, to connect and exchange data with other devices and systems via the Internet (Oracle, 2021).

Natural Language Processing (NLP)

Natural Language Processing refers to the branch of computer science known as artificial intelligence (AI) that is concerned with giving computers the ability to understand text and spoken words (IBM, 2020).

Near-Field Communication (NFC)

Near-Field Communication technology lets smartphones and other enabled devices communicate wirelessly with devices containing an NFC tag (NFC, 2017).

Patient-Centered Medical Home (PCMH)

"The patient-centered medical home is a model of care in which patients are engaged in a direct relationship with a chosen provider who coordinates a cooperative team of healthcare professionals, takes collective responsibility for the comprehensive, integrated care provided to the patient, and advocates and arranges appropriate care with other qualified providers and community resources as needed" (PCC, 2015).

Personal Health Information (PHI)

Personal Health Information is an individual's private health information that is protected under the HIPAA Privacy Rule, which provides federal protections for personal health information held by covered entities and gives patients an array of rights with respect to that information (HHS.gov, 2013). PHI should only be provided by these entities in a need-to-know manner while permitting the disclosure of PHI required for patient care and other essential purposes.

Picture Archiving and Communication System (PACS)

A Picture Archiving and Communication System replaces conventional radiological film's role to make them available digitally (Strickland, 2000).

Primary Care Physician (PCP)

A Primary Care Physician is a medical provider who is trained to prevent, diagnose, and treat a broad array of illnesses and injuries in the general population (Healthline, 2021).

Radio Frequency Identification (RFID)

Radio Frequency Identification technology, which uses radio waves to identify people or objects, is a device that reads the information contained in a wireless device or tag from a distance without making any physical contact or requiring a line of sight (DHS, 2009).

Secure Messaging (SM)

Secure Messaging is a server-based communication approach to protect sensitive data, such as health records, that are transferred to others outside a secure network (Schillinger et al., 2017).

Traumatic Brain Injury (TBI)

Traumatic brain injury, a significant cause of death and disability in the United States, is an injury that affects how the brain operates (CDC, 2021b).

Summary

EMR systems are implemented to improve healthcare communication between the patient and physician, and physician and care teams; however, healthcare professionals report that the EMR often creates communication barriers. This research explored the effects of EMRs on community health center communication by examining patient-provider communication. Understanding the effects of the EMR on communication within the community health center creates a deeper comprehension of the impact that the EMR has on healthcare communication as a whole. Community health centers provide essential services, including primary care, vaccination, testing, dental care, behavioral health, family planning, and nutrition education to their patients in the immediate and surrounding areas. The community health center is also a vital liaison between the patient and specialty care providers, often several counties or even states away. Therefore, this research on the effects of the EMR on community health center communication, in essence, was research on the impact of the EMR on communication throughout the health sector.

CHAPTER TWO: REVIEW OF LITERATURE

Communication Tradition: Cybernetics

Within the myriad of communication theories, it is possible to lose one's insight, the logical path, and an understanding of the research at hand. To encourage dialogue among scholars, Robert Craig divided the world of communication theory into seven traditions, the semiotic, the phenomenological, the cybernetic, the socio-psychological, the socio-cultural, the critical, and the rhetorical (Littlejohn et al., 2017; Maguire, 2006). Communication is theorized as intersubjective mediation by signs and symbols in the semiotic tradition; as dialogue in the phenomenological tradition; as information processing, with the goal of getting the most information across with the least amount of interference in the cybernetics tradition; as expression, interaction, and influence in the socio-psychological tradition; as the production or reproduction of social order in the socio-cultural tradition; as a discursive reflection in the critical tradition, and by the practical art of discourse in the rhetorical tradition (Littlejohn et al., 2017; Maguire, 2006). These communication traditions can substantially overlap or even oppose other communication traditions, offering the scholar different perspectives on human communication (Littlejohn et al, 2017). Understanding and utilizing the cybernetic tradition, encompassing the actor-network theory and the distributed cognition theory are vital to researching the effects of electronic medical records on community health center communication.

Cybernetics Tradition

Cybernetics has been and continues to be defined in many different ways. These definitions include a general theory of regulation; control and communication in animals, machines, and social systems; the science or art of effective organization; and the art of constructing defensible metaphors (Umpleby, 2008). Cybernetics, originating from the Greek roots meaning to pilot or steer (Dubberly & Pangaro, 2019), is an interdisciplinary term and has

been the focal point of many conferences but has not prospered as a scholarly field of study. As defined by Littlejohn et al. (2017), “cybernetics is the tradition of complex systems in which interacting elements influence one another” (p. 40). Associated theories within the cybernetic tradition elucidate how physical, biological, social, and behavioral processes function (Littlejohn et al., 2017).

The cybernetics field of scientific activity in the United States began between 1946 and 1953 with a series of conferences in New York City sponsored by the Josiah Macy, Jr. Foundation (Umpleby, 2008). Cybernetics, originating from these initial conferences, has influenced many academic fields. The cybernetics of Allen Touring and John von Neumann became computer science, Artificial Intelligence (AI), and robotics; Norbert Wiener’s cybernetics became part of electrical engineering; Warren McCulloch’s cybernetics became second-order cybernetics; and Gregory Bateson and Margaret Mead worked on the cybernetics of social systems which is being continued by the American Society of Cybernetics and the Socio-Cybernetics Group within the International Sociological Association (Umpleby, 2008). Cybernetics work in the 1940s consisted of two landmark papers, the first was *A Logical Calculus of the Ideas of Immanent in Nervous Activity* written by McCulloch and Pitts. At the same time, Rosenblueth, Weiner, and Bigelow published *Behavior, Purpose, and Theology* (Umpleby, 2008). By the decade’s end, three books published by von Neumann and Morgen, Weiner, and Shannon and Weaver defined a new science of information and regulation (Umpleby, 2008).

The hard view of information, derived from Weiner and Shannon in the 1940s, used mathematical and statistical mechanics, with the content of the message treated in probability (Umpleby, 2008). The soft view of information began simultaneously alongside the hard view of information from the Macy conferences. The soft view links information with the concepts of

cybernetics, the observer, and the mental process of those who create, share, or make sense of the information, and is associated with techno-centrism (Umpleby, 2008). The soft view of information is associated with the works of Gregory Bateson, Donald Mackay, and Ross Ashby. McColloch's cybernetics was quite different from Wiener and Turing's and led to the second-order cybernetics' development in the 1970s (Umpleby & Dent, 1999). The second-order cybernetics created a philosophy of constructivism, which holds that observers have more immediate access to thoughts than the world of experience, contrasted with realism, which holds that the world is primary and theories are imperfect descriptions of a real world (Umpleby & Dent, 1999). Cyberneticists who followed in the footsteps of McColloch, the McColloch tradition, were interested in cognition, adaption, and understanding, which distinguishes them from the other fields.

Understanding the System

To understand cybernetics, it is necessary to understand the core principle, that of the system. Systems are sets of interacting components that form something more significant than the sum of its parts and are constrained by their dependence upon other parts, where communication is one of the parts of or variables in the system (Craig, 1999; Littlejohn et al., 2017). System theorists are interested in more than just the function of the system, but how the system manages to sustain and control itself over time. A system takes inputs from the environment, processes the data, and creates the required outputs, which are then fed back into the environment (Littlejohn et al., 2017). A heater is an excellent example of a system. The heater provides heat for the surrounding area and is controlled by a sensor/switch or thermostat. The switch turns off the heater when the ambient temperature exceeds the goal temperature. Then, the switch turns the heater back on when the ambient temperature falls below the goal temperature, in effect, controlling the room's temperature. The stability of the heater system does

not exist solely with the heater or switch but lies between the two devices. The whole system creates stability, achieving and maintaining the desired ambient temperature (Glanville, 2002). Therefore, systems monitor, regulate, and control their outputs to remain stable, achieving their intended goals (Littlejohn et al., 2017).

Theoretical Frameworks

Theory, as seen in the eyes of the communication scholar or researcher, is an organized set of concepts, explanations, and principles that depict some aspect of the human experience (Littlejohn & Foss, 2009). Furthermore, Steven Littlejohn (2009) technically defines theory as "a unified, or coherent, body of propositions that provide a philosophically consistent picture of a subject" (p. 7). Theory can be understood as being comprised of four dimensions. These dimensions most often include philosophical assumptions, concepts, explanations, and principles (Littlejohn et al., 2017). To further understand communication, it is necessary to understand the building blocks of theories or constructs, explaining the ideas, people, organizations, events, and objects to examine the how and why of phenomena (Laerd, 2012). Furthermore, constructs provide a common language and shared meaning, allowing the researchers to communicate their ideas clearly and precisely (Laerd, 2012).

Actor-Network Theory

Actor-Network Theory (ANT), which falls within the cybernetics tradition, is becoming more commonplace in information technology research (Alexander & Silvis, 2014). ANT was developed initially by science and technology scholars, including Michel Callon, Bruno Latour, and John Law (Law, 2008; Littlejohn et al., 2016). ANT defines everyone and everything as entities or actors and focuses on the relationships between those entities. ANT denies any difference between human and non-human entities, making the communication theory applicable to information technology or electronic systems research. In essence, ANT deals with the

sociotechnical divide by denying that a divide exists (Doolin & Lowe, 2012; Hanseth et al., 2004; Tatnall & Gilding, 1999). Organizational communication scholars, such as James Taylor, Elizabeth Van Every, and François Cooren, identify an organization as the product of communication activities, not necessarily the starting point, therefore studying the organizing properties of communication that occur among various actors in interaction, including managers, procedures, computers, machines, architectural elements, ideologies, policies, and attitudes (Littlejohn et al., 2017).

ANT was originally developed by Latour, Callon, and Law between 1978 and 1982 for sociology, anthropology, and science and technology studies, but it continues to be adapted into other fields of study (Law, 2008). Latour (1993) contends that things are constructed by many different actors, not just human minds; there is no privileged version of the truth to which others can be reduced; and there are only actors, and all actors are equally real (Alexander & Silvis, 2014). Latour does not perceive a social world but rather a distinct physical world, a world made up of actors in alliances with other actors. Furthermore, Latour does not differentiate between physical, social, subjective, objective, fictitious, or real actors; there are just actors working in alliances. Within these alliances, an actor is only as strong as its alliance with any of the other actors.

Strengths and Weaknesses of Actor-Network Theory

As the theory is conceived, the strength of ANT is the inclusion of heterogeneous actors within the analysis, shedding light on the relationships between these actors (Alexander & Silvis, 2014). Further analysis of the involved actors often exposes relationships between actors that may not have been originally perceived and may have been thought of as contrarian to the alliances or the actors involved. One of ANT's perceived weaknesses is the vague boundaries of the theory (Alexander & Silvis, 2014). When analyzing the EMR in a study, it is necessary to

view the network as a culmination of other networks within the system. Therefore, when using ANT, the number of actors within the study was, in effect, infinite. The researcher had to limit the number of actors and stop collecting data at a predetermined time.

Theorists also see ANT as having other weaknesses. First, with its applicability to research, ANT can be seen as a framework and not necessarily as a theory. ANT can be seen as being too descriptive and can be proposed as being used in combination with other theories (Cresswell et al., 2010). Finally, causing concern with some theorists is how ANT gives equal positioning to all actors, whether human or non-human. Conceptualizing human and non-human actors as equals creates a theological debate many theorists wish to distance themselves from or refrain from entirely.

Application of ANT to Community Health Center Communication

Within the community health center, many different actors are present. Healthcare requires providers, patients, healthcare teams, labs, the EMR, and other actors, whether human or non-human, to be successful. Therefore, healthcare is constructed of many different actors, not just human minds, and all actors involved are equally real. ANT provides the potential to examine community health center communication by examining the actors associated with healthcare. Furthermore, ANT realizes that all the actors within the exam room are equally responsible for the ongoing care. Neither the provider, the patient, the EMR, nor the other associated medical tests and apparatuses are solely responsible for the ongoing care. All the actors within need to function together in an alliance to achieve the best possible health outcome.

Distributed Cognition Theory

Distributed Cognition (DCog) is another essential communication theory that falls within the cybernetics tradition. Ed Hutchins, considered to be the modern philosopher behind DCog, theorized that cognition was best understood in a distributed model. Therefore, DCog

encompasses cognition being performed by the collective, an organized group, and that which an individual could not physically carry out. Furthermore, Hutchins' conception goes beyond the collective, the organized group, and includes instruments and artifacts as part of the cognitive system (Giere, 2007). For a better understanding, take, for example, an airplane cockpit or a vessel's bridge at sea. In each case, a team of individuals works in conjunction with each other to operate the craft. However, to do so, the collective cognition of the crew must be integrated with the craft's apparatuses, technology, and mechanization for a successful flight, or an effectual voyage (Hutchins, 1995). The individuals and the instruments, then, become the distributed cognition. Dillenbourg (1996) argues that distributed cognition does not just mean multi-agent; rather, it is about agents which build a mutual understanding, even though machines are not capable of understanding anything.

The Dissent from the Distributed Cognition Theory

There are those who seem to accept the theory for what it is intended, those who wish to break the theory down into smaller parts to criticize the theory, and those who wish to label DCog as a hybrid system. Bruno Latour (1993) theorized and popularized the hybrid system, meaning there is a combination of humans and non-humans that he termed actants. Others, including Giere (2007), describe distributed cognitive systems as having physical, computational, and human systems. Moreover, others theorize that objects such as instruments and charts are just aids to human cognition (Giere, 2007) and, therefore, do not differ from traditional cognitive science explanation of human activity (Rogers, 1997).

Pea (1993) argued that social, historical, and other external processes should be seen as integral components of competent action. Therefore, traditional notions of cognition and intelligence, which relegate these processes to an individual, require reconsideration (Barab & Plucker, 2002). Another point of view is that there are no computational models available and

what does exist is not acceptable (Dillenbourg, 1996). The problem Rogers (1997) sees with DCog is that there needs to be a methodology that one can readily use. A considerable amount of time can be consumed understanding the concepts, creating a huge learning curve to interpret and represent data captured in the work environment (Rogers, 1997). Susi and Ziemke (2001) justify that the primary concern with the DCog approach is how information is represented and how representations are transformed and propagated in the tasks being performed.

Similar to ANT, the most intriguing criticism regarding DCog is that theorists maintain that the theory establishes individuals and artifacts as equals. Nardi's (1996) criticism stems from the notion of cognitive systems consisting of people and artifacts and the propagation of representations within such systems. Nardi explains that activity theory differs fundamentally from cognitive science, rejecting the idea that computers and people are equivalent, as people and artifacts are unambiguously asymmetrical. Therefore, people know when they are interacting with others or whether they are interacting with a computer. However, according to Hutchins' writings, "the idea of equaling artifacts and humans is false; as an anthropologist, Hutchins has a deep respect for humans and their intelligence and does not consider artifacts and people as equal" (Susi & Ziemke, 2001, p. 26).

Application of Distributed Cognition to Community Health Center Communication

A consideration of the utilization of technology stemming from an individual's cognition, was the initial understanding of DCog. "Distributed Cognition is a hybrid approach to studying all aspects of cognition, from a cognitive, social and organizational perspective" (Rogers, 1997, p. 1). As DCog pertains to healthcare, the theory is much more complex than first determined. Successful patient encounters require coordination of efforts from the whole of the healthcare team. Not only is the coordination and communication between the provider and the healthcare team essential for cognition, but it is the whole of the communication, cooperation, and

coordination from all support roles throughout the community health center. This cognition, in conjunction with technology and medical informatics, provides the required outcome. Although the EMR is essential in the process, it is just one technology utilized by the cooperation of the healthcare team. The blood pressure cuffs, thermometers, pulse oximeters, lab equipment, imaging equipment, and visualization tools become essential pieces of technology, feeding into the EMR. Furthermore, the essential technology utilized within the patient-provider encounter is that of language. Without language, there is no orality, no communication, no diagnoses of patients, and no healthcare.

Diffusion of Innovations Theory

Diffusion of Innovations is a communication theory essential to understanding the adaptation and acceptance of the EMR in community health centers and other healthcare facilities. The Diffusion of Innovations Theory probes to explain the how, why, and at what rate new ideas and technologies spread throughout different cultures and across geographies. Diffusion was originally studied by Gabriel Tarde, a French sociologist, Georg Simmel, a German diffusionist, and Fredrich Ratzel and Leo Frobenius, German and Austrian anthropologists. Diffusion, as described by Everett Rogers (2003), is the "process in which an innovation is communicated through channels over time among members of a social system" (p. 11). Rogers synthesized differing diffusion studies and produced the Diffusion of Innovations Theory to explain the adoption of innovations among organizations and individuals (Rogers, 2003).

Elements of Diffusion Research

Rogers (2003), in the fifth edition of his book, *Diffusions of Innovations*, defined the elements of diffusion research. These diffusion elements include innovation, communication channels, time, and social system. As defined by Rogers, innovation is "an idea, practice, or

object that is perceived as new by an individual or other unit of adoption" (p. 12); a communication channel is the means by which messages get from one individual to another, reaching a mutual understanding; time is "the innovation-decision process by which an individual passes from first knowledge of an innovation through its adoption or rejection" (p. 20); and social system is a "set of interrelated units that engaged in joint problem solving to accomplish a common goal" (p. 23). Essentially, these elements are identifiable in all diffusion research.

The Innovation-Decision Process

As Rogers (2003) described, the innovation-decision process is a process in which individuals navigate from gaining initial knowledge of an innovation to confirmation of their decision. The innovation-decision process includes five distinct steps: knowledge, persuasion, decision, implementation, and confirmation. The stages of the innovation-decision process sequentially follow each other, and the innovation-decision process starts with the knowledge stage.

The Knowledge Stage

In this phase of the innovation-decision process, an individual learns about the existence of innovation or technology and seeks information regarding the same. What, how, and why are the critical questions in this stage for the individual? The individual attempts to understand "what the innovation is and how and why it works" (Rogers, 2003, p. 21). These questions form the three types of knowledge, awareness-knowledge, how-to-knowledge, and principles-knowledge. Awareness-knowledge is information that an innovation exists, and this knowledge may motivate the individual to seek how-to-knowledge and principles-knowledge (Rogers, 2003). How-to knowledge comprises the information necessary to properly use the innovation or technology

(Rogers, 2003). Finally, principles-knowledge comprises of information dealing with how the innovation or technology works (Rogers, 2003).

The Persuasion Stage

The persuasion stage occurs when the individual has a positive or negative attitude toward the innovation or technology. However, this positive or negative attitude towards an innovation or technology does not necessarily lead directly or indirectly to the innovation's adaption or rejection (Rogers, 2003). "The main outcome of the persuasion stage in the innovation-decision process is a favorable or unfavorable attitude toward the innovation" (Rogers, 2003, p. 176). Whereas the knowledge stage is more cognitive-centered, the persuasion stage is more affective-centered (Rogers, 2003).

The Decision Stage

At this critical stage of the innovation-decision process, the individual chooses to adopt or reject the innovation. Rogers (2003) defines adoption as the "full use of an innovation as the best course of action available" (Rogers. 2003, p. 177). Therefore, rejection is the decision of the individual not to adopt the innovation or technology. Individuals can also try out an innovation or technology in the decision stage. "Most individuals do not adopt an innovation without first trying it on a probationary basis" (Rogers, 2003, p. 177). Most individuals who try out an innovation or technology move on to adopt the innovation. However, the adoption occurs only if the innovation has a certain level of relative advantage for the individual. Rogers also describes two different types of rejection: active rejection, and passive rejection. Active rejection consists of when the individual considers the innovation, even with a trial period, but chooses not to adopt the innovation. Passive rejection consists of the individual never considering the adoption (non-adoption) of the innovation or technology (Rogers, 2003).

The Implementation Stage

The implementation stage of the innovation-decision process occurs when the innovation or technology is put into use by the individual. The implementation stage requires an overt behavior change in the individual, going from a strictly mental exercise to the implementation of the innovation (Rogers, 2003). Uncertainty of the outcomes can still be an issue for a typical individual at this stage. “Problems of implementation are usually more serious when the adopter is an organization rather than an individual” (Rogers, 2003, p. 179). Furthermore, the organization may resist the implementation of the innovation, causing instability within the company structure (Rogers, 2003). Reinvention is “the degree to which an innovation is changed or modified by a user in the process of its adoption and implementation” (Rogers, 2003, p. 180) and occurs at this stage of the innovation-decision process.

The Confirmation Stage

During the confirmation stage of the innovation-decision process, the innovation adoption decision has already been made, and the individual looks for support for their decision. Whereas an individual most often seeks supportive messages in confirmation of the decision, the adoption decision can be reversed if the individual is exposed to conflicting messages regarding the innovation or technology (Rogers, 2003). Therefore, attitudes toward the innovation become more crucial during the confirmation stage. Discontinuance can also occur at the confirmation stage of the innovation-decision process. The two types of discontinuance include replacement and disenchantment. In replacement discontinuance, the individual rejects an idea to adopt a better idea that supersedes it. Disenchantment discontinuance is a decision to reject an idea because of poor performance or dissatisfaction with the innovation (Rogers, 2003).

Rogers' Five Factors

Rogers (2003) identifies five factors influencing an individual's decision to either adopt or reject an innovation or technology. These five factors include relative advantage, compatibility, complexity or simplicity, trialability, and observability. Relative advantage is the degree to which an innovation is perceived as being better than the preceding idea; compatibility is the degree to which an innovation is perceived as being consistent with existing values, past experiences, and the needs of potential adopters; complexity is the degree to which an innovation is perceived as being relatively difficult to understand and use (Rogers, 2003). Trialability is the degree to which an innovation or technology may be tested on a limited basis, and observability is the degree to which the results of an innovation are visible to others (Rogers, 2003).

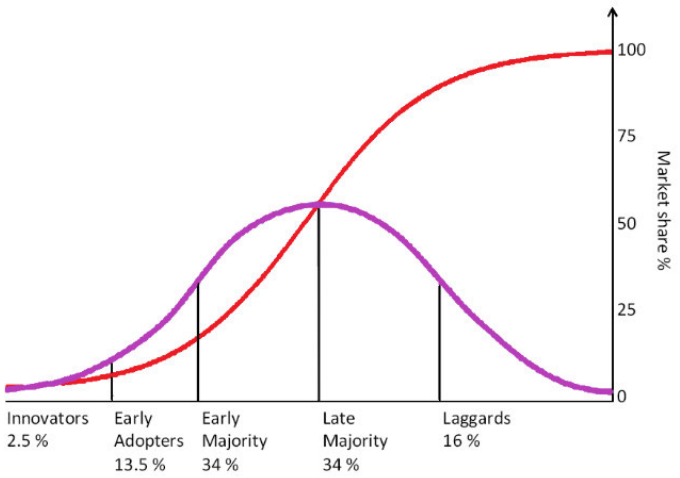
Adopter Categories

Rogers (2003) suggests five categories of adopters that are plotted on a naturally occurring bell curve when plotted over time on a frequency basis and where the S-shaped adopter distributions closely approach normality. A bell curve is a graph depicting the normal probability distribution where the standard deviation from the mean creates the curved bell shape (see Figure 1, purple line). The S-shaped adopter distribution rises slowly at first with only a few adopters, then accelerates to a maximum until half of the individuals in a system have adopted. It then increases at a gradually slower rate as fewer remaining individuals adopt the innovation (see Figure 1, red line) (Rogers, 2003). Rogers defines an adopter category as a classification of individuals within a social system on the basis of innovativeness in diffusion research. The adapter categories include innovators, early adopters, early majority, late majority, and laggards (Rogers, 2003). "The dominant attributes of each category are innovators-venturesome, early adopters-respect, early majority-deliberate, late majority-skeptical, and laggards-traditional" (Rogers, 2003, p. 298). Rogers assigns notional percentages for each of the adopter categories.

These notional percentages are broken down to the following: innovators 2.5%, early adopters 13.5%, early majority 34%, late majority 34%, and laggards 16% (Rogers, 2003).

Figure 1

Diffusion of Innovation Bell Curve with S-Shaped Adopter Distribution



Innovators

Innovators are most often associated with venturesomeness and are the first to adopt an innovation (Rogers, 2003). Innovators are willing to experience new ideas and are prepared to cope with unprofitable and unsuccessful innovations. Innovators are the gatekeepers bringing innovation from outside the system, and may not be respected by other members of the social system because of their venturesomeness (Rogers, 2003). Most often, innovators have complex technical knowledge.

Early Adopters

Early adopters are more limited with their boundaries, as are the innovators. Since early adopters are most likely to hold leadership roles, others in their social system come to them for their advice (Rogers, 2003). “The early adopter is considered by many to be the ‘individual to check with’ before adopting an idea” (Rogers, 2003, p. 283). The early adopter is respected by his or her peers and puts their stamp of approval on a new idea by adopting it (Rogers, 2003).

Early Majority

The early majority adopt new ideas just before the average member of a social system (Rogers, 2003). The early majority frequently interact with their peers but generally do not hold positions of opinion leadership in a social system (Rogers, 2003). “The early majority’s unique location between the very early and the relatively late to adopt make them an important link in the diffusion process” (Rogers, 2003, pp. 283-284). As a rule, the early majority may deliberate before adopting an idea, and their innovation-decision period is more extended than that of the innovators and the early adopters (Rogers, 2003).

Late Majority

The late majority adopts ideas after the average member of a social system (Rogers, 2003). “Adoption may be both an economic necessity for the late majority and the result of increasing peer pressure” (Rogers, 2003, p. 284). The late majority are cautious and skeptical and do not adopt ideas until most others in their social system have already done so (Rogers, 2003). Due to their scarce resources, the late majority do not adopt an idea until its uncertainty is removed.

Laggards

Finally, laggards are the last members of a social system to adopt ideas and possess little, if any, opinion leadership (Rogers, 2003). “Decisions are often made in terms of what has been done previously, and these individuals interact primarily with others who also have relatively traditional values” (Rogers, 2003, p. 284). The laggard’s innovation-decision process is relatively lengthy, has resistance to innovation, and remains highly cautious (Rogers, 2003).

The Role of Diffusion of Innovation in EMR Adoption

Technology and innovation have considerably improved healthcare diagnoses and outcomes over the past several decades. Of these innovations, the EMR has been instrumental in

improving the availability and accessibility to medical records, which is essential in the timely diagnosis of healthcare ailments and diseases. The role that Diffusion of Innovation Theory plays in the adoption process of all new medical technology, therefore, is significant, especially as it pertains to the EMR. Understanding the diffusion elements and the innovation-decision process itself can help determine where the EMR is in the adoption process. Furthermore, a comprehension of the roles of the adopter categories can help identify individuals or groups that can help speed along the adoption process within the medical social system.

The Tipping Point

Whereas Diffusion of Innovation Theory elucidates the how, why, and the rate at which new ideas and technologies spread throughout different cultures and geographies, the Tipping Point exposes how little things can make a big difference. *The Tipping Point: How Little Things Can Make a Big Difference*, Malcolm Gladwell (2000), scrutinizes why certain products and ideas become viral, creating an epidemic of sorts, while others do not. Therefore, a Tipping Point is a point in time when fundamental change takes place, causing an idea, trend, innovation, or social behavior to traverse a threshold, tip, and spread like wildfire (Gladwell, 2000). According to Gladwell, "The three rules of the Tipping Point, the Law of the Few, the Stickiness Factor, the Power of Context, offer a way of making sense of epidemics" (p. 29). These three rules not only provide an understanding of the process of how epidemics spread but provide direction for how to reach a Tipping Point, making an idea or innovation successful.

The Law of the Few

Gladwell (2000) recognizes that it requires only a few key people to spark an epidemic. Where economists discuss the 80/20 rule, expressing that 80 percent of all work is accomplished by 20 percent of people, Gladwell speaks of how an even smaller percentage of individuals is often responsible for sparking epidemics. Gladwell maintains that there are three types of people

responsible for the spread of an idea or innovation. These three types of people are termed Connectors, Mavens, and Salesmen. Connectors are individuals with vast social networks who specialize in making friends and connecting people. “It’s possible that Connectors learn about new information by an entirely random process, that because they know so many people, they get access to new things wherever they pop up” (Gladwell, 2000, p. 59). Not only are Connectors necessary for the number of people they know, but they are also crucial for the kinds of people they know (Gladwell, 2000).

Mavens are individuals who accumulate knowledge and are information specialists. However, like Connectors, Mavens also have advanced social skills. Therefore, they take their proficiency in obtaining and collecting knowledge and spread it to others efficiently and effectively. Although the Mavens do not have vast social networks like the Connectors, they are well-trusted within their social circle. Those in this circle most always follow the Maven’s recommendations. “The critical thing about Mavens, though, is that they aren’t passive collectors of information” (Gladwell, 2000, p. 62). Mavens spread this information to everyone they know and to anyone willing to listen. Therefore, they have the knowledge and social skills to start word-of-mouth epidemics.

The third type of individual is the Salesman, the charismatic, optimistic, and enthusiastic individual who is effective in the art of persuasion (Gladwell, 2000). Salesmen can express their emotions so convincingly that they become contagious. It is not uncommon for an individual communicating with a Salesman to empathize with the Salesman and change their behavior to match the Salesman’s verbal and non-verbal communication queues. Therefore, in a social epidemic, Mavens are the data banks and provide the message, Connectors spread the information, and the Salesmen persuade those individuals who may not yet be convinced of the message.

The Stickiness Factor

The second rule of the Tipping Point is the Stickiness Factor. In epidemics, not only does the messenger matter, but the content of that message is significant. “If you look closely at epidemic ideas or messages, as often as not the elements that make them sticky turn out to be as small and as seemingly trivial” (Gladwell, 2000, p. 95). Even with Connectors, Mavens, and Salesmen in place, social epidemics are unlikely to occur if the message or innovation is not sticky. The way the idea or innovation is packaged, presented, and repeated has a momentous influence on its stickiness. Furthermore, it is essential to not only know but to understand the target audience, and it is crucial to make the idea or innovation memorable to them. “There is a simple way to package information that, under the right circumstances, can make it irresistible” (Gladwell, 2000, p.132). It is up to the individual or organization to find that stickiness factor to create the social epidemic.

The Power of Context

After the Law of the Few and the Stickiness Factor, Gladwell (2000) outlines the final rule of the Tipping Point, the Power of Context. Context is often the most influential concept in an epidemic. Environmental conditions are essential as to whether an idea or innovation will spread or fail to be noticed. “Once you understand that context matters, however, that specific and relatively small elements in the environment can serve as Tipping Points, that defeatism is turned upside down” (Gladwell, 2000, p. 167). One small physical change to the environment is often all that is required to transcend the threshold and cause the idea or innovation to tip.

Group size, or the rule of 150, is another significant factor of context noted by Gladwell (2000). The rule of 150, attributed to British anthropologist Robin Dunbar, states that 150 people is the point at which members of a social group lose their ability to function effectively (Gladwell, 2000). The rule of 150 suggests that to create a social epidemic, established groups,

such as clubs, communities, and companies should not exceed 150 individuals. Gladwell indicates that if you want an idea or innovation to become viral, the epidemic must be ignited in small intimate groups of 150 people or less for the idea to have hopes of blazing into epidemic proportions outside of the original group's borders.

The Tipping Point and the EMR

The three rules of the Tipping Point, the Law of the Few, the Stickiness Factor, and the Power of Context provide direction for igniting a knowledge epidemic to advance the widespread understanding, adoption, and acceptance of the EMR in the immediate medical social system. Identifying the Connectors, EMR Mavens, and Salesmen in the community health center's patient and staff population would establish the few individuals necessary to ignite the EMR epidemic. Effectively packaging, presenting, and repeating the medical benefits and purpose of the EMR can create a stickiness factor that, under the right circumstances, can make the EMR compelling to the community health center patient population. When implemented correctly, the little things have the potential to make a big difference to the adoption and acceptance of the use of the EMR, while improving healthcare and better patient outcomes.

Related Literature

Effective communication within the community health center is vital. Without efficacious communication between the health professional and the patient, there is no healthcare, and most often, there is nothing but poor patient outcomes. Patients, providers, healthcare facilities, emergency room physicians, primary care physicians, inpatient, outpatient, and pharmacy communication are all impacted by the EMR. The following review of literature confirms that the EMR system has positive, neutral, and adverse effects on communication within the community health center. Whether the healthcare-related communication is either patient-provider or inter-professional by nature, the proper implementation and utilization of the EMR,

and the confidentiality, integrity, and availability of its patient medical records is vital to enhancing healthcare communication channels.

Patient-Centered Communication

The relationship between the patient, the provider, and the EMR system, dictates the proficiency of communication in healthcare. As this study examined patient-provider communication, related literature on patient-centered communication will be considered first. EMR impact on the patient-doctor relationship was the purpose of the Alkureishi et al. (2016) systematic literature review. Researchers utilized parallel searches in online research for reference reviews, meeting extract reviews, and expert reviews from August 2013 to March 2015. Only 53 of the 7,445 studies found met the inclusion criteria for the study (p. 548). Results reported from the study included EMR communication behaviors that were both potentially negative and positive, while patient satisfaction mainly reported no impact of communication with EMR use. However, the study's small sample size could cause reliability issues with the results.

The Alkureishi et al. (2016) study reviewed research on the effects of technology and EMRs on patient-doctor communication. Negative connotation from using computers and technology during provider consultations has been, and will continue to be, a significant research topic for researchers, hospital administrators, and healthcare professionals alike. The benefits of the EMR must be weighed against the disadvantages. However, with the regulation of the healthcare system, the EMR is no longer an option, the question now is which EMR best fits the needs of the healthcare facility in question. "Despite objective evidence that EMR use may negatively impact patient-doctor communication, studies examining patient perceptions found no change in patient satisfaction or patient-doctor communication." (Alkureishi et al., 2016, p. 548).

Shachak and Reis (2009) also found a neutral impact from accessing the EMR system in the exam room. Shachak and Reis examined the effect of the EMR on patient-doctor communication. Shachak and Reis conducted a literature review of 14 empirical articles published in the prior ten years that were a direct assessment of EMR impact on patient-doctor communication. The Shachak and Reis research established that EMR use often has a positive impact on information exchange but often causes negative influences on patient-centered care. Some physicians can overcome these adverse effects with computer skills and behavioral style. The use of EMR has both positive and negative impacts on patient-provider communication. The negative impacts can be overcome by physician computer and communication skills, medical education interventions, and better-designed EMR systems. “It is currently widely accepted and evidence-based that patient–doctor communication is perhaps the most significant component of the healthcare visit, with ramifications for patient satisfaction, compliance/adherence, conflict-resolution, and clinical outcomes” (Shachak & Reis, 2009, p. 642). The implementation and utilization of the EMR in the community health center must be leveraged in such a way as to improve patient-provider communication despite neutral or negative impacts being reported as the result of EMR implementation efforts.

Positive Impact of the EMR

Whereas the Alkureishi et al. (2016) and Shachak and Reis (2009) literature reviews found more of a neutral perspective towards patient-doctor communications, Anderson et al. (2017) established that incorporating the patient into their physician encounter added value and improved communication. The Anderson et al. study queried patients and healthcare providers via a survey, determining the effects of patients entering their visit agendas in the EMR system before an office visit. Patients were recruited from June 9 and July 22, 2015, from Harborview Medical Center in Seattle, Washington (p. 158). The medical center is a 67-clinician primary

care facility, serving 5,000 patients annually (p. 158). Patients under the age of 18 or who could not read or write in English were ineligible (p. 159). Of the 209 invited patients, 26 (12%) declined and 54 (26%) were not eligible (p. 159). Of the 129 remaining patients, 17 did not arrive early enough to participate, 112 typed agendas, and 11 left before the post-visit survey, leaving 101 patients to participate (p. 159). Patients (79%) and providers (74%) felt that the patient-created agendas improved communication, and both expressed interest in patient-written agendas in the future (p. 158).

Patient-provider communication in healthcare facilities is a requirement for patient-centered healthcare. One of the most significant obstacles during the health encounter is the limited time that the provider has available to spend with the patient. “Clinicians often cite inadequate visit time as a barrier to relationship development and communication with patients” (Anderson et al., 2017, p. 159). Most appointments in the community health centers are 15 minutes in length, with the longest often being scheduled for 30 minutes. Procedures, of course, have a longer time slot scheduled, but patient-provider communication is not necessarily the reason for this type of office visit. Patients often feel rushed and forget many of the questions they wanted to ask once they are in the office visit. The patient written agenda for the office visit helps alleviate the memory issue and enhance the communication with the provider within the encounter, improving healthcare. “Collaborative agenda setting is a communication skill that helps patients identify concerns early in the clinic visit” (Anderson et al., 2017, p. 158). Involving patients in their healthcare and preparing them adequately before their scheduled provider helps ensure that patient-provider communication is as effective as possible in the limited window available for the medical encounter.

Confusion Reading EMR Physician Notes

For the EMR to be effective, the patient must understand the communication presented by the provider, both oral and written. Patients have access to physician notes on a visit summary printed at the end of an encounter and available online via the patient portal. The community health center's patient panels often consist of an older population, a population that may not be as cognizant as younger patients. The Root et al. (2016) study examined the characteristics and health behaviors of patients who reported confusion after reading the physician notes in the electronic medical record online. The study analyzed data from 4,518 patients in Boston, Massachusetts, central Pennsylvania, and Seattle, Washington, who were granted online access to their primary care physician's notes, and who viewed at least one note during the one-year intervention (p. 778). Only three percent of patients reported confusion after reading their online medical visit notes (p. 778). The patients who were confused by reading the visit summaries were less likely to report benefits in health behaviors.

Patients must be able to read and comprehend their physician visit notes and health summaries, ensuring that their healthcare is meeting their medical needs. Most patients are not confused by the visit notes, which is extremely important as more and more physicians release the visit notes online. "Yet, because patients who were confused by reading their visit notes reported fewer beneficial health behaviors and may miss the many potential advantages of online medical records, it is critical to bridge the gap in patient-provider communication" (Root et al., 2016, p. 780). The physicians must remain vigilant, ensuring the information contained in the visit notes remains in plain English and is easily understood by the patient. However, the small percentage of patients confused by the visit notes are often the patients who need more extensive personal care. It is in the best interest of the physician, the healthcare facility, and the patient to keep open lines of communication with the patients who fall into these criteria.

Detrimental Impact of the EMR

The EMR can also be seen as detrimental to the healthcare center's patient communication. Providers interacting with the computer system containing the EMR during an office visit can cause issues with patient-provider communication. Street et al. (2017) investigated how physicians interact with computer systems during patient visits, including inputting data into and retrieving data from personal health records of the EMR and its effect on physician-patient communication during the visit. The design of the Street et al. study was a cross-sectional observation study of video recordings of primary and specialty care providers. Thirty-two physicians and 217 patients participated in the study (p. 423). The main measures of the study included predictor variables of physician interaction with the EMR, active patient participation, physician facilitation of patient involvement, and silence. The critical result of the Street et al. research included that patients were less active participants during the consultations while the provider's attention was on their computers, causing less direct communication with the patient. Patients may be more reluctant to participate during medical consultations when the physicians actively use computers. However, using simple communication tactics, such as participating in social conversation and asking for patient input, helps to engage the patient and communications during the encounter.

Although the benefits of EMR systems and technology in healthcare are many, patients often incur negative effects from providers using said systems and may be reluctant participants in medical encounters (Frankel et al., 2005; Street et al., 2017). Attention is often taken away from the patient and placed upon the system which generates the patient's electronic medical chart. "Patients may be more reluctant to actively participate in medical encounters when physicians are more physically engaged with the computer, keyboard activity, than when their behavior is less demonstrative, gazing at EHR" (Street et al., 2017, p. 423). Even when

communication between the provider and patient is effective, the addition of technology creates a virtual culture triad. A break in any of the three legs of this communication triad will yield ineffective communication, miscommunication, and misunderstanding.

Frankel et al. (2005) also identified the negative aspects of the EMR by evaluating the impact of exam-room computers on communication between clinicians and patients. Frankel et al. utilized a longitudinal, qualitative study using videotapes of regularly scheduled visits from three points in time, including nine clinicians and 54 patients, finding that the introduction of computers into the exam room affected the visual, verbal, and postural connection between clinicians and patients. Through the research, Frankel et al. identified four domains in which exam-room computing affected clinician-patient communication, including visit organization, verbal and nonverbal behavior, computer navigation and mastery, and spatial organization of the exam room. Frankel et al. concluded that effective use of computers in the outpatient exam room might depend upon clinicians' baseline skills that are carried forward and amplified, positively or negatively, in their effects on clinician–patient communication. Furthermore, computer use behaviors did not appear to change much over the first seven months. "Administrators and educators interested in improving exam-room computer use by clinicians need to understand better clinician skills and previous work habits associated with electronic medical records" (Frankel et al., 2005, p. 677). Understanding the aspects of communication, can help alleviate the main issues associated with bringing technology into the world of medicine and the exam room.

Inter-Professional Communication

Patient-provider communication is just one crucial aspect of healthcare communication. Inter-professional communication between the physician and his or her peers, is also crucial. The objective of the Anderson et al. (2018) study was to implement an early mobility collaboration program on the existing EMR to improve inter-professional communications while improving

the Intensive Care Unit (ICU) early mobility program to enhance patient outcomes. In phase 1, staff members viewed online education on the existing mobility protocol and the mobility levels grading scale. During phase 2, the EMR communication tool displayed recently recorded mobility levels to all care providers. A survey accessed staff knowledge of the mobility protocol and the mobility grading scale. Patient outcomes, ventilation time, and length of ICU stay were accessed by medical record review. "Statistically significant increases were found for staff satisfaction with mobility-related communication and communication frequency, but not for staff knowledge" (Anderson et al., 2018, p. 23). Inter-professional communication and collaboration most often lead to improved patient outcomes. Improved communication led to better mobility scores and improved patient care.

Patients requiring ventilation are transferred from community health centers to the local hospital to be transported to the regional health center via helicopter. The Anderson et al. (2018) study shows that the improved collaboration and communication from utilizing the EMR significantly improved patient care and outcome. "Combining routine educational reviews and electronic health record communication tools may improve patient and system outcomes for intensive care unit early mobility program patients" (Anderson et al., 2018, p. 23). There are multiple modules available in EMR systems; some used, and many disregarded. However, the training and use of these collaboration and communication modules tend to improve inter-professional communication and, thus, improve patient-provider communication.

Radiologist/Provider Communication

Communication between radiologists and clinicians has been an issue since the introduction of the Picture Archiving and Communication System (PACS), causing a detriment to patient care and health outcomes. PACS holds the imaging from the radiation department. Filice (2017) reviewed the communication barriers between radiologists and healthcare providers

when conveying critical results promptly. The American College of Radiology considers it a best practice to contact clinicians to convey critical results in a timely manner. However, PACS are not integrated into the EMR systems, and most often, there needs to be direct communication or collaboration between the two. The Filice study reviewed a healthcare institution that installed a new information technology system to track inpatient-team-provider relationships in real time. The application was embedded into the EMR and was used by the provider to track inpatients for whom they were responsible. The radiology department had access to the EMR but rarely accessed the system. A single-click plugin was developed in the PACS to directly integrate the patient coverage information from the EMR tool into the radiologist workflow. Thirty-six users participated during a trial of the system involving 338 exams (p. 596). Approximately half of the exams used the old system, while the other half used the new plugin and tool. The 12 critical results using the new system had an average critical result turn-around time of 6.9 minutes, while 16 critical results from the old workflow had an average critical result turn-around time of 11 minutes (p. 596). The new system had a shorter mean turn-around time, but the result could have been more scientifically significant.

Communication between providers and medical departments is essential in healthcare, especially for patients with critical level results. The secondary departments or specialists often do not have access to the EMR, especially in the community health care facilities. “Building a plugin to integrate clinician coverage information into radiology workflow is technically possible, fairly straightforward, and results in a dramatic improvement in radiologist satisfaction and subjective assessment of workflow” (Filice, 2017, p. 601). The ability to link different systems via an information technology interface can result in drastic time reductions during the communication process, providing quality care for the patient. Furthermore, the results and any communication can be captured in the patient’s medical record, ensuring accuracy and

timeliness. A two-way interface capability to third-party systems is essential when choosing the EMR system.

Pharmacy/Prescriber Communication

Communication between pharmacists and providers can also be turbulent, often creating improper medication prescribing, medicine errors, and incorrect dosing, which can cause extreme sickness or even death of the patient. The Singer and Fernandez (2015) study analyzed the effect of the EMR system use on communication between pharmacists and prescribers. The study utilized a retrospective chart analysis of primary care EMR data, comparing faxed pharmacy communications captured before and after the implementation of an EMR system (Singer & Fernandez, 2015). Communication requests were classified into multiple categories, including refill accepted, refill denied, clarification of incorrect dose, interaction, drug insurance/coverage application, new prescription request, supplies request, continued care information, duplicate fax substitution, opioid early release request, confirmation by phone, and others. The study's results showed a significant change in fax communication between pharmacists and primary care providers after the implementation of an EMR. "The most clinically significant change is the dramatic reduction in the number of incorrect dose and clarification requests, with a slight decrease in the number of interaction requests" (Singer & Fernandez, 2015, p. 3). Furthermore, the number of refills accepted, and new prescription requests also increased.

Many community health center facilities incorporate multiple areas of care, including healthcare, behavioral health, dentistry, nutrition, and pharmacy. It is imperative that all the areas of care located within the walls of the community health center are incorporated within the EMR, utilizing their own distinct EMR module, and have the capacity for enhanced facility-wide communication. The pharmacy is a vital part of the community health center. "The

implementation of an EMR in an academic family medicine clinic significantly changed the volume of communication between pharmacists and prescribers in significant ways" (Singer & Fernandez, 2015, p. 5). Before implementing an EMR, physicians, located within the same building as the pharmacy, would often fax multiple requests to the pharmacy. Even communication between the pharmacy and outside providers improves with the implementation of the EMR, increasing refill requests and new prescriptions.

Hospitals/Provider Communication

Healthcare facilities are incorporating technology and the EMR into their clinics and hospitals to improve communication and patient care. Bardach et al. (2017) and Munchhof et al. (2020) examined how technology influences inter-professional communication within the hospital setting. Bardach et al. conducted nine focus groups, comprising a range of healthcare professions located on two floors of a newly designed academic medical center, to determine the key findings (p. 301). The participant responses focused on the EMR and technology. Bardach et al. determined that technology and the proper use of the EMR were barriers to the flow of information and communication. Charting styles, information needs, access to notes, inefficiencies in the design, and implementation of technology were all issues discovered.

The Bardach et al. (2017) research into EMRs, and the healthcare professionals who utilize them, gives a better-structured understanding of the barriers of technology in healthcare. The participants required an understanding of the increasing information technology integration into healthcare while improving their ability to identify and evaluate the role of the EMR in patient care and inter-professional communication. "Participants emphasized two main barriers to effective and timely communication between specialties: different approaches to EMR use and limitations in technology" (Bardach et al., 2017, p. 302). Training and a phased implementation approach are both keys to the successful integration of an information technology EMR system.

Munchhof et al. (2020) examined how hospitalists and Primary Care Physicians (PCPs) with a shared EMR prefer to directly communicate at the time of hospital discharge by identifying preferred modes, information prioritization, challenges, facilitators, and proposed solutions. Munchhof et al. conducted a sequential, explanatory mixed methods study with surveys and semi-structured interviews of 38 academic hospitalists and 63 PCPs working in outpatient clinics in a single safety net hospital system with a shared EMR (p. 1789). "Hospitalists and PCPs reported that ensuring patient safety, flagging patients with social challenges, and expressing concerns about patients based on clinical judgment were key communication priorities" (Munchhof et al., 2020, p. 1789). Munchhof et al. established that PCPs preferred direct communication at discharge through an EMR while hospitalists preferred an EMR message and an email. Munchhof et al. also determined that both groups prioritized direct communication for high-risk medications, pending and follow-up studies, and high-risk patients.

Specialty Care/Provider Communication

Efficient and effective communication between providers and specialists also plays a significant role in the successful treatment of patients. With proper inter-professional referrals, the patient can establish required care with the new healthcare facility or provider. The Vimalananda et al. (2018) research explained the perspectives of specialty care, patients, PCPs, and endocrinologists, identifying potential opportunities for improvement. Vimalananda et al. used qualitative methods to compare specialty care perspectives in an integrated healthcare system, using diabetes specialty care as an exemplar. "Clinicians required excellent coordination with each other, but clinicians' work suffered from a lack of procedures and protocols to clarify roles and responsibilities related to the organization of specialty care, i.e., programming approaches in organizational theory" (Vimalananda et al., 2018, p. 7). Through their research,

Vimalananda et al. established that PCPs and endocrinologists relied on inter-clinician relationships to coordinate care, while clinicians rarely included patients or other staff in their conceptualization of specialty care coordination. Furthermore, Vimalananda et al. determined that greater EMR flexibility is needed, but EMRs alone are insufficient for time-sensitive or complex inter-clinician communication.

Multiple-Encounter Communication

Medical facilities, such as the community health center, create the ability for patients to see multiple providers for multiple services in a single location. Without a comprehensive EMR, providers would require multiple logins to see all the patient encounters at the medical facility. The Ganio et al. (2016) study created and adapted an inpatient intervention tool to facilitate multiple-encounter communication within the EMR. The study analyzes the National Cancer Institute Comprehensive Cancer Center, consisting of six outpatient clinic locations, 10,000 annual inpatient admissions, and over 300,000 outpatient clinic visits (p. 627). The infusion clinic administers approximately 150,000 outpatient chemotherapy infusions yearly (p. 627). The National Cancer Institute implemented a comprehensive EMR to leverage tools within the medical record, hoping to replace third-party tools. The tools within the EMR were developed to create a method of communication that alleviated the need to log into an additional tool. The solution within the EMR was a simple sticky note application that could be displayed in various parts of the EMR. The sticky note was modified to allow pharmacist-only access, which met the majority of the project's criteria. The tool quickly replaced the third-party tool in the pharmacy workflow, which allowed the cancer center to cancel the third-party subscription.

Workflow within a community health center changes with the patient's health care requirements. Adopting a basic EMR will restrict the health center from utilizing additional tools and modules available only with the comprehensive EMR. "The adoption of a comprehensive

EMR can pose some challenges, but it can also provide more robust tools to improve patient care" (Ganio et al., 2016, p. 627). The comprehensive EMR comes with a heftier price tag but can adjust and change to the requirements of the patient's health record and the healthcare facility. Often, the tools available within the comprehensive EMR package can replace legacy third-party tools that require additional logins and are not integrated into the EMR package. By utilizing tools within the EMR, subscriptions to additional third-party tools can be canceled, and all communications and health records can reside within the EMR of choice.

School Nurse Access to EMR

External access to a community health center's EMR is often a requirement for continuity of care, especially for those requiring immediate care at another health facility or school clinic. Baker and Gance-Cleveland (2021) examined the efficacy of allowing school nurses access to healthcare system EMRs. Baker and Gance-Cleveland argue it is imperative to include school nurses as part of the health care team since school-aged children spend around 1,080 hours at school each year and many of them have chronic diseases (p. 28). "Care coordination between health care providers and school nurses is currently hindered by communication that relies on an inadequate system of fax, phone, and traditional mail" (Baker & Gance-Cleveland, 2021, p. 28). Utilizing the EMR system to connect the school nurses and healthcare systems is usually limited in scope, even with the EMRs advancement in these health care systems. "Stakeholders and experts in educational, administrative, clinical, legal, privacy, security, and information technology arenas need to be engaged to develop programs for school nurse access to EMRs" (Baker & Gance-Cleveland, 2021, p. 38). Allowing school nurses access to the child's EMR can improve patient care; however, school nurses and healthcare providers must comprehend and navigate within both the Health Insurance Portability and Accountability Act of 1996 (HIPAA)

and the Family Educational Rights and Privacy Act (FERPA) laws to facilitate communication and the sharing of health information.

Transition of Care

Patient care is often only as good as the transition from one healthcare team or provider to another healthcare team or provider, especially for inpatient care applications. For emergency room patients, an effective transfer of care to their primary physician must occur, to continue the treatment for their health concern. Without successful transfer of care, the patient often has a higher rate of return to the emergency room with the same chronic condition. The Rider et al. (2018) research categorized current practices in the transition of care from the emergency department to the primary care facility, emphasizing the EMR. The study utilized a literature review and a modified DELPHI technique to create and test a pilot survey evaluating face and content validity. The final survey was administered face-to-face at eight clinic facilities throughout the United States (p. 245). A total of 52 emergency physicians and 49 primary care physicians took the survey, and the data were analyzed using the chi-square test (p. 245). Rider et al. found significant differences exist between emergency physicians who prefer synchronous telephone contact and primary care physicians who prefer EMR asynchronous contact. The study concluded the need to optimize technology, including the EMR, for an effective transition of care from the emergency department to outpatient care.

The primary care facility ensures that the patient receives the care required, improving the healthcare outcome. However, especially in the community health care system, the emergency rooms and emergency physicians are most often outside of the community health center organization. The transfer of care must utilize the EMR or multiple EMRs to ensure an effective transfer of care. When the two facilities are not part of the same EMR, an interface is required to ensure the proper transfer of medical records for the patient’s ongoing care. The

Rider et al. (2018) study examined “the need for a consistent system of communication, while also emphasizing the need for flexibility as emergency physicians and primary care physicians work in distinct environments with different needs and expectations” (p. 252).

Proper transfer of care from one provider to another provider or specialist is also significant. Slager et al. (2017) identified factors that led to poor communication and developed strategies to optimize provider-provider communication. Slager et al. highlighted the methods providers use to communicate and document health information within two separate EMR systems during the transition of care and presented a conceptual diagram of how information exchange occurs within these two EMR systems. “Poor communication of health information between healthcare providers is associated with over 80% of medical errors that occur during transitions of care” (Slager et al., 2017, p. 1). The Slager et al. research interviewed primary care providers and surgical providers during their patients’ transitions of care before and after surgery at a Veteran's Health Administration hospital and a large tertiary academic medical center to understand how providers communicate and exchange health information for the medically complex older patient across different care settings. Slager et al. highlighted the methods providers use to communicate and document health information within two separate EMR systems during the transition of care. “It is critical for all healthcare providers to have readily available information about a patient's care and status during transitions of surgical care” (Slager et al., 2017, p. 4). If there were no complications in the surgery, many providers were content to rely upon conveying the patient's surgical course to the other provider via documentation alone; however, if the patient experienced complications, many providers would attempt to contact the PCP directly.

Shift Report Transition

In Japan, shift report, another form of transition of care, communicates essential information about patients from pre-nurses to post-nurses. The shift process report usually takes a half hour or more to complete. Therefore, the oncoming nurses lose time from patient care, and the off-duty nurses are forced to stay until the turnover is complete. Tanaka et al. (2016) investigated the shortening or abolishing of the shift report and its side effects after the implementation of an EMR at 10 Japanese hospitals. Tanaka et al. established that the majority of staff nurses accepted this change, but both directors and staff nurses recognized the risk of insufficient collection and communication of the required patient information, the difficulties of understanding the risks and matters of patients not under care, and an increase in time to collect information from the computer before starting patient care. Since the EMR enhances the sharing of patient information among nurses, executives considered shortening or abolishing this turnover in some hospitals. Tanaka et al. found that nurses with less computer expertise had a negative attitude toward the EMR, and the inability to quickly find the relevant patient information was one of the unintended adverse consequences of introducing an EMR. Therefore, shortening, or abolishing shift reports after implementing an EMR system negatively influenced patient care.

EMR Handoff Tools

EMRs can effectively improve communication if the tool required to provide the required type of communication is available in the EMR being utilized. Pandya et al. (2019) examined the development and implementation of a standardized handoff process on an EMR-based tool, ensuring optimal communication of treatment-related information. The tool was developed over multiple phases utilizing the Plan-Do-Study-Act methodology, using current workflow process mapping; identifying gaps, limitations, and potential causes of ineffective handoffs; and

prioritizing these using a Pareto chart (p. 480). The project developed an EMR-based tool incorporating a standard treatment handoff process. All outcomes of the study were evaluated over a one-year time frame. The proportion of medication errors because of ineffective handoffs was reduced by 60% pre-intervention to 32% post-intervention (p. 480). The EMR-based tool was used in 855 of the patient treatment visits, and the handoff completion rate increased from 32% pre-intervention to 86% post-intervention (p. 480). A majority of nurses (85%) reported that the EMR tool conveyed the necessary information and was influential in preventing errors (81%) (p. 480).

The development of EMR-based tools can be effective if they are developed with the correct methodology and based on an efficient workflow. EMRs have become robust, comprehensive tools for the healthcare industry. However, proper care is required to ensure that poor project planning and the misunderstanding of corporate protocol and workflows do not doom the project. “Multidisciplinary stakeholders guided the development and implementation of a handoff process and an EMR based tool to optimize communication between nurses during patient transition” (Pandya et al., 2019, p. 480). With the proper planning, the EMR-based tools can effectively increase communication and productivity while diminishing the number of occurrences of medical errors.

The Tisdale et al. (2018) research also examined using EMR handoff tools. Tisdale et al. measured the effect of an EMR-based handoff tool on handoff completeness. This EMR-based handoff tool included a radio button prompting users to classify patients as either stable, a watcher, or unstable; it automatically pulled in EMR data on the patient’s 24-hour vitals, standard lab tests, and code status; and it provided active text boxes to fill in with the required patient information. “Physician-to-physician handoffs are particularly prone to communication errors yet have been shown to be more complete when systematized according to a standardized

bundle. Interventions that improve thoroughness of handoffs have not been widely studied" (Tisdale et al., 2018, p. 1). Written handoffs from general and specialty internal medicine inpatient wards were evaluated on a random sample of days after the intervention EMR tool was implemented. Tisdale et al. found that a simple EMR-based handoff tool providing a mix of frameworks for completion and automatic import of patient data improved handoff completeness, suggesting that EMR-based interventions may be effective at improving handoffs, possibly leading to fewer medical errors, and resulting in better patient care.

Ambulance Technician/Emergency Department Transition

An inefficient transition of care from the ambulance technician to the Emergency Department (ED) can cause loss of time and the unavailability of medical records, impacting patient outcome. Since 2015, Denmark has required an electronic Prehospital Medical Record (ePMR) in all Danish ambulances. An ePMR is a mobile version of medical EMRs that is modified for ambulance technician use and transfer of care. Jensen et al. (2021) examined ambulance professionals' work practices regarding the use of medical records, and their communication with patients, before and during transfer of care to the hospital ED. Jensen et al. observed the use of an ePMR during ambulance responses and performed informal interviews with ambulance professionals and technicians. Jensen et al. established that the ePMR is an essential tool aiding ambulance professionals with the overview of patient data collection and facilitated a checklist for ED transfer of care, mobility, and flexibility of the ePMR facilitated conversations and relations with the patients. In acute severe situations, the ePMR was not able to stand alone in the transfer of care or communication with the ED. "The ePMR affected the ambulance professionals' work practice in various ways, and utilization of ePMR while simultaneously treating patients in ambulances does not obstruct the relation with the patient"

(Jensen et al., 2021, p. 1). The study determined that the ePMR is efficacious in collaboration across the prehospital setting, creating a transfer of care essential to the patient's well-being.

EMR Utilization and Communication

Time Management

Time management is a substantial concern for all healthcare team members and providers. Using an EMR in a healthcare facility often requires significant time to record patient health records entirely and accurately. The Arndt et al. (2017) study accessed time allocated by primary care professionals when using the EMR as indicated by the EMR user-event log data, during and outside of clinic hours. The Arndt research was a retrospective cohort study of 142 family medicine physicians in a single health center in southern Wisconsin (p. 419). Physician EMR interactions were captured from event logs over a three-year period. Clinicians spent 5.9 hours of an 11.4-hour workday in the EMR per weekday per 1.0 clinical full-time equivalent (FTE), 4.5 hours during clinic hours, and 1.4 hours after clinic hours (p. 419). Clerical and administrative tasks, including documentation, order entry, billing and coding, and system security accounted for nearly one-half of the total EHR time (44.2%), and inbox management accounted for another 23.7% of the EMR time (p. 419). Arndt et al. found that EMR event logs can identify areas of EMR-related work that could be delegated, thus reducing workload, improving professional satisfaction, and decreasing burnout. "There are a variety of solutions to address the many facets of physician burnout and developing organizational metrics that are specifically related to decreasing stress from EHR systems is critical" (Arndt et al., 2017, p. 425).

The subject of the Lafata et al. (2016) research also dealt with time utilizing the EMR. Lafata et al. evaluated the association of exam room use of EMRs, Health Risk Appraisal (HRA) instruments, and self-generated written patient reminder lists with patient-physician

communication behaviors, recommended preventive health service delivery, and visit length. The Lafata et al. research conducted an observational study of 485 office visits with 64 primary care physicians in a Detroit health center comprised of patient surveys, direct observation, office visit audio-recordings, and automated health system records (p. 728). The research outcome measures included visit length in minutes, patient use of active communication behaviors, physician use of supportive talk and partnership-building communication behaviors, and percentage of delivered guideline-recommended preventive health services for which patients are eligible and due. Lafata et al. determined that office-based tools intended to facilitate the implementation of desired primary care practice redesign are associated with both positive and unfavorable cost and quality outcomes. These findings indicate the need for monitoring both the intended and unintended consequences of office-based tools commonly used in primary care practice redesign.

EMR Training

The EMR used in the examination room is becoming the primary method of capturing medical data in primary care practices in the United States today. Furthermore, one of the challenges in using the EMR is maintaining effective patient-provider communication, which requires substantial and ongoing training. Lynott et al. (2012) explored various health record training programs for clinical providers and utilized a researcher to participate in and observe three different health systems' EMR training programs. The Lynott et al. research used a focused ethnographic approach, emphasizing patient-provider communication. "In order to realize their full potential in healthcare, EMRs must be presented to clinicians in a manner that emphasizes their full potential in the exam room and beyond" (Lynott et al., 2012, p. 11). Lynott et al. discovered that only one system had formalized communication training. The other two EMR systems emphasized only information regarding the software and patient data. Clinical providers

utilizing the EMR in the exam room require communication training in the EMR training program.

Medical Workflow

Modifying and configuring the EMR to be in close construct with a healthcare center's daily workflows is essential to properly utilizing the EMR. Assis-Hassid et al. (2019) assessed the extent to which the EMR supports healthcare team workflow during hospital morning rounds. "Although EMRs can improve healthcare quality and have done so in many ways, our findings show that there are many challenges in the current inpatient environment that need to be addressed if EMRs are to reach their full potential". (Assis-Hassid et al., 2019, p. 12). Assis-Hassid et al. applied a mixed-method approach, including observations of care teams during morning rounds, semi-structured interviews, and an electronic survey of hospital inpatient clinicians for the study (p. 1). Data analysis from the three methods yielded four main findings, including a high degree of variance in the ways care teams use EMRs during morning rounds, the pervasive use of workarounds at critical points of care, the EMR is not used for information sharing and frequently impedes intra-care team communication, and system design and hospital room settings do not adequately support care team workflow (p. 1). Assis-Hassid et al. found gaps between EMR design, and the functionality needed in the complex inpatient environment result in lack of standardized workflows, extensive use of workarounds, and team communication issues, citing that these issues pose a threat to patient safety and quality of care, and found that the clinical staff extensively employed workarounds.

Third-Party EMR Applications to Enhance Communication

At times, the EMR implemented within a healthcare facility may not have a module or tool available that is necessary for daily workflows, decision-making, and communication. Pamplin et al. (2020) investigated how to improve clinical decisions and communication in

critical care by using an EMR with a third-party application. “Research on decision aids suggests that the way a problem is presented can improve, or degrade, clinicians’ cognitive work” (Pamplin et al., 2020, p. 255). The Pamplin et al. research team developed a Novel Health Information Technology (NHIT) that interfaces with an existing EMR, displaying salient clinical information and enabling communication with a dedicated text-messaging feature. This novel software allows clinicians to customize their display according to their role and the information needed. Pamplin et al. utilized physicians, nurses, respiratory therapists, and physician trainees in the research. Two phases of this study were conducted, a usability assessment and a validation assessment. During the usability assessment, Pamplin et al. identified that clinicians could complete all the requested tasks and indicated that the NHIT was easier to use, and the novel information display allowed for more straightforward data interpretation than from the EMR. In the validation assessment, Pamplin et al. also discovered that a junior care team using the NHIT arrived at accurate diagnoses and decision points at times similar to a more experienced team. Both teams noted improved communication between team members when using the NHIT and rated the NHIT as easier to find patient medical data overall. The Pamplin et al. research findings, in contrast to common user experiences with the use of new EMR systems, indicate that clinicians found the NHIT easy to use despite minimal training and experience and that it did not degrade clinician efficiency or decision-making accuracy.

The Burke et al. (2020) research identified barriers and facilitators to the use of the EMR from the perspective of primary care providers and identified reasons why the EMR did not affect outcomes in the trial. Burke et al. utilized a convergent mixed methods design, requiring primary care physicians to complete a post-trial survey and participate in interviews about using the EMR for managing patients’ skin problems. Data from interviews revealed barriers and facilitators at four steps of evidence-based practice including clinical question recognition,

information acquisition, appraisal of relevance, and application with patients. Facilitators included uncertainty in dermatology, intention for use, the convenience of access, diagnosis and treatment support, and patient communication. Barriers included confidence in dermatology, preference for other sources, interface difficulties, presence of irrelevant information, and lack of decision impact. Primary care physicians found the EMR useful for diagnosis, treatment support, and patient communication; however, the barriers including interface difficulties, irrelevant search results, and preferred use of other sources limited its positive impact on patient skin problem management (p. 428).

Comparison Between Cultures

American EMR systems are often more robust in their intricacies and abilities than those in Europe. Furthermore, communication is a crucial feature created in the technology of the EMR systems in the United States. “In the United States, the computer has become a tool not only of documentation but also of communication” (Michel, 2017, p. 712). Documentation of electronic health records by health professionals is also more robust than in France. Michel (2017) compared the realities and challenges of communication and teamwork in American hospitals unlike those in France. The research came from the observation of a doctoral student familiar with residency in both countries. Although minimalistic in approach, the Michel study shows many of the glaring differences in healthcare between Europe and the United States. The most crucial difference is that of the EMR systems and technology. “In both countries, nurses’ chart on the computer, but in France, the amount of charting is lighter, and the computer system is less developed than EPIC, the program nurses use in North Carolina” (Michel, 2017, p. 712). As culture changes, so do work habits, the use of technology, and even the medical practice changes. These differences can even be detected between healthcare facilities across the United

States or across the street. It is vital that the EMR being utilized can be modified, maintaining communication with other healthcare organizations, whether in the United States or worldwide.

Effects of EMR Implementation on Communication

Significant investment has occurred in payer and provider organizations for analytical and operational health information technology systems. However, the investment in information technology systems needs to account for the current, ever-changing care model, and many need to be updated before implementation. The Aller (2016) analytics study confirmed that risk-based population health management programs have gained traction in hospital environments and are expected to proliferate in the future (p. 16). The Aller research findings concluded that the right technology is being used, but for the wrong care model; implementation created communication hurdles; the information technology is required to be patient-centered, not facility centered, identity management is required; and quality-care goals must be utilized.

Implementing an EMR, once a necessity, now a requirement, demands extensive planning to ensure that the information technology solution is the right solution for the healthcare facility. Needs and requirements should be gathered before defining vendors and software solutions. The EMR must be structured to create avenues to improve communication between providers, healthcare workers, payer organizations, and patients. A patient-centered approach to the EMR is recommended, as a facilities-centered approach is ineffective in the patient's ongoing care, especially if the patient goes outside the current healthcare system for their care. "The concept of value-based care is that we should pay for outcomes, not service delivery" (Aller, 2016, p. 17). The EMR must follow this protocol and be both patient-centered and patient-friendly.

Facilitators and Barriers to EMR Implementation

Not all EMR systems are adequate for all healthcare facilities. It is necessary to understand the facilitators and barriers of the EMR that the health center is planning to implement before purchasing. Ngugi et al. (2018) identified, analyzed, and categorized the facilitators and barriers to implementing EMRs in resource-constrained settings to gain insight into successful EMR implementation. Ngugi et al. conducted a literature review of articles from 2007 to 2017 concerning facilitators and barriers to EMR implementation. Ngugi et al. acknowledged that healthcare organizations are complex, and the introduction of an EMR system can bring further complications, especially to the workflow, leading to the rejection of the EMR system regardless of the setting. Ngugi et al. found that users are likely to embrace systems that do not interfere with their workflow. Therefore, EMR systems must be designed or customized to fit their intended environment. Additionally, a system's simplicity and usability greatly support skeptical users and those lacking in information technology skills. EMR systems often facilitate healthcare improvement in quality patient care, patient safety, and cost reduction; however, EMR adoption requires careful planning and execution for successful implementation and optimal benefits.

Cucciniello et al. (2015) also studied EMR implementation by examining the interaction of sociological and technological factors to obtain insights for managers planning future implementation projects. "The process of implementation should be informed by an understanding of its micro and macro-contexts, taking into account stakeholder needs at the organizational level and policy goals and objectives in more general terms" (Cucciniello et al., 2015, p. 18). Cucciniello et al. utilized a case study using documentary analysis, interviews, and observations for this research. Qualitative analyses revealed a complex network of interactions between organizational stakeholders and technology that helped shape the system and influence

its acceptance and ultimate adoption. The results of the Cucciniello et al. study illustrated the importance of planning innovative and complex information systems with the expressed needs and involvement of different actors, starting from the initial introductory phase; promoting commitment to the system and adopting a participative approach; defining and resourcing new roles within the organization capable of supporting and sustaining the change; and assessing system impacts in order to mobilize the network around a common goal. Cucciniello et al. also discovered that organizational, cultural, technological, and financial considerations are required when planning EMR implementation strategies.

Coordination of Implementation

Coordination and collaboration are effective before, during, and after the implementation of the EMR. The purpose of the Dreger and Bains (2019) study was to examine the collaborative efforts between healthcare entities transitioning to a single EHR across three health authorities in British Columbia. The study suggested that the relationship between the healthcare facilities during the implementation of the EHR was strategic and essential to the implementation. The study also revealed that the relationship between the healthcare facilities during the collaboration had long-term effects fostering ongoing information sharing of quality improvement initiatives. Furthermore, the collaboration and adoption of a single EHR have allowed for real-time data to be available across all three entities while fortifying the use of standard definitions to help re-imagine critical care (Dreger & Bains, 2019).

EMR solutions are often only as accessible as the healthcare center in which it has been implemented. EMRs were not originally developed as a cross-platform solution to share medical records across multiple healthcare facilities. In fact, due to modifications and enhancements, EMR solutions often cannot share health records with other facilities utilizing the same technology, much less health centers utilizing competing EMR solutions. If possible, building a

collaboration of healthcare facilities before purchasing an EMR solution has several advantages. The first advantage is the ability to transfer medical records from facility to facility, allowing patients seamless access to providers and their medical records. Another advantage of the collaboration is that it creates negotiating power with the EMR vendor; often, the larger the collaboration, the better the price. Furthermore, collaboration offers the advantage of creating relationships with healthcare worker's peers, a relationship that most often only comes to fruition with the early collaboration. "This clinical transformation project has turned temporary partnerships across the critical care programs into lasting relationships, as a single electronic system has pushed for practice and policy alignment" (Dreger & Bains, 2019, p. 18). Collaboration and simultaneous implementation are clear advantages to building an EMR network across several healthcare facilities that require sharing of patient medical records.

Scalability

Scalability is essential for choosing the correct EMR for the healthcare center implementation. Corbie-Smith et al. (2019) sought to understand healthcare disparity to implement a scalable EMR meeting patient requirements. The study examined social determinants of health and clinical science, informatics and data science, dissemination, and implementation. "Currently, the primary function of most electronic medical records is to facilitate documentation and billing for services" (Corbie-Smith et al., 2019, p. 531). The Corbie-Smith et al. study recognized the potential of EMRs to incorporate modules to advance health equity by harnessing information technology and data. During the trial of CommunityRx, an EMR-integrated intervention tool that matches people with nearby community resources to meet their health-related social needs, 48% of intervention participants shared automatic referrals to community resources (p. 532). "Chronic disease and self-management of health promotion theories posit self-efficacy as an important antecedent to health-promoting behavior" (Corbie-

Smith et al., 2019, p. 532). The Corbie-Smith et al. research found that the EMR integrated tool is promising for catalyzing access to community health resources through low-intensity intervention. The study also recommended future research into such EMR modules to improve the disparity gap in healthcare.

An EMR-integrated tool such as CommunityRx is not necessarily relevant in the community healthcare arena due to the multitude of programs centered around public outreach that reach the same outcome. However, understanding the needs of the community and the patient is an essential first step when determining which EMR solution to implement. Determining the availability of modules and the system's flexibility will help to determine which EMR will meet the needs of the patient and the healthcare facility.

Interoperability

Along with scalability, interoperability is an essential requirement when choosing the EMR. Ndlovu et al. (2021) reviewed published reviews of eHealth interoperability frameworks for linking mHealth solutions with eRecords and assessed their relevance to informing interoperability efforts concerning Botswana's eHealth Strategy. "Delivery of healthcare is shifting from hospital-based to patient-centered primary healthcare and community-based settings, using mHealth interventions" (Ndlovu et al., 2021, p. 2). The mHealth solution presents innovative approaches to enhance primary healthcare delivery in developing countries, and the impact of mHealth solutions can be improved if they are interoperable with other EMRs. Ndlovu et al. analyzed four articles reviewing eHealth interoperability frameworks that support linking to the EMR and their associated implementation strategies. Ndlovu et al. found that the frameworks were developed for specific circumstances and therefore were based upon varying assumptions and perspectives, and they entailed aspects that are relevant and could be drawn upon when developing the mHealth interoperability framework. Infrastructure, interoperability standards,

data security, and usability were identified by Ndlovu et al. and were deemed critical to the framework.

Likewise, D'Amore et al. (2012) examined how the continuity of care document can advance medical research and public health. "The adoption of Electronic Health Records (EHRs) has focused on enhancing the delivery of individual care, but the application of digital medical data to widespread population health analysis is critically lacking" (D'Amore et al., 2012, p. 1). D'Amore et al. argued that the patient's health surveillance should rely on automated detection rather than manual inspection. The EMR allows healthcare facilities to calculate quality measures and transmit them directly to agencies, enhancing quality improvement. Unfortunately, interoperability between EMR systems requires common language and structures for medical data so that communication can become seamless between care providers. However, current practices within healthcare do not require a common language between providers in a medical facility, much less common language across different facilities, making interoperability difficult, at best. Successful new EMR implementations must ensure that the new digital infrastructure is effectively harnessed, breaking down barriers to quality improvement, effective information sharing, and the use of medical data across multiple facilities.

Integration

Although national EMR systems are starting to become more readily available in developed countries, there continues to be limited research into the successful strategies for ensuring the integration of national medical records in the healthcare systems of low- and middle-income countries (LMIC). Kumar and Mostafa (2019) explored the requirements of EMR systems in LMIC. The Kumar and Mostafa findings describe the narrow focus of EMR implementation, the prominence of vertical disease programs in EMR adoption, the testing of theoretical and conceptual models for EMR implementation and success, and strategies for EMR

implementation. “In the absence of evidence strategies that could drive integration of national EMR infrastructure in the health care system, fragmentation of the health data system will continue to pose challenges to healthcare systems” (Kumar & Mostafa, 2019, p. 1024). Kumar and Mostafa argued that EMR infrastructure is vital for facilitating population and individual healthcare service delivery, guiding resource allocation and utilization, enabling data sharing and use, and aligning health sector goals and eHealth strategies. Kumar and Mostafa also claimed that available evidence explains successful EMR implementation but fails to articulate strategies for integrating EMR systems in the health care centers as the foundational digital health infrastructure.

Design

The design and use of an EMR can be just as crucial as its utilization. The do Carmo Alonso et al. (2020) study investigated how Activity Ergonomics (AE) contributed to improving the design of an EHR that supports the collaborative mental health care of children and youth. “The design of this platform generally focuses on the individual use of the system and does not integrate the specific needs of workers to provide support for collaborative activities” (do Carmo Alonso et al., 2020, p. 187). Do Carmo Alonso et al. conducted a qualitative study based on the theoretical framework of AE and conducted individual and group interviews and a document analysis as research procedures. The do Carmo Alonso et al. study highlighted the following points: the characteristics that marked the different perceptions of workers regarding the use of a communication tool for collaborative care, the problems related to spreadsheet usability, and the desirable attributes that should be considered in the conception of a new EMR. The do Carmo Alonso et al. research suggested that AE favors improving the design of an EMR by incorporating the work dimension into the project.

Privacy Considerations

The privacy of healthcare records is a significant concern with all healthcare facilities. HIPAA requires that access to electronic medical records is required to be on an as needed and minimalistic basis. Kuo et al. (2019) explored the possible antecedents that will motivate hospital employees' compliance with privacy policy related to the EMR from the deterrence perspective. Data was collected from a large Taiwanese medical facility using surveys. A total of 303 responses were analyzed utilizing the hierarchical regression analysis (p. 1). The study's results showed that sanction severity and sanction certainty predicted the compliance of the hospital worker from accessing unnecessary electronic medical records. Kuo et al. also revealed that external computer monitoring significantly moderated the relationship between sanction certainty and compliance intention. The findings of the Kuo et al. study showed that healthcare facilities should take a proactive approach, including computer monitoring, to protect the privacy of individual medical records.

Kuo et al. (2019) demonstrated that draconian measures, sanction severity, and sanction certainty will help minimize inappropriate access to medical records. "By focusing on the moderating impact of computer monitoring, knowledge of deterrence theory can be augmented and diversified" (Kuo et al., 2019, p. 9). Increasing the severity of the sanction will diminish the impropriety. These measures may, indeed, be a result of the difference in culture, being the healthcare center is in Taiwan. However, proactive computer monitoring and scheduled monitoring of employee access to medical records can prevent HIPAA breaches. Creating firm but manageable security policies and implementing yearly HIPAA training ensures that the healthcare staff understands the risks of improper access to medical records.

Privacy laws reduce the network effects of EMRs, defined as positive externalities experienced by individual hospitals that adopt EMRs when other local hospitals have adopted

electronic records. “Evidence has shown that although there may be many reasons for states to restrict medical providers’ ability to disclose information, these restrictions do lead to lower adoption of EMRs” (Miller & Tucker, 2009, p. 1092). Miller and Tucker (2009) examined how privacy protection affects the diffusion of electronic medical records. Miller and Tucker found that state privacy protection of hospital medical information inhibits EMR adoption by around 11% per three-year period, or 24% overall, in states with such laws (p. 1092). Miller and Tucker found that in states without hospital privacy protection, one hospital’s adoption increases the propensity of other hospitals in the local area to adopt by 7%. In contrast, states with privacy protection, no network effects are detected (p. 1092).

Resistance to Implementation

Poor implementation strategies and methodologies can cause issues with EMR implementation and create significant communication issues. Gross et al. (2016) described how trust among healthcare team members, and in the technology supporting them, eroded with the improper implementation of an EMR system in an oncology cancer center. In 2015, the cancer center implemented an EMR with an overnight, all at once, implementation of an EHR (Gross et al., 2016, p. 1075). Instead of using a phased approach for the integration, the nuclear, or all at once implementation, was chosen. Even with significant staff training on the new EMR system, before and throughout the implementation of the EMR, the trust among team members and the technology supporting them eroded, creating delays in the care of patients. Although the EMR implementation method was to blame for the eroding of trust and communication, change, and the process of implanting the EMR and physician order-entry systems, the implementation was associated with the emergence of unintended consequences that can negatively affected team performance in any facility (Gross et al., 2016).

There are many considerations before implementing an EMR in a healthcare facility. There is no right or wrong, cut-and-dry solution available. Whereas every healthcare facility is different, every EMR system is different, creating a multitude of options for implementation. The implementation approach that works well for one community health center may not work for another, even if they are relatively similar in their patient care approach and philosophy. "Delaying implementation of the component of the tool used for communications until clinicians were familiar with the rest of the EMR may have made the change of pace more manageable" (Gross et al., 2016, p. 1081). Significant hands-on training and EMR technology testing must be completed before adaptation. Furthermore, change in almost every aspect creates a negative association with many staff members. Obtaining executive leadership and medical department champions for the new EMR system will significantly enhance the successful implementation of the facility's EMR.

The EMR and information technology in healthcare have continued to receive resistance since their inception in their new role. Barrett (2018) explains this resistance through professional, organizational experience, and EMR communication quality. The study surveyed 345 employees in a single healthcare organization that recently implemented an EMR (p. 496). The job characteristic model, used to explain findings, and the hierarchical regression analysis, used to demonstrate the quality of the communication within the EMR, were utilized in this study. A pilot survey was conducted from May 2013 to July 2013 to ensure the wording and instruction of the survey questionnaire (p. 497). The healthcare organization study was comprised of approximately 500 employees who provided healthcare for underprivileged citizens, including a 24-hour emergency room and comprehensive and preventative healthcare (p. 499). A hard copy survey was given to the employees three weeks after implementing the EMR. The Barrett research received a 71% response rate (219) from the 310 distributed surveys

(p. 500). Furthermore, two mailed surveys generated 82 additional surveys from physicians and 44 questionnaires from their coworkers for a total sample size of 345 healthcare employees (p. 500). The results defined that the EMR system required refining, and the healthcare employees showed resistance to using the new EMR.

Due to the regulation of health centers across the United States, the EMR is a requirement, not just a convenience or a communication tool. Healthcare facilities must utilize EMR systems to provide patient-centered healthcare, receive much needed grant money, and care for patients. EMRs are an excellent tool for collaboration, improvement of patient healthcare, and increased patient-provider communication. The EMR is not a turn-key solution, as it takes many years of modifications and manipulation to create a system that reflects the needs of the patient and the healthcare facility. “Resistance to new technology, especially in the healthcare industry, is often a taboo topic because it can involve undermining or bypassing patient safety procedures” (Barrett, 2018, p. 504). Resistance comes with change; however, a well-trained staff with the phased integration approach to the EMR can help alleviate the issues generated by moving to the EMR.

Post Implementation

Changes are necessary to determine ways to overcome the obstacles within the healthcare industry; however, significant resistance to change and perceptions related to information technology integration in healthcare continue to exist. Cost is a primary concern for physician groups and smaller practice groups who may need help to sustain the financial costs incurred with EMR software updates, and the realization that technology and information systems will render obsolete over time. Duncan et al. (2018) analyzed the challenges in healthcare after adopting and implementing an EMR system. “A 2001 Institute of Medicine reported indicated that more people in the United States died from medical errors than from significant illnesses,

highway accidents, and work-related injuries" (Duncan et al., 2018, p. 1). Duncan et al. argue that with a significant number of injuries and deaths attributed to medical errors, prescription errors, and other related causes due to human error, improved technological integration in the healthcare systems continues to gain momentum.

Modifying the EMR is a critical post-implementation process. Not all EMRs have all the required modules available to enhance communication throughout the community health center. The Garvey and Evensen (2015) research examined whether computer-based tracking systems, not embedded in the EMR, improve accurate and timely communication of results and patient adherence to follow-up recommendations. The pre- and post-study used data from 2005 to 2012 collected from medical chart reviews for at least 18 months (p. 21). The pre-intervention sample size was 72, while the post-intervention size was 128 (p. 21). Using an external tracking system improved communication of abnormal results but did not significantly improve patient adherence to recommended care.

Providing Patient-Centered Medical Home (PCMH) care delivery model is the mission of many community health centers. "Many potential patient-, clinician-, and system-level barriers should be examined to create a system that does more than simply meet PCMH requirements and truly improves patient-oriented outcomes" (Garvey & Evensen, 2015, p. 25). Determining the best processes for providing test results and increasing patient adherence to follow-up care are essential aspects of healthcare. Most often, an off-the-shelf EMR does not provide the requirements of the physician or the patient. It takes many years of personalization and configuration for the EMR to become the tool it was meant to be.

Nurse Satisfaction with EMR

The healthcare professionals' satisfaction with an implemented EMR greatly enhances the utilization of the technology. Furthermore, nurse satisfaction with the EMR, the ability to

handoff patients, and to communicate with their patients is vital to good healthcare. Chapman (2016) measured nurses' satisfaction with transition of care, levels of comfort using information technology, and overall satisfaction with the EMR tool. The study was a descriptive study design comparing relationships and interpretation of nurses' satisfaction with using an EMR during bedside handoff, utilizing a 10-question survey (p. 314). The first six questions on the survey dealt with nurse demographics (p. 314). The remaining four questions dealt with nurse satisfaction with communication of patient care, using the EMR, patient care information received, and overall satisfaction with using the EMR during patient handoff (p. 314). Nurses were satisfied (72% to 86%) with the EMR during patient handoff (p. 314). The study also noted a higher level of nurse satisfaction when the nurse perceived themselves as competent. Additionally, nurses expressed satisfaction with the reliability of patient information and end-of-shift efficiency, implying that the nurse's expertise and organizational culture norms influenced EMR tool satisfaction positively.

Mills et al. (2015) also examined nurse satisfaction with the EMR by evaluating changes in specialty areas nurses' knowledge and perceptions of a consolidated EMR system before and after implementation. "Effective implementation of new technology will capitalize on nurses' willingness to learn by employing effective communication, constructive workplace practices, and ongoing consultation to iron out inevitable problems" (Mills et al., 2015, p. 12). Mills et al. surveyed nurses in specialist areas, including community health, palliative care, discharge planning, wound and stoma care, diabetes education, and renal dialysis satellite services (n=110) (p. 6). The pre-implementation survey found that specialist nurses reported dissatisfaction with most aspects of the current patient information system but high confidence and comfort in using electronic systems. The post-implementation survey showed that satisfaction scores either remained the same or increased. Satisfaction with ease of access to consolidated patient data and

the usefulness of electronic systems increased significantly with the post-implementation survey. The Mills et al. findings indicate that specialist nurses are optimistic about the possibilities that a consolidated EMR system offers to centralize, consolidate, and improve access to patient data.

Accessing and utilizing an EMR is also essential when educating healthcare professionals, including nurses. Mollart (2021) investigated third-year undergraduate nursing students' perceptions and views on being prepared for using patient EMR in clinical placement after using only paper-based documentation during their education program, and their opinion on the introduction of EMR in the university-simulated learning environments to be work ready. Mollart surveyed all third-year undergraduate nursing students at three campuses at a regional metropolitan university in New South Wales. Of the 70 third-year nursing students (13.2%) who completed the questionnaire, most (71.1%) did not feel prepared to use an EMR system in the clinical setting after only learning paper-based documentation, and 81.7% did not feel confident accessing patients' data contained in the EMR for the first time (p. 44). Nearly all students (98.5%) believed they would be more confident using an EMR system initially in their clinical placements if there had been an opportunity to use a simulation EMR (p. 44). The Mollart research found that third-year nursing students believed that learning to use an EMR program in a university-simulated environment would increase their confidence and prepare them for their duties as registered nurses.

To ensure quality of care, the patient's medical record must be up-to-date and correct. To maintain accurate records, it is vital for the nurse to feel comfortable with the EMR and be confident that the records are accurate. The Chapman (2016) study shows that as the nurse's expertise rises, so does the comfort level with information technology. "When considering IT-enhanced bedside improvement innovations, nurse leaders should consider variables, such as sex, race, education, years as a nurse, and years working in the organization, as influential"

(Chapman, 2016, p. 318). When implementing an EMR to improve communication, the staff must be well-trained and comfortable with the EMR system. Furthermore, when hiring new staff, it is essential to require experience and self-competency to maintain the level of detail that medical records demand.

Provider Satisfaction with EMR

Provider satisfaction with the EMR is also critical to its successful utilization. O'Donnell et al. (2018) reviewed and synthesized international literature on the attitudes of PCPs to EMR adoption using the Clinical Adoption (CA) Framework. O'Donnell et al. asserted that the recent decades had seen rapid growth in the implementation of EMR systems in both developed regions as well as low- and middle-income countries. Yet, despite substantial investment, the implementation of EMRs in some primary care systems has lagged other settings, with the gradual adoption of EMR functionality by PCPs themselves. O'Donnell et al. selected 33 articles based in North America, South America, Europe, the Middle East, and Hong Kong with concerns about how EMR accessibility, reliability, and utility exerted an adverse influence on PCPs' attitudes to adoption (p. 1). O'Donnell et al. found that many PCPs were positive about their potential to improve clinical productivity, patient safety, and care quality. The authors also found that younger, computer-literate PCPs, based in large/multi-group practices, were more likely to be positively inclined to EMR use than older physicians who were less skilled in technology use and based in private practices. Furthermore, financial factors were typical system level influencers shaping EMR adoption, from start-up costs to the resources required by their continued use.

Like the O'Donnell et al. (2018) research, Hines et al. (2017) explored health professionals' experiences and attitudes towards eHealth technologies to support interdisciplinary practice within rehabilitation for people after Traumatic Brain Injury (TBI).

Hines et al. conducted a qualitative study using narrative analysis, including one individual interview and three focus groups with health professionals (n=17) working in TBI rehabilitation in public and private healthcare settings across regional and metropolitan New South Wales, Australia (p. 1). Narrative analysis revealed that participants held largely favorable views about eHealth and its potential to support interdisciplinary practice in TBI rehabilitation; however, participants encountered various issues related to the design and access to the EMR, technology, eHealth implementation, and information and communication technology processes that obstructed them from their required tasks. In response, providers attempted to make the most of unsatisfactory EMR systems and processes, but remained unsuccessful in optimizing their work's quality, efficiency, and client-centeredness.

EMR Accessibility

The retrieval and processing of the EMR data, stored on the healthcare facility's server, is often unavailable during times of patient need, while traveling, or during an emergency. One of the significant issues with the EMR is that the data is often restricted to the facility that collects it. Unless the healthcare facility is part of a more extensive medical record storage network, the patient's medical record is often unavailable when the patient requires a specialist, emergency care, or while traveling. Development of Near-Field Communication, blockchain, and patient portals are developing technologies giving the patient much-needed access to their medical records when the records would otherwise be unavailable.

Near-Field Communication Technology

A Near-Field Communication (NFC) application is a solution allowing for the portability of the medical record, with the caveat that the secondary medical professional facility would need to have the ability to access and process the medical record held within the patient's smartphone. "EMR is a medical record that utilizes server as storage place, web as media for

reading and updating data, and Internet as communication media between server and web-based applications" (Basjaruddin et al., 2019, p. 4). The Basjaruddin et al. (2019) research examined if a technology, such as NFC, could be utilized to make EMR patient records portable and available when the patient requires their use. NFC allows the smartphone to communicate with other mobile devices to transfer data without utilizing the cellular network. Three technologies were studied, Bluetooth, Radio Frequency Identification (RFID), and NFC. The main advantage of NFC over Bluetooth is its swift setup time, which is essential in the clinical office setting (p. 6). Furthermore, the advantage of NFC over RFID is the availability of two-way communication, allowing the patient to have an up-to-date version of his medical record always available. NFC was ultimately chosen as the technology used in the study. Basjaruddin et al. determined that the application functioned correctly using dummy data during the alpha test. During the beta test, after the application was modified to enhance usability and performance, doctors and patients utilized the NFC technology to examine the usability and interoperability of the application. NFC can safely transfer data at a close range without the need for an Internet connection, making it ideal for medical record applications. The beta test revealed that the medical record application performed well with interoperability between the provider and patient.

NFC technology would allow patients to have their medical records on their smartphones for use as required. The application would allow for provider modification, while the patient would have read-only access to the medical record. Renardi et al. (2018) explored processes to encrypt EMR data to keep it from being vulnerable while ensuring the security process does not hinder the speed of the transaction. The Renardi et al. research utilized an experiment to obtain data for the study. The researchers developed a mobile EMR NFC-based application to encrypt and decrypt patient data which consisted of a different number of binary characters. Renardi et al. chose NFC due to its quick transfer time and the ability of the patient to transfer their medical

records to the provider easily. The proposed security solution implemented pre-defined key Advanced Encryption Standard (AES) for both encryption and decryption. The emphasis of the experiment was to study the effect of AES encryption/decryption on data transfer speeds from the transfer and acceptance of the data package. The study concluded that the implementing encryption in the NFC application did not hamper the process and exchange of data.

The provider requires access to the patient's medical records for an effective physician visit. In many cases, this can be a long and arduous task. However, with an NFC-based EMR application, the patient can quickly transfer their medical record to the provider. Because medical records contain Personal Health Information (PHI), HIPAA regulations require using only encrypted data. Using AES pre-shared key security for the encryption/decryption logarithm creates a secure and effective data transfer process. Combined with creating enhanced security, AES did not hamper the data transfer speed, making it an ideal solution for the NFC EMR medical record transfer. However, "there could be a threat such as Man in the Middle Attack and eavesdropping, thus, a security method is required to secure the data" (Renardi et al., 2018, p. 357).

Blockchain Technology

Blockchain is a new technology that is also being tested to make patient medical records available and secure. Blockchain technology is a decentralized database maintained by the collective and is currently being applied to multiple fields. In essence, blockchain is a list of encrypted records that make stored data immutable. Zhang and Poslad (2018) proposed an architecture for blockchain-based EMRs called GAA-FQ (Granular Access Authorization supporting Flexible Queries) comprising of an access model and an access authorization scheme. Unlike existing blockchain schemes, Zhang and Poslad determined that an access model can authorize different levels of granularity of authorization while maintaining compatibility with the

underlying blockchain data structure. Furthermore, the authorization, encryption, and decryption algorithms proposed in the GAA-FQ scheme dispense with the need to use a Public Key Infrastructure (PKI) and improve the computation performance needed to support more granular and distributed, yet authorized, EMR data queries. “Blockchain-based EMR can respond to a requester without leaking unauthorized private data efficiently, especially for a resource-constrained device in an Internet of Things (IoT) eHealth system” (Zhang & Poslad, 2018, p. 6).

Like Zhang and Poslad (2018), Hang et al. (2019) examined the efficacy of using blockchain technology to secure EMR records and make them accessible to the patient and other healthcare facilities. Hang et al. performed a hospital case study built on a permissioned network, a series of experimental tests were performed to demonstrate the design’s usability and efficiency, and a benchmark study was concluded. “In the case of personal medical data sharing, data security and convenience are crucial requirements to the interaction and collaboration of electronic medical record (EMR) systems” (Hang et al., 2019, p. 1). It is difficult for current EMR systems to meet the security and accessibility requirements due to the inconsistent security policies and access control models. Blockchain technology can benefit patient medical records by utilizing blockchain features such as data privacy and transparency. Blockchain technology provides patients with a comprehensive, immutable log and easy access to their medical information across different departments within and outside of their hospital. The Hang et al. findings demonstrate that their proposed solution has the potential to accelerate the development of a decentralized digital healthcare ecosystem. “It is visible to see that there are many conducive benefits for integrating blockchain technology into healthcare research, from data sharing and tracking to the needed transparency and privacy concerns for patients” (Hang et al., 2019, p. 25).

Chen et al. (2020) also used the hospital setting to propose a secure inter-hospital EMR sharing system. With the growth of PHI in EMR systems, medical information is becoming

increasingly important in terms of privacy, patient identity background, medical payment records, and medical history. Chen et al. proposed a blockchain-based inter-hospital EMR sharing system in which the EMR is secured. The Chen et al. scheme provides and guarantees data integrity, nonrepudiation, user un-traceability, forward and backward secrecy, and resistance to replay attacks by utilizing mutual authentication. With the current EMR systems, the patient's medical record cannot be searched across different medical centers or hospitals, making inter-hospital medical records important to patient care. "Assuming that the hospitals and the patients are in the same medical alliance, the blockchain center will issue identity verification keys to these members" (Chen et al., 2020, p. 26). This process allows the patient's medical records to be both accessible and secure.

Providing security, privacy, and availability to EMR records continues to be a challenge, especially since the patient often loses control over their medical records after data publication. The de Oliveira et al. (2019) study also examined blockchain by proposing a blockchain-based approach to secure EMR records where access control is patient-centric. The de Oliveira et al. research proposal keeps encrypted EMRs in the blockchain, and the patient can only share the decryption key with the healthcare or provider of their choice. Blockchain technology allows untrusted nodes in a distributed peer-to-peer network to interact with each other correctly and verifiably without any reliable intermediary. The de Oliveira et al. study investigated the scalability of the blockchain approach through simulations, ultimately showing the system's scalability with an increasing number of nodes. "EMR management imposes a challenge for preserving privacy while assuring data availability for the authorized peers" (de Oliveira et al., 2019, p. 978).

In a different approach to blockchain technology, O'Donoghue et al. (2018) examined the trade-offs, a compromise between two desirable but incompatible features involved in different

blockchain designs relevant to creating blockchain-based EMR systems. O'Donoghue et al. concluded that multiple trade-offs could be managed adaptively to improve EMR utility. These multiple trade-offs involve improving the security of blockchain systems at the cost of other features, and multiple trade-offs result in improved blockchain scalability. In new EMR implementations, considering these trade-offs will be necessary to the specific environment in which electronic medical records are being developed. “It is important that providers wishing to implement blockchain EMR systems understand the current and future scale of their institution” (O'Donoghue et al., 2018, p. 9).

Patient Portal Access

Patient portals are synonymous with patient engagement, a requirement for community health centers. Unfortunately, research into the use and effects of patient portals is still in its infancy. The patient portal is an essential tool to allow patient access to their personal health information. “Patient portals can provide secure, online access to personal health information such as medication lists, laboratory results, immunizations, allergies, and discharge information” (Dendere et al., 2019, p. 1). When used by the patient, it can be an effective tool to determine medical history, lab results, and prescription needs. In contrast, others offer online communication with their healthcare provider, enhancing patient-provider communication. Research into the availability of a tethered patient portal is a requirement and should be considered when determining which EMR solution to acquire, especially for a community health center.

Health Literacy (HL) and the ability of patients and providers to communicate via secure messaging is another essential communication aspect of the EMR. The Schillinger et al. (2017) study examined the HL of patients and its effect on the patient’s capacity to utilize online communication via secure messaging within the EMR system. The Schillinger et al. study

occurred in two different settings, Kaiser Permanente in Northern California, and the San Francisco Health Network, and included three different aims, to develop and validate an automated Linguistics Complexity Profile (LCP); to access secure message content, employ Natural Language Processing (NLP) indices to develop and validate LCP; and aggregate the selected automatic linguistic indices into a more prominent component. The primary research suggested that patients who access portals are more likely to have better healthcare utilization, prescription adherence, and medical condition control. Furthermore, the research shows that secure messaging is a critical mode of communicating in clinically relevant matters. The Schillinger et al. research concluded that measuring individual HL in a healthcare population is an extremely time-consuming and cost-prohibitive task. The patient LCP proves to be a valid indicator of individual HL and is predictive of health outcomes. Patient-clinician discordance in LCP is found to be prevalent and is associated with suboptimal communication-sensitive outcomes (Schillinger et al., 2017, p. 6).

Electronic communication between the patient and the provider, or the patient's care team, is extremely valuable to the overall patient's healthcare outcome. The ability of the patient to interact with the healthcare provider creates a measure of communication, helping the patient to enhance their healthcare utilization, prescription adherence, and medical condition control. The EMR's patient portal gives patients access to their healthcare team, health records, lab results, medication lists, and immunization records. The availability of medical records allows the patient to enhance self-care, providing better healthcare outcomes if the patient's health HL is at the required levels. "HL can restrict online communication via Secure Messaging (SM) because patients' literacy skills must be sufficient to convey and comprehend content while clinicians must encourage and elicit communication from patients and match patients' literacy level" (Schillinger et al., 2017, p. 1).

Leroy and Dupuis (2014) also examined the access and utilization of medical records by analyzing the impact of patients accessing their EMR. Leroy and Dupruis focused their research on 26 articles about patients accessing their EMR via the Internet (p. 11). The articles indicate that patients are interested in access to their EMR, while providers are more hesitant due to privacy and security concerns. Leroy and Dupuis found that physicians seem more nuanced and agree with patients on the positive impacts such as better knowledge of their health status and a more active role, getting better care due to accurate information in the record, enhanced confidence in their provider, more effective use of the time during the consultation, and a better understanding of what had been said during consultations. Leroy and Dupuis also found that patients with the ability to access their EMR have a feeling of control or ownership of their data. "Patient-accessible medical record is an important element of evolution in the patient-physician relationship: patients want to become more active in their health care process" (Leroy & Dupuis, 2014, p. 9). The patient's right to decide when they access their record plays a huge role in the feeling of ownership and control.

Like Leroy and Dupuis, van der Vaant et al. (2014) measured the use, satisfaction, and impact of a web portal that provides patients access to medical records. A pretest-posttest study was conducted among 360 patients to measure the impact of the portal, patients' satisfaction with care, trust in their rheumatologist, self-efficacy in patient-provider communication, illness perceptions, and medication adherence (p. 1). The posttest included questions on portal use, satisfaction, and self-perceived impact due to portal use. The van der Vaant et al. research found that 54% of respondents with Internet access had viewed their EMR and that respondents were optimistic about the ease of use and usefulness of the portal and reported very few problems (p. 1). Of the respondents who had logged into the portal, 44% reported feeling more involved in their treatment, and 37% felt they had more knowledge about their treatment (p. 1). The research

also found that significant differences over time were not found in the empowerment-related instruments. “Offering patients home EMR access, therefore, appears to be a valuable addition to the care process” (van der Vaant et al., 2014, p. 1). Although its true impact is difficult to grasp, the current portal succeeded in offering patients access to their EMR in a usable and understandable way, and a relevant portion of the patients felt more involved in their treatment due to the web portal.

The Dendere et al. (2019) literature review analyzed EMR patient portals in inpatient settings, their patient engagement role, and their impact on healthcare delivery to determine best practices and to successfully implement the EMR technology. The Pubmed, CINAHL, and Embase databases were searched for articles published between 2005 and 2017 using keywords related to patient engagement, electronic health records, and patient portals (p. 1). The articles were required to be in English, in a hospital inpatient setting, and include inpatient portals tethered to an EMR. The initial database search resulted in 703 articles, with an additional 16 identified by scanning the article reference lists (p. 1). After excluding duplicates and articles not meeting the inclusion protocol, 40 articles were selected (p. 1). After additional database searches, 18 more articles were included, for a total of 58 articles (p. 1). The themes of the articles were categorized and placed into 14 categories (p. 1). “The results suggest that the evidence for inpatient portals is currently immature” (Dendere, 2019, p. 1). The study suggested that additional research is required to understand the impact of patient portals.

EMR Availability

Communication within the community health center is vital, especially when the technology that hosts the EMR, or the data within the EMR itself, is unavailable, either due to a planned maintenance window, failed hardware, or data corruption. All electronically based technology systems will fail. The question is not if, but when. The Walsh et al. (2019) research

examined strategies in EMR downtime planning to identify themes and discuss downtime planning in a clinical setting. Four articles met the study's inclusion criteria and were analyzed for common themes and findings (p. 449). Walsh et al. discovered four common themes during the review, communication plans, procedure review and revision, managing system availability, and preparing staff for handling incidents. The Walsh et al. research concluded that healthcare facilities utilizing an EMR must have comprehensive downtime plans, ensuring continuity of patient care during downtime or periods of limited availability. Furthermore, the comprehensive downtime plans should include these strategies, creating a framework for organizational procedures, and ensuring the best possible access to vital patient information before, during, and after recovering from an EMR downtime event (p. 449).

Community health centers that utilize an EMR system must have procedures in place during a system outage to ensure patient continuity of care. "Downtime planning includes strategies to reduce the likelihood of unplanned outages or mitigating the effects of unplanned outages with backup and redundant systems to manage availability" (Walsh et al., 2019, p. 454). The healthcare facility must have backup and redundant systems to help mitigate downtime. Furthermore, clinicians must have procedures that allow for the continuation of care, and the ability to capture medical records, to be incorporated into the EMR after the recovery.

EMR Data Analytics

Today's EMRs and Internet-attached medical devices are generating volumes of data that are large in nature, extremely complex, and next to impossible to capture or process for the traditional medical facility. Once this data is processed, analyzed, and interpreted, it creates a wealth of information about the patient's health and possible diagnoses. The ability, or inability, to harness this great wealth of information creates great disparity among those in the medical

field. The ability to analyze and communicate this vital information to the patient will in turn, create better patient health outcomes.

Big Data Analytics

Big data analytics supply solutions that meet the increasing demand of healthcare centers to employ thorough real-time data, consolidate patient medical records, and acquire information from patient medical devices to reinforce evidence-based medicine. Donovan (2018) affirmed that evidence-based medicine in the small data age was effective but was affected by its insistence on samples, data quality, and condensed statistics. However, big data methods concentrate more vigorously on the patient, therefore assisting medicine in fortifying its human touch. The Donovan research reviewed recent literature concerning how hospital care routines can be improved through utilizing big data analytics. The study performed analyses and made estimates regarding the relationship between digital health and data analytics, the global digital health market, and U.S. hospital adoption of patient engagement functionalities. “Electronic health records and administrative data are primary sources, but broader series of information inputs are progressively accessible to advance more substantial exposomes for each individual” (Donovan, 2018, p. 38). Donovan maintained that big data analytics could recognize comparable patient clusters, generating various phenotypes within each disease entity.

Machine Learning Technology

When employed correctly, Natural Language Processing (NLP) can be utilized to derive admission criteria from the EMR notes and identify patients suitable for clinical trials. NLP can analyze medical literature and can refashion years of archives and EMR records. “Natural language processing (NLP) can produce important input from unstructured data in the particular sphere of the categorization of incident reports and adverse events” (Costea, 2020, p. 93). Costea (2020) looked to develop a conceptual framework based on a systemic and comprehensive

literature review on the relationship between machine learning-based natural language processing algorithms and EMR data. Costea analyzed and estimated the benefit of leveraging natural language processing for healthcare organizations. “Interpretation of big data by machine learning provides relevant upsides for incorporation and assessment of huge volumes of elaborate health care information” (Costea, 2020, p. 94).

Data Extraction

The EMR can potentially improve the safety, quality, and efficiency of healthcare. The van Velthoven et al. (2016) study assessed information governance procedures for extracting data from EMR systems in 16 countries; and explored the extent of EMR adoption and the quality and consistency of EMR data in seven countries, using the management of type 2 diabetes patients as an exemplar. Van Velthoven et al. conducted a literature review and completed structured interviews with 59 stakeholders, including 25 physicians, 23 academics, seven EMR providers, and four information commissioners (p. 86). The van Velthoven et al. study found that procedures for information governance, levels of adoption, and data quality varied across the countries studied. Furthermore, the required time and ease of obtaining approval also vary widely. “While some countries seem ready for secondary uses of data from EMR, in other countries, several barriers were found, including limited experience with using EMR data for research, lack of standard policies and procedures, bureaucracy, confidentiality, data security concerns, technical issues and costs” (van Velthoven et al., 2016, p. 86).

Patient Analytics

Although medical data analytics are commonplace in EMRs, the ability to visualize information for a single patient is only sometimes available. The Schrodt et al. (2020) systematic literature review investigated the frontiers of the current research in graphs representing and processing patient data. The researchers analyzed 11 out of 383 articles in this literature review.

Schrodt et al. found that most articles use graphs to represent temporal relations, often representing the connection among laboratory data points; however, only two papers reported that the graph data were further processed by comparing the patient graphs using similarity measurements. Schrodt et al. found that graphs representing individual patients are seldom used in the research context. Only 11 papers considered such kinds of graphs in their investigations. "The potential of graph theoretical algorithms, which are already well established, could help with increasing this research field, but currently there are too few papers to estimate how this area of research will develop" (Schrodt et al., 2020, p. 1). Schrodt et al. contend that using such patient graphs could be a promising technique to develop decision support systems for diagnosis, medication, or therapy of patients using similarity measurements or different kinds of analysis.

Summary

The EMR will continue to influence patient-provider and inter-professional communication within community health centers. However, implementing and utilizing the EMR properly is vital to enhancing these communication channels. This literature review defines the issues associated with bringing technology into the exam room and offers some solutions to enhance communication in community health centers utilizing an EMR. More in-depth research is required to identify further the areas within the community healthcare center that are negatively impacted by the EMR and what changes are required to improve this vital communication. The quality of patient care and improving patient outcomes are deeply affected by this process, and the confidentiality, integrity, and availability of health records are essential.

CHAPTER THREE: METHODOLOGY

Overview

Qualitative, quantitative, and mixed-method research approaches can all be effective methodologies utilized to study the effects of EMR on communication. As a majority of the available literature depicts, research, to date, has focused on inter-professional communication, EMR implementation, EMR utilization, and EMR availability. Although significant, previous research, for the most part, has overlooked how the EMR impacts patient-provider communication. This study examined patient-provider communication, and the quantitative paradigm was used to examine the phenomenon. Chapter three discusses the design for the research, the research questions and hypotheses, the participants and setting, instrumentation, procedures, and data analysis.

Institution Review Board and Site Approval Process

The application for this study, *Effects of EMR on Community Health Center Communication,* was completed, certified, and submitted to the Liberty University Institution Review Board (IRB) on December 2, 2021. The Liberty University IRB requested initial corrections to the application on January 5, 2022. The application revisions were considered, and the corrected IRB application was completed on January 5, 2022, with the IRB application being re-certified on January 6, 2022. The Liberty University IRB analyst confirmed that a HIPAA review of the application would not be required. The IRB application for the study received stamped approval on January 20, 2022 (see Appendix A). The IRB process took approximately six weeks from application to final approval. The preliminary research site approval occurred on March 9, 2022, and full site approval occurred on March 21, 2022.

Design

A quantitative survey was developed for this research, investigating the experiences and perceptions of patients during their most recent healthcare encounter at the community health center. A packet including the recruitment letter and the IRB consent letter was created for use during the participant recruitment process. A research invitation card was created, allowing those patients who consent to the survey to obtain the associated URL or QR code included on the invitation to gain immediate access to the online survey. Paper surveys (see Appendix D) with the attached IRB consent (see Appendix C) were also printed and placed on clipboards in the reception area of the clinic, allowing patients without Internet access or without access to personal technology devices, such as computers, tablets, or smartphones, a vital segmentation for this study, to participate.

The quantitative questionnaire, consisting of 28 total questions, was administered through SurveyMonkey.com. The survey design effectively focused on any possible communication barriers and benefits of utilizing technology and the EMR during a physician encounter and took an average of nine minutes for completion. The survey utilized a correlation research design, which "aims to determine whether two or more variables are related and if so, to discover the nature of the relationship" (Bloomfield & Fisher, 2019, p. 29). The survey looked to establish the correlation between patient-provider communication and the use of technology, the EMR, in a physician encounter. The findings from the correlational study were expressed using statistics, and can be explained in three ways, a positive correlation, negative correlation, and no correlation, successfully testing the study's three hypotheses (Bloomfield & Fisher, 2019). The survey also collected demographic data identifying the gender, race, ethnicity, education, employment status, and age of all participants.

Methodologies from Previous Literature

In previous research examining the effects of the EMR on communication, qualitative and quantitative paradigms have been effectively utilized to study this communication phenomenon. Qualitative research, even though it allows the researcher to delve deeper into any given question or questions surrounding the phenomenon, limits the number of participants due to the requirements and demands associated with this type of research. Therefore, for this study's population (N=5,101) and sample size (n=513) required by this research, it would not be feasible to interview the hundreds of participants or include an adequate number of patient participants in focus groups. Since little research has been completed examining the impact of the EMR on patient-provider communication, the quantitative paradigm permitted this study to examine a much larger sample of patients, more thoroughly examine the population, and answer the research questions associated with this research. Therefore, this study utilized the quantitative paradigm exclusively.

Previous Literature Utilizing the Qualitative Paradigm

The qualitative paradigm in research most often begins with a wide field of interest and uses research to interpret and establish significance (Terrell, 2016). Qualitative research collects and analyzes non-numeric data, providing detail and insight into the study's results. There are five different approaches that a researcher can exert for a qualitative study: narrative research, phenomenological research, grounded theory research, ethnographic research, and case study research (Creswell & Poth, 2018). In an abbreviated review of literature, a qualitative methodology was used in research by Lynot et al. (2012), Alkureishi et al. (2016), and Lamer et al. (2018). The Lynott et al. study explored various clinician health record training programs. Lynott et al. utilized a focused ethnography approach to observe three health systems' EMR

training systems. The fundamental challenge to ethnography research design is the need to understand the concepts associated with cultural anthropology (Creswell & Poth, 2018).

Utilization of the Literature Review

The Alkureishi et al. (2016) research utilized a literature review. Alkureishi et al. sought to understand the impact of EMR use on patient-provider relationships and communication. Alkureishi et al. reviewed 7,445 studies and chose 53 that met their research criteria, including behavioral analysis (28) and patient perception (25) surveys. Lamer et al. (2018) also utilized the qualitative approach to describe the framework developed to structure the operation of an anesthesia data warehouse for research. To accomplish their goal, Lamer et al. used semi-structured meetings to gain an understanding of the physicians, determining background and variables originating from a review of literature, and a second meeting to determine the types of results that the physicians wished to see in the EMR.

Previous Literature Utilizing the Quantitative Paradigm

Quantitative research is an approach for testing objective theories by examining the relationship among variables and consists of either a survey or experimental design (Creswell & Creswell, 2018). “A survey design provides a quantitative description of trends, attitudes, and opinions of a population, or tests for associations among variables of a population, by studying a sample of that population” (Creswell & Creswell, 2018, p. 147). In the experimental design, one or more variables are systematically manipulated to evaluate the impact on an outcome (Creswell & Creswell, 2018). Mollart et al. (2021), Mills et al. (2015), Pamplin et al. (2020), and Arndt (2017) utilized the quantitative paradigm for their research. To investigate a third-year undergraduate nursing student’s perception of an EMR, Mollart et al. utilized a student survey. Like Mollart et al., Mills et al. utilized pre- and post-implementation surveys to evaluate changes in nurses’ perceptions of a consolidated EMR solution.

Although Pamplin et al. (2020) and Arndt et al. (2017) utilized the quantitative paradigm, they used a different approach. Pamplin et al. used both a survey and an experiment for their research. To examine improving clinician decisions and communications in critical care, Pamplin et al. utilized a simulation to modify one of the variables in the study. The Pamplin et al. study then followed up with a survey of the clinicians. Arndt et al. utilized EMR logs to assess the time allocated by primary care physicians with the EMR during direct patient care and non-face-to-face activities.

Methodology for this Research

Both qualitative and quantitative approaches can be effective methodologies for studying the effects of EMR on communication. However, most of the available literature shows that a majority of the available research focuses on physicians, healthcare teams, and specialists. This research into the effects of the EMR on patient-provider communication within the community health center examined the phenomenon in much greater detail. To effectively accomplish this goal, the research utilized a random sample quantitative patient survey of more than 10% of the annual patient population, along with providers, healthcare teams, behavioral health, dental, and pharmacy staff who are also patients of the community health center. The availability and accessibility of these populations gave great insight into the effects of EMR on communication. The results of the surveys and the detailed analysis allow for a deeper understanding of the utilization of the EMR in the community health center environment. Dependent upon the demographics of future research sites, the findings of this research are generalizable, and this research has provided considerable depth to the literature available.

Research Questions

Multiple research questions were created for the research topic, Effects of Electronic Medical Records (EMR) on Health Center Communication. The study was designed to answer the following:

RQ1. How does the utilization of the EMR affect patient-provider communication within the community health center?

RQ2. What communication barriers are created when bringing technology, and the EMR, into the physician encounter?

Hypotheses

$H1_0$: The use of an EMR will have no effect on patient-provider communication within the community health center.

$H1_1$: The use of an EMR will have a positive effect on patient-provider communication within the community health center.

$H1_2$: The use of an EMR will have a negative effect on patient-provider communication within the community health center.

Participants and Setting

The participants of this study included active patients of the community health center who were 18 years of age or older and had seen their primary physician within the previous 12 months. This population included 5,101 patients of the community health center. Due to the primarily homogenous nature of the total population of the community health center, the sample was not stratified. Simple random sampling was utilized to identify patients fitting the study's criteria until at least 510 (10%) patients had successfully completed the survey. Once the study reached this desired threshold, the survey was closed. The survey was open from April 5, 2022, until August 31, 2022, when 513 surveys were successfully completed, exceeding the study's

threshold. To achieve a confidence level of 95% with a 5% margin of error, the required sample size for the survey would need to exceed 358 completed surveys. For a confidence level of 98% and a 5% margin of error, the goal for this research, 491 successfully completed surveys were required. The number of successfully completed surveys exceeded this goal, reducing the margin of error for this research. Those who agreed to participate in this research were asked to read and consent to the terms (see Appendix C), were informed of their right to privacy, and notified that their personal health information (PHI) is protected by the Health Insurance Portability and Accountability Act of 1996 (HIPAA).

Instrumentation

This study required a single type of collection instrument, a survey. The benefits of utilizing a survey instrument for this research are fourfold. Surveys are relatively inexpensive, having a relatively small cost per respondent; are useful in describing the characteristics of a large population; can be administered in many modes, including online surveys, paper surveys, email surveys, and social media surveys; and allow respondents to answer with more candid and valid answers (DeFranzon, 2020).

The quantitative survey was cross-sectional by design, examining data from the population at one specific moment in time. Multiple survey question types were utilized on the survey, including Likert scale and open-ended questions. The Likert scale used a 5-point scale using the following range: 1 strongly disagree, 2 somewhat disagree, 3 neither agree nor disagree, 4 somewhat agree, and 5 strongly agree. Other Likert scale ranges included: 1 not very important, slightly important, important, very important, and extremely important. Data items were not collapsed into scales. Since the survey was designed using the 5-point Likert scale from the inception of the survey, collapsing the scale could have resulted in data scales that were not

properly tested and possibly skewing the data analysis from that of the preferred participant reactions.

Survey Monkey was ultimately chosen to execute the survey due to its ease of use, accessibility, and ability to export the collected data into IBM SPSS Statistical software. The finalized survey consisted of 28 questions, taking the participant, on average, 9 minutes to successfully complete. Patients were notified of the survey instrument in two distinct ways, passively through the placement of research invitations in the community health center reception area and actively through a researcher offering either the research invitation or a paper survey to the population. Although most patients were receptive to taking the survey, only a few used the URL link or QR code to access the survey. Due to the poor reception of the initial passive recruitment and underutilization of the URL and QR code, a more active approach was used to increase recruitment, resulting in a substantial increase in completed surveys. During the active recruitment, patients who agreed to participate in the survey were given a paper copy of the survey on a clipboard. Patients were much more receptive to completing the survey in its paper form.

The survey was tested via a pilot process which effectively field-tested the quantitative survey. The pilot process used an emailed link to the online survey instrument soliciting community health center staff members, who are also patients of the clinic and had seen their healthcare provider in the previous 12 months, to participate in this research. Of the clinical staff receiving the email, 44 (85%) successfully completed the survey instrument. The results were collected, analyzed, and tested, verifying that the survey was working correctly and that the data was accurately being recorded. To ensure the reliability of the Likert scale questions on the survey, a Cronbach's Alpha, α, or coefficient alpha, was performed in IBM SPSS (see Table 1). "Cronbach's Alpha was developed to meet the need of finding an objective way of measuring the

internal consistency reliability of an instrument used in a research work" (Adeniran, 2019, p. 2). The results of the reliability tests show an alpha score of 0.873 for scales in question 13 of the survey, 0.879 for scales in question 14, 0.934 for scales in question 15, 0.843 for scales in question16, and an alpha score of 0.898 for scales in question 22 of the survey. To better understand these scores, alpha scores ≥ 0.9 are most often associated with excellent internal consistency, alpha scores ≥ 0.8 are associated with good internal consistency, and alpha scores ≥ 0.7 are associated with acceptable internal consistency.

Table 1

Cronbach's Alpha Reliability Statistics (After Survey Test)

Survey Questions	Cronbach's Alpha	N of Items
Q13 a, b, c, d	.873	4
Q14 a, b, c, d, e, f, g	.879	7
Q15 a, b	.934	2
Q16 a, b, c, d, e	.843	5
Q22 a, b, c, d, e, f, g, h, i	.898	9

Variables

In analytical research, there are generally two types of variables, independent and dependent variables, but other variables exist. Independent variables are what we expect will influence dependent variables, while a dependent variable is what happens as a result of the independent variable (NIH, 2020). Flannery et al. (2014) define a variable as something that takes on different values; it is something that varies (p. 162). Independent variables can be considered the cause, and therefore their value is independent of other variables of the study (Thomas, 2020). The dependent variable can be considered the effect, with its value being variant upon the independent variable (Thomas, 2020). In this study, the independent variable is the EMR, or the use of the EMR, in the community health center during a physician encounter. The dependent variable, therefore, is patient-provider communication. The survey utilized these

variables, both independent and dependent, in the survey questions, answering the research questions of the study.

Procedures

Before beginning the research, the survey and the survey questions were endorsed by the Liberty University IRB, the community health center HIPAA compliance officer, the community health center leadership team, and the executive director. The full consent of the participants was obtained before being allowed to complete the survey. The study was closed after 513 patients had successfully completed the survey, surpassing the threshold of 10% (510) of the community health center population. All successfully completed surveys in excess of the 500-survey threshold effectively increased the confidence level and decreased the margin of error for the research.

Data Analysis

The online quantitative survey was designed to preclude data entry errors, require questions to be answered, and utilize masks to ensure proper format, ensuring the validity of the collected data. Multiple patients within the same household were given the opportunity to participate as long as each participant met the criteria for the research.

The Survey Monkey survey instrument's dashboard visualized the results of the survey in real-time and allowed for the export of survey data into IBM SPSS Statistical software for further analysis. The data from the surveys were descriptively and inferentially analyzed to answer the research questions and test the study's hypotheses (see Chapter 4 and Chapter 5). Since Likert-type scales were utilized on the survey instrument, Cronbach's Alpha coefficient was calculated for internal consistency reliability on all scales of the study (Joseph & Rosemary, 2003). The Cronbach's Alpha analysis was generated on the summated scales and not on

individual items. The data from the open-ended questions were coded and analyzed to find common themes and key phrases.

Response Bias

Response bias, or the various conditions that bias or influence survey responses, can be an immense concern with survey responses. Response bias comes in multiple forms, including demand bias, when respondents change their behavior and opinions as a result of taking part in a survey; social desirability bias, when participants answer questions with socially desirable answers instead of their own; extreme response, where respondents provide extreme answers to questions; neutral responding, where respondents choose the neutral answer every time; acquiescence bias, where participants respond in agreement with all questions on the survey; and dissent bias, where the participant disagrees with every statement on a survey (Johnson, 2021). All survey results were individually checked to minimize response bias in any of the survey results.

Descriptive Analysis

Descriptive statistics were used to analyze the results of the survey data. There are multiple steps involved when conducting a descriptive analysis. The first step was to describe the size of the sample. Next, the center of the data was analyzed using the mean as the standard measure for the distribution of the survey data. Furthermore, tables and bar charts were created to effectively analyze and visualize the data (see Chapter 4).

Inferential Analysis

Whereas descriptive analysis describes the data, inferential analysis uses the data to predict or infer the results from the population. Inferential data was utilized for hypothesis testing for the research. Post hoc testing, chi-square, and cross-tabulations were completed on the research data making predictions on the population. Therefore, the inferential statistics

determined that the findings had a meaningful result and determined which hypothesis was the most appropriate (see Chapter 5).

Assumptions

Since the staff of the community health center is supportive of providing the best care possible to their patients, it is assumed that they were truthful in their disclosure of the effects of the EMR on communication in the exam room.

Since the patients of the community health center are interested in the best possible care and the best health outcome possible, it is assumed that they were truthful in their disclosure of the effects of the EMR on communication during their office visits.

Summary

Across the globe, EMR systems are implemented to improve healthcare communication between patients and physicians and physicians and care teams; however, healthcare professionals report that the EMR often creates communication barriers. The purpose of this research, *Effects of EMR on Community Health Center Communication*, was to explore the impact of EMRs on community health center communication, in effect, examining patient-provider communication. A cross-sectional quantitative survey was employed, examining data from the population at one specific moment in time. Simple random sampling was utilized, identifying patients fitting the study's criteria until at least 510 (10%) of the community health center's patients had successfully completed the survey. The 513 completed surveys exceeded the threshold (358) necessary to achieve a confidence level of 95% with a 5% margin of error and exceeded the threshold of 491 successfully completed surveys required to achieve a confidence level of 98% with a 5% margin of error. Furthermore, the 513 completed surveys decrease the margin of error for this research to 4.88% at a 98% confidence level. The survey questions were designed to answer the following research questions, how does the utilization of

the EMR affect patient-provider communication within the community health center, and what communication barriers are created when bringing technology, and the EMR, into a physician encounter? The findings from this correlational study were analyzed to determine either a positive correlation, a negative correlation, or no correlation, successfully testing the study's three hypotheses. Furthermore, these findings, dependent upon demographics, are generalizable and provide considerable depth to the literature available.

CHAPTER FOUR: FINDINGS

Overview

The purpose of this research was to explore the effects of EMRs on community health center communication by examining patient-provider communication. The study was designed to answer the following research questions:

RQ1. How does the utilization of the EMR affect patient-provider communication within the community health center?

RQ2. What communication barriers are created when bringing technology, and the EMR, into the physician encounter?

The participants of this study included patients of the Northwest Community Health Center (N=5,101) (August 2021 to August 2022) who were 18 years of age or older and who had seen their primary care physician within the last 12 months. The U.S Census Bureau (2021) estimated the 2021 population of Lincoln County, Montana, who are 18 years of age and older to be 16,727. Therefore, one-third (30.5%) of the Lincoln County population, 18 years and older, use Northwest Community Health Center for their healthcare needs. A random sampling was used to identify at least 510 (10%) patients to determine the effects of the EMR on community health center patient-provider communication. The survey opened on April 5, 2022, and was closed on August 31, 2022. The sample includes 513 participants who successfully completed the survey during this time. A participant was disqualified from the research if they did not meet the requirements of the research. Participants with incomplete or disqualified surveys were removed from the sample. To achieve a confidence level of 98% with a margin of error of 5%, the goal of this research, 491 successfully completed surveys were required. Therefore, this study's sample of 513 effectively drops the margin of error for this study to 4.88%.

Descriptive Statistics

The first area of this descriptive statistics section presents the analysis of the community health center's sample demographics. Gender, age, ethnicity, level of education, and employment status were captured. Of the 513 participants, 277 (54%) were female, 235 (45.8%) were male, and one participant did not answer the question (see Table 2). The ages of the participants were widely distributed from the 18 to 24 age group to the 75 and over age group (see Table 3). Over half (56.6%) of the participants were aged 45 or older, with three-quarters of the participants (76.9%) being 35 years of age or older. The median age of the participants in this study is approximately 49.2 years of age. The vast majority of the participants (94.5%) reported being white, with 3.7% being Hispanic or Latino, 1.2% being Native American or Alaskan Native, and a small percentage of the remaining participants identifying as Native Hawaiian or Pacific Islander (0.6%), African American (0.4%), Asian-Eastern (0.2%), Asian-Indian (0.2%), or other ethnicities (0.8%) (see Table 4). The ethnicity of the participants closely approximated the ethnicity of individuals living in Lincoln County, Montana. In 2021, Lincoln County's population was estimated to be comprised of 94.5% white, 3.5% Hispanic or Latino, 1.3% Native-American or Alaskan Native, 0.5% African American, 0.5% Asian, and 0.1% Native Hawaiian or Pacific Islander (U.S. Census, 2021).

Table 2

Gender

	N	%
Male	235	45.8%
Female	277	54.0%
Missing	1	0.2%

Table 3

Age

	N	%
18-24	26	5.1%
25-34	93	18.1%
35-44	104	20.3%
45-54	81	15.8%
55-64	102	19.9%
65-74	58	11.3%
75 and over	49	9.6%

Table 4

Ethnicity

	N	%
White	485	94.5%
Asian – Eastern	1	0.2%
Asian – Indian	1	0.2%
Hispanic or Latino	19	3.7%
African American	2	0.4%
Native American or Alaskan Native	6	1.2%
Native Hawaiian or Pacific Islander	3	0.6%
Other	4	0.8%

Level of education and current employment status demographics were also recorded by the survey. Of the 513 participants, 36.7% had never completed the requirements for their diploma, held a High School Diploma, or had obtained a GED; 32% had some college; 23% had completed an undergraduate degree; and 7.8% held a graduate degree (see Table 5). Of these participants, three chose not to answer the question. The U.S. Census Bureau (2021) reports that 19.7% of the population living in Lincoln County had a bachelor's degree or higher, which mirrors the 19.9% of participants in this study holding a bachelor's or higher degree. When

asked about the status of their employment, half (50.9%) reported they were employed full-time, 10.1% were employed part-time, and 1% held contract or temporary positions (see Table 6). One-third (37.6%) of the respondents reported their status as unemployed, with 8.4% seeking opportunities for employment, 7.6% being disabled, and 21.6% being retired.

Table 5

Level of Education

	N	%
Less than high school	26	5.1%
High school diploma or GED	162	31.6%
Some college	164	32.0%
Associate's (2 year) degree	56	10.9%
Bachelor's (4 year) degree	62	12.1%
Master's degree	29	5.7%
Doctoral degree	11	2.1%
Missing	3	0.6%

Table 6

Current Employment Status

	N	%
Employed Full-Time	261	50.9%
Employed Part-Time	52	10.1%
Contract/Temporary	5	1.0%
Seeking Opportunities	43	8.4%
Unable to Work/Disabled	39	7.6%
Retired	111	21.6%
Missing	2	0.4%

Patient Experience with Healthcare Appointments

The next section of the survey examined the participants' experience with healthcare appointments at the community health center. Table 7 shows the number of appointments each of

the participants kept at the community health center during the previous year. Nearly half (47.2%) of the participants had 4 to 6 appointments, 25.5% had 7 to 12 appointments, 10.5% had more than 12 appointments, 5.5% had 1 to 3 appointments, and 11.3% were not sure of the number of appointments that they had kept during the previous year. The approximate mean was 6.35 appointments to see community health center providers per participant over the previous year. Of these appointments, 81.5% of the participants reported that they either always saw their primary care physician or saw their primary care physician most of the time (see Table 8). Only 11.3% were unable to see their primary care physician regularly, and 11.3% were not sure. Results in Table 8 reflect that the patients were most likely familiar with their care provider and their provider's habits of accessing the EMR during their healthcare appointment.

Table 7

In the past 12 months, how many times have you been to the Northwest Community Health Center for a healthcare appointment?

	N	%
1 to 3 times	28	5.5%
4 to 6 times	242	47.2%
7 to 12 times	131	25.5%
More than 12 times	54	10.5%
Don't Know	58	11.3%

Table 8

Of those visits to the Northwest Community Health Center for healthcare, how often did you see a provider other than your primary care physician?

	N	%
Always saw my primary care physician	218	42.5%
Saw my primary care physician most of the time	200	39.0%
Saw other healthcare providers more than my primary care physician	52	10.1%
Was unable to see my primary care physician	6	1.2%
Don't Know	37	7.2%

Impact of COVID-19

Since this research was conducted during the COVID-19 pandemic, it was essential to understand if the number of visits to the community health center had been impacted by the pandemic (see Table 9). Two-thirds of the participants (63.0%) reported that their number of visits to the clinic was not impacted by COVID-19. Furthermore, only 10.1% stated that their healthcare visits either increased or decreased significantly during this timeframe. Only 6.2% of the participants were unsure of the impact COVID-19 had on their number of healthcare visits. Understanding that 83.7% of the participants felt little, if any, impact on the number of healthcare visits due to COVID-19 helps ensure the generalizability of the research compared to if this study had been conducted outside of the time of the pandemic.

Table 9

How did the COVID-19 pandemic impact the number of healthcare visits you made to the Northwest Community Health Center?

	N	%
My number of healthcare visits increased slightly	38	7.4%
My number of healthcare visits increased significantly	16	3.1%
My number of healthcare visits did not change	323	63.0%
My number of healthcare visits decreased slightly	68	13.3%
My number of healthcare visits decreased significantly	36	7.0%
Don't Know	32	6.2%

Patient Comfort with Technology

When examining the effects of the EMR on patient-provider communication, it is also relevant to establish how comfortable the participants are with modern electronics, especially personal computers, laptops, tablets, and smartphones; as well as their comfort level using the Internet. Of the 513 participants of the study, 83.2% expressed that they use a web-enabled smartphone on at least a daily basis (see Table 10). Only 15.2% have not used a smartphone. Use

of the personal computer and/or laptop is also prevalent in the sample. Approximately one-third (30.2%) have not used either a personal computer or a laptop, with 43.9% mentioning that they use a personal computer or a laptop daily. Nearly one-third (31.4%) of the participants used a tablet or iPad-type device daily; however, approximately half (48.3%) have never used this type of device. When asked what activities the participant of the study perform regularly on the Internet, 62.8% have conducted banking, bill payment, stock purchases, or other financial transactions (see Table 11). Nearly three-quarters (72.1%) of the participants have shopped on the Internet, while two-thirds (67.3%) have accessed social media. However, it is important to note that almost one in five (19.3%) participants of the study have not utilized the Internet for any of these everyday tasks.

Table 10

How often have you used any of the following?

	Daily	Weekly	Monthly	Have Not Used	Mean
Personal Computer/laptop	43.9%	11.9%	14.0%	30.2%	2.31
	225	61	72	155	
Tablet/iPad device	31.4%	10.1%	10.1%	48.3%	2.75
	161	52	52	248	
Web-enabled mobile phone	83.2%	1.6%	0.0%	15.2%	1.47
(smartphone	427	8	0	78	

Table 11

Thinking outside of healthcare now, which of the following activities do you regularly do on the Internet? [CHOOSE ALL THAT APPLY]

	N	%
Banking, bill payment, stock purchases, or other financial transactions	322	62.8%
Shopping (e.g., Amazon, eBay, individual store sites, etc.)	370	72.1%
Access social media (e.g., Facebook, YouTube, TikTok, etc.)	345	67.3%
Selling items on eBay or other auction sites	84	16.4%
None of the above	99	19.3%

Patient Preferences

The next section of questions examined the use of the EMR and the participants' preferences towards the use of the EMR. Only three-quarters (77.2%) of the survey participants realized that the community health center utilizes an EMR (see Table 12). One-quarter of the respondents were not sure if either an electronic or paper version of their medical chart was being used by the community health center, and 1.4% inaccurately perceived that their healthcare provider used a paper chart. Table 13 presents the participant's preference for the use of either a paper or electronic chart. Over half (54.4%) of the participants had no preference, 31.2% preferred an electronic chart, while 14.4% preferred a paper chart. Of the participants that preferred an electronic chart, being easier, ease of access, and availability of records were the most common responses. Figure 2 presents a word cloud representing why some participants preferred electronic charts and the number of times those responses appeared on the survey.

Table 12

Does your healthcare provider currently use an electronic/computerized medical record (EMR) or a paper chart?

	N	%
Electronic medical record	396	77.2%
Paper chart	7	1.4%
Don't Know	110	21.4%

Table 13

Which type of chart would you prefer that your medical provider use?

	N	%
Electronic medical record	160	31.2%
Paper chart	74	14.4%
I have no preference	279	54.4%

Figure 2

For what reason(s) would you prefer that your doctor use an electronic medical record?

EMR Access During Physician Appointments

Determining the patient's perceptions of whether the provider accessed the EMR or the patient's electronic records during an office visit is also significant to this study. Most (91.8%) of the participants recalled that the provider used a computer, laptop, and/or mobile phone during the exam (see Table 14). Less than 2% (1.9%) did not recall any electronic devices being used during the exam, while 6.2% of the participants did not know. Furthermore, 87.1% of the participants recalled that the provider accessed their health record, while 1.4% said their health record was not accessed, and 11.5% were unsure (see Table 15). Of those participants that stated their health record was accessed during the office visit, 42.5% said their health records were accessed throughout the office visit, 18.1% recollected their health record being accessed once or twice, while 13.6 said the provider accessed the health record only at the beginning or at the end of the office visit (see Table 16).

Table 14

Did your healthcare provider use any of the following during your last office visit/medical exam?

	N	%
Computer/laptop	411	80.1%
Mobile phone	3	0.6%
Both a computer and a mobile phone	57	11.1%
Neither a computer nor a mobile phone	10	1.9%
Don't Know	32	6.2%

Table 15

Did your healthcare provider access your electronic medical record or use a computer during your last office visit/medical exam?

	N	%
Yes	447	87.1%
No	7	1.4%
Don't know	59	11.5%

Table 16

How often did your healthcare provider access your electronic medical record or use a computer during your last office visit/medical exam?

	N	%
Only at the beginning or end of the office visit/medical exam	70	13.6%
Once or twice during the office visit/medical exam	93	18.1%
Throughout the office visit/medical exam	218	42.5%
Don't know	66	12.9%

Patient Utilization of the EMR and the Internet

It is also relevant to this research to identify if the participants actively track their health records, and if so, by what means they track their health records. Half (50.7%) of the respondents recounted that they track their and/or their family's health records (see Table 17). Of those respondents who do track their health records, only half (50.1%) have utilized an online website

or portal to access their EMR (see Table 18). However, less than half of the participants that access their EMR online do so regularly, 30.7% access their EMR once or twice a month, and only 12.7% of respondents access their EMR daily (see Table 19). One-third (33.1%) of the respondents that have accessed their EMR online have only done so once or twice since gaining access. Two-thirds (66.6%) of the participants that access their EMR online setup their access over 1 year ago, with 29.6% gaining access between one and two years ago, 25.3% gaining access three to five years ago, and 11.7% gaining access five or more years ago (see Table 20).

Table 17

Do you currently keep track of your or your family's medical history, either on paper or in a computerized or online record? [SELECT ALL THAT APPLY]

	N	%
Yes, on paper	104	20.3%
Yes, on a personal computer	46	9.0%
Yes, using an Internet site or mobile application	115	22.4%
No, I do not maintain my own health records	248	48.3%

Table 18

Have you ever used a website or web portal to access an electronic medical record maintained by a doctor or hospital?

	N	%
Yes	257	50.1%
No	220	42.9%
Don't know	36	7.0%

Table 19

How frequently do you access an electronic medical record for yourself or a family member?

	N	%
I have only accessed it once or twice	85	33.1%
Once every few months	50	19.5%
Once or twice a month	79	30.7%
Weekly	31	12.1%
Daily	2	0.8%
Don't know	10	3.9%

Table 20

Approximately how long ago did you first start using an online medical record?

	N	%
Within the past 6 months	25	9.7%
6 months to 1 year ago	34	13.2%
1 to 2 years ago	76	29.6%
3 to 5 years ago	65	25.3%
More than 5 years ago	30	11.7%
Don't know	27	10.5%

Of those respondents that have accessed an online EMR, they report that they have done multiple tasks within the website or portal (see Table 21). Those tasks include: check medical records or test results (41.9%); make/confirm an appointment, or schedule a test (24.4%); request a prescription refill (22%); pay medical bills (21.6%); keep track of immunizations and preventive screening tests (19.5%); send a message to a physician or nurse (17.3%); complete paperwork prior to an appointment (14.2%); and monitor fitness activities, diet, or other healthy behaviors (8.4%).

The half (49.9%) of respondents that do not access their EMR online refrain for various reasons (see Table 22). These reasons include, I do not need to access my health information

outside of my doctor's office (34%), I am not very comfortable using computers or the Internet (32%), I prefer to manage my health information offline (19%), I do not know where/how to set up an online health record (18.8%), and I am concerned about the privacy of my medical information (11.3%).

Table 21

Which of the following have you ever done online? [CHOOSE ALL THAT APPLY]

	N	%
Request a prescription refill	113	22.0%
Make/confirm an appointment or schedule a test	125	24.4%
Check medical records or test results	215	41.9%
Send a message to a physician or nurse	89	17.3%
Complete paperwork prior to an appointment	73	14.2%
Look up or manage health information for a child or other family member	85	16.6%
Pay medical bills	111	21.6%
Keep track of immunizations and preventive screening tests	100	19.5%
Monitor fitness activities, diet, or other healthy behaviors	43	8.4%
None of the above	18	3.5%

Table 22

For what reasons have you not tried to use an online medical record? [SELECT AS MANY AS APPLY]

	N	%
My doctor/hospital does not offer an online health record	7	2.7%
I don't know where/how to set up an online health record	48	18.8%
I am concerned about the privacy of my medical information	29	11.3%
I don't need to access my health information outside of my doctor's office	87	34.0%
I prefer to manage my health information offline	49	19.1%
I am not very comfortable using computers or the Internet	82	32.0%
Other (please Specify)	20	7.8%

Scale Reliability

The quantitative survey utilized in this research employed five different question sets that used a 5-point Likert scale to collect respondents' opinions and attitudes towards the utilization of the EMR in a clinical setting. After the data collection process concluded, these Likert scale questions were re-checked for reliability and their internal consistency. To check reliability, a Cronbach's Alpha, α, or coefficient alpha, was performed in IBM SPSS (See Table 23). The results of the reliability tests show an alpha score of 0.757 for scales in question 13 of the survey, 0.938 for scales in question 14, 0.917 for scales in question 15, 0.796 for scales in question 16, and an alpha score of 0.966 for scales in question 22 of the survey. To better understand these scores, alpha scores ≥ 0.9 are most often associated with excellent internal consistency, alpha scores ≥ 0.8 are associated with good internal consistency, and alpha scores ≥ 0.7 are associated with acceptable internal consistency.

Table 23

Cronbach's Alpha Reliability Statistics

Survey Questions	Cronbach's Alpha	N of Items
Q13 a, b, c, d	.757	4
Q14 a, b, c, d, e, f, g	.938	7
Q15 a, b	.917	2
Q16 a, b, c, d, e	.796	5
Q22 a, b, c, d, e, f, g, h, i	.966	9

The five-point Likert scale is an interval scale; therefore, the mean is significant. Means scored from 1 to 1.8 indicates the result being strongly disagree. Means from 1.81 to 2.60 indicates disagree. Means from 2.61 to 3.4 signify neutral. Means from 3.41 to 4.20 represent somewhat agree. And finally, means from 4.21 to 5.0 convey agreement from the participants.

Patients' Attitudes Toward Accessing EMR During Medical Exam

To understand the patients' attitudes toward the providers' utilization of the EMR during an office visit, four questions were asked of the participants (n=477). These questions were answered on a 5-point Likert scale consisting of the following values, strongly disagree, somewhat disagree, neither agree nor disagree, somewhat agree, and strongly agree (see Table 24). For the question, accessing the electronic medical record was important to the office visit/medical exam, the mean of participants' answers was 3.89 or somewhat agree. The mean of participants' answers to accessing the electronic medical record improved the quality of the office visit/medical exam was 3.85 or somewhat agree. Accessing the electronic medical record detracted from the office visit/medical exam scored a mean of 2.7 or neither agree nor disagree. And finally, the question, I was able to communicate with my doctor/medical provider while he/she was accessing the electronic medical record had a mean of participant answer of 3.97 or somewhat agree.

Likewise, Table 25 examines the patients' perception of the providers' utilization of electronics and the EMR in the exam room. When asked to rate whether it is necessary for their healthcare provider to use a computer in the exam room during the office visit/medical exam, the participants' mean was 3.65 or somewhat agree. Furthermore, the mean when asked to rate if having a computer in the exam room has no impact on my ability to communicate with their healthcare provider scores 2.50, or the participants disagree with the statement. The next three perceptions deal with distractions attributed to the EMR in the exam room. When asked to rate if their healthcare provider is able to listen to their healthcare concerns while using a computer during the office visit/medical exam, the participants scored a means of 3.85 or somewhat agree with the statement. A mean of 2.63 was established for the statement I find myself distracted when my healthcare provider uses a computer during the office visit/medical exam, which falls

in the neutral range. And finally, the statement my healthcare provider appears to be distracted when using a computer during the office visit/medical exam scored a mean of 2.50, or the participants disagree with the statement.

Table 24

Please rate your level of agreement with the following statements about your healthcare provider accessing your medical record during your visit/medical exam. Question 13

		Accessing the electronic medical record was important to the office visit/medical exam.	Accessing the electronic medical record improved the quality of the office visit/medical exam.	Accessing the electronic medical record detracted from the office visit/medical exam.	I was able to communicate with my doctor/medical provider while he/she was accessing the electronic medical record.
N	Valid	447	447	447	447
	Missing	66	66	66	66
Mean		3.8904	3.8501	2.7002	3.9687
Median		4.0000	4.0000	3.0000	4.0000
Mode		5.00	5.00	3.00	5.00
Std. Deviation		1.14589	1.08491	1.33412	1.20496
Skewness		-.727	-.652	.095	-.959
Std. Error of Skewness		.115	.115	.115	.115
Kurtosis		-.284	-.103	-1.096	-.020
Std. Error of Kurtosis		.230	.230	.230	.230
Minimum		1.00	1.00	1.00	1.00
Maximum		5.00	5.00	5.00	5.00

Table 25

Please rate your agreement with the following statements about your healthcare provider using a computer during an office visit/medical exam. Question 16

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Mean
It is necessary for my healthcare provider to use a computer in the exam room during the office visit/medical exam.	2.9% 15	8.0% 41	34.3% 176	30.8% 158	24.0% 123	3.6491
My healthcare provider is able to listen to my healthcare concerns while using a computer during the office visit/medical exam.	2.1% 11	9.0% 46	25.0% 128	29.6% 152	34.3% 176	3.8499
I find myself distracted when my healthcare provider uses a computer during the office visit/medical exam.	6.4% 33	19.1% 98	32.6% 167	15.0% 77	26.9% 138	2.6316
My healthcare provider appears to be distracted when using a computer during the office visit/medical exam.	5.5% 28	16.8% 86	31.6% 162	15.2% 78	31.0% 159	2.5049
Having a computer in the exam room has no impact on my ability to communicate with my healthcare provider.	3.7% 19	16.0% 82	28.8% 148	16.8% 86	34.7% 178	3.6277

The Benefits of Utilizing an EMR

The next set of questions comprises patients' viewpoints on the perceived benefits of the EMR. These questions were answered on a 5-point Likert scale consisting of the following values, strongly disagree, somewhat disagree, neither agree nor disagree, somewhat agree, and strongly agree (see Table 26). The mean of participant scores for six of the seven questions scored in the somewhat agree range. The statements include: an EMR reduces medical mistakes by ensuring that all of your health care providers have the same information about your health history, allergies, and medications; an EMR brings down health care costs by reducing test duplication and making record-keeping more accurate and efficient; an EMR makes it easier for you to access your health information, including prescription history, immunizations, and test results; an EMR helps patients keep track of family health information including tests, immunizations, and upcoming appointments; an EMR enables better coordination of care, enabling doctors to collaborate and obtain second opinions; and an EMR system improves the overall quality of my care. Only one mean of participants' answers landed in the neither agree nor disagree range. This mean (3.35) was for the statement an EMR improves communication with your doctor, by allowing you to send and receive an online message.

Table 26

Thinking about the possible benefits of your doctor using an electronic medical record (EMR) system, please indicate the importance of the following potential benefits for you. Question 14

	Not very important	Slightly important	Important	Very important	Extremely important	Mean
An EMR reduces medical mistakes by ensuring that all of your healthcare providers have the same information about your health history, allergies, and medications.	1.8% 9	5.8% 30	32.9% 169	25.0% 128	34.5% 177	3.8460
An EMR improves communication with your doctor, by allowing you to send and receive online messages.	9.9% 51	11.9% 61	34.7% 178	20.3% 104	23.2% 119	3.3489
An EMR brings down healthcare costs by reducing test duplication and making record-keeping more accurate and efficient.	2.7% 14	8.0% 41	41.5% 213	21.6% 111	26.1% 134	3.6043
An EMR makes it easier for you to access your health information, including prescription history, immunizations, and test results.	4.3% 22	7.4% 38	35.3% 181	21.2% 109	31.8% 163	3.6881
An EMR helps patients keep track of family health information including tests, immunizations, and upcoming appointments.	4.1% 21	8.4% 43	34.5% 177	22.8% 117	30.2% 155	3.6667

An EMR enables better coordination of care, enabling doctors to collaborate and obtain second opinions.	2.5% 13	7.4% 38	34.9% 179	22.8% 117	32.4% 166	3.7505
An EMR system improves the overall quality of my care.	2.7% 14	7.4% 38	38.8% 199	17.7% 91	33.3% 171	3.7154

Interest in Patient Online EMR Activities

To understand the participants' perceptions of having the ability to access their EMR online, a set of eight common patient activities on online EMRs were listed. These questions were answered on a 5-point Likert scale consisting of values ranging from not interested at all to very interested (see Table 27). Participants were most interested in checking medical records and test results, followed by requesting prescription refills, keeping track of immunizations, making an appointment or scheduling a test, paying medical bills, and looking up a family member's medical record. The participants were less interested in the ability to send a message to a physician or nurse, complete paperwork, or monitor fitness and diet.

Table 27

If you had access to an online medical record, how interested would you be in the following activities? Question 22

	Not at all interested 1	2	3	4	Very interested 5	Mean
Request a prescription refill	25.5% 131	5.1% 26	16.6% 85	14.6% 75	38.2% 196	3.3489
Make an appointment or schedule a test	24.0% 123	9.9% 51	18.7% 96	12.9% 66	34.5% 177	3.2398
Check medical records or test results	20.3% 104	7.4% 38	15.6% 80	16.0% 82	40.7% 209	3.4951
Send a message to a physician or nurse	24.0% 123	9.7% 50	20.9% 107	13.5% 69	32.0% 164	3.1969
Complete paperwork prior to an appointment	22.6% 116	12.3% 63	18.7% 96	15.2% 78	31.2% 160	3.2008
Look up or manage health information for a child or other family member	26.9% 138	8.0% 41	16.0% 82	15.0% 77	34.1% 175	3.2144
Pay medical bills	26.5% 136	7.6% 39	16.0% 82	17.5% 90	32.4% 166	3.2164
Keep track of immunizations and preventive screening tests	23.8% 122	6.8% 35	17.0% 87	17.3% 89	35.1% 180	3.3314
Monitor fitness activities, diet, or other healthy behaviors	35.9% 184	12.9% 66	20.9% 107	8.8% 45	21.6% 111	2.6745

Summary

The demographics of the sample for this research closely resemble the demographics of the Lincoln County, Montana, population. On average, patients visit the community health center for healthcare slightly more than six times a year. Of these appointments, 81.5% of the participants saw their primary care provider most or all the time, and COVID-19 had little impact on the number of visits during the pandemic. Most of the participants showed at least some comfort with technology, with smartphones (83.2%) and personal computers/laptops (43.9%) being used most often. However, a significant portion of the participants do not use technology with some having little to no access to the Internet.

One-third of the participants preferred that their provider used an EMR, while 14.4% preferred paper charts. Most (91.8%) of the participants recalled their provider accessing the EMR during their appointment and acknowledged that their provider used the EMR throughout the medical encounter. To understand the patients' attitudes toward the providers' utilization of the EMR during an office visit, several 5-point Likert scale questions were asked. The mean of these questions indicates that the participants somewhat agree that the EMR is beneficial and somewhat agree that the EMR had a positive impact on their healthcare visit. However, when asked if they had a more positive impression of their provider or if they felt more confident about the care their doctor provides because he or she uses an EMR, the mean suggests the participants fall into the somewhat agree range, slightly outside of being neutral.

CHAPTER FIVE: CONCLUSIONS

Overview

The purpose of this study was to explore the effects of EMR on community health center communication by examining patient-provider communication. The study participants included patients of the Northwest Community Health Center (N=5,101) (August 2021 to August 2022) who were 18 years or older and had seen their primary physician within the last 12 months. The sample was defined by a random sample, identifying 513 (10%) patients who successfully completed a quantitative survey to examine the effects of the EMR on community health center communication. This chapter provides a summary of the study, a discussion of the findings, recommendations to improve the patient's perception of the EMR, limitations of this research, and recommendations for future research.

Summary of the Study

EMR systems are designed, implemented, and utilized to improve healthcare communication between patients and providers, and between providers and care teams; however, healthcare professionals often report that the EMR creates communication barriers. More research needs to be conducted to understand the effects of the EMR on patient-provider communication. This study was designed to do just that. This research effectively answered the two research questions, how does the utilization of the EMR affect patient-provider communication within the community health center, and what communication barriers are created when bringing technology, and the EMR, into a physician encounter? Furthermore, this research identified that comfort with technology, utilization of the EMR technology, and patient access to the online EMR portal significantly impact the positive perception of the EMR, and therefore improved patient-provider communication.

Discussion

The results of this research revealed multiple findings surrounding the impact of EMR on patient-provider communication within the community health center. Discomfort with technology, the utilization of the EMR during the medical exam, and patient utilization of the EMR portal all play essential roles in the acceptance of the EMR in the exam room and how this utilization impacts patient-provider communication. Only one-third (32.2%) of the study's participants preferred the use of an EMR by their provider over the use of a paper chart (14.4%). Participants also only somewhat agree that the use of the EMR is beneficial and that the EMR had a positive impact on their healthcare visits. Furthermore, when asked if they had a more favorable impression of their provider or felt more confident about the care their doctor provides because he or she uses an EMR, the participants mostly had only a neutral opinion. Although these findings exhibit that the majority of participants have a comfort level with the EMR in the exam room, many still do not. This discomfort and apprehension of the EMR create issues with patient-provider communication. Without this vital communication, healthcare is negatively affected, often resulting in poor patient diagnosis and poor patient outcomes. Therefore, it is crucial to understand the barriers the EMR imposes on patient-provider communication.

Comfort with Technology

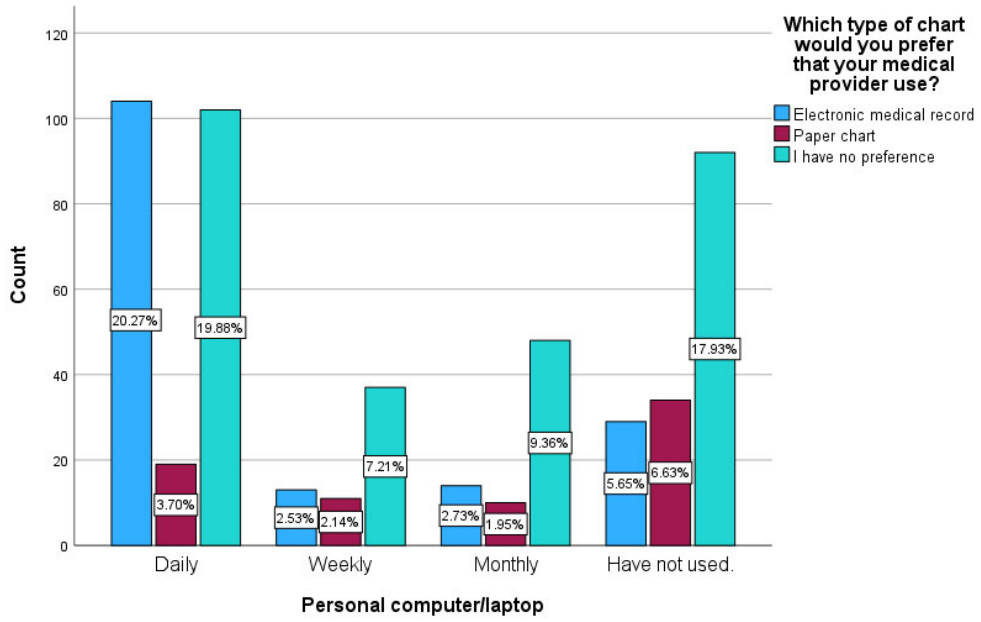
Although many of the participants of this study were comfortable with and owned personal technology devices, many still do not. Within northwestern Montana, either due to age, education, or income levels, many do not own or have access to personal technology devices, such as computers, tablets, or smartphones, and many do not have daily access to the Internet. Not having access to these types of devices creates a technological barrier. Therefore, comprehension of the functionality of the EMR and why technology such as a laptop or

smartphone would be required in an exam room adds to the apprehension, directly affecting patient-provider communication.

Understanding the benefits or even the general functionality of the EMR allows the patient to feel more comfortable with its use and to be more tolerant of the presence and use of technology or the EMR during the physician encounter. As the rate of technology ownership and/or use declines amongst the participants, so does the preference that their provider use an EMR. Figure 3 exhibits the use of workstations or laptops among the participants. As the utilization of workstations and laptops diminishes from daily to not used, so does the preference for the EMR.

Figure 3

Preference for Medical Record Versus Utilization of a Personal Computer/Laptop



The same is true regarding smartphone usage (see Figure 4). As the frequency of use of smartphones decreases, so does the participants' preference that their provider utilizes an EMR. Therefore, paper charts become the medical record of choice for those who do not use a smartphone regularly. Tablet and iPad utilization become a bit of an outlier. As the utilization of

tablets diminishes, so does the preference for the EMR. However, the preference for the EMR is not surpassed by the preference for the paper chart (see Figure 5).

Figure 4

Preference for Medical Record Versus Utilization of a Smartphone

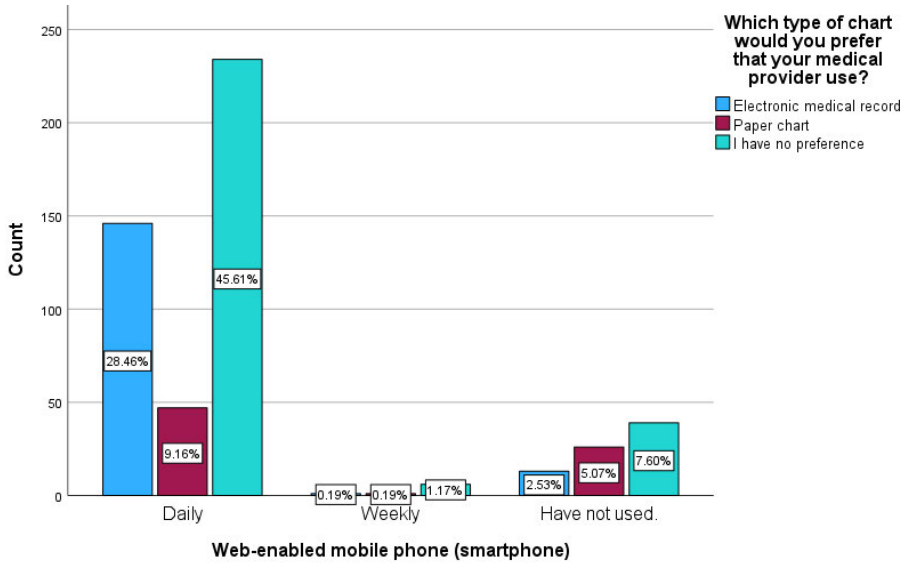
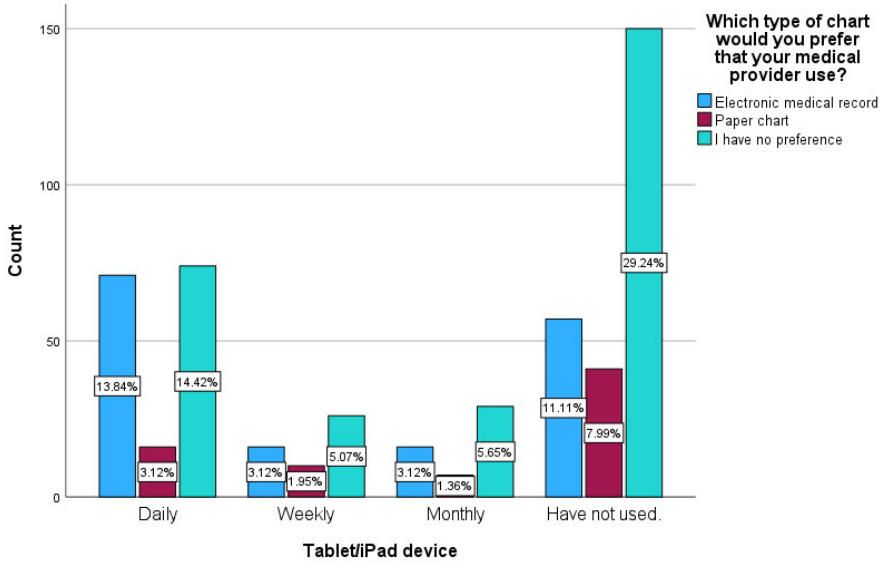


Figure 5

Preference for Medical Record Versus Utilization of a Tablet/iPad device



Comfort with Technology Versus the Distraction of Technology

Even when a patient is comfortable with technology, introducing technology into the exam room can disrupt patient-provider communication. The laptop or other technology that houses the EMR becomes the third entity, or actor, within the room. Adding this third actor changes the dynamic of the communication structure and comprehension. If a provider spends too much time accessing the EMR, eye-to-eye contact diminishes, often causing the patient to wonder if their medical questions and concerns are being heard by the provider, much less being addressed. Timely input of medical information into the EMR is vital, but a breakdown of communication due to the use of the EMR can result in poor patient healthcare and patient outcomes. Good provider communication skills are required to lessen the effect of technology in the exam room.

Staff-Patients Versus Non-Staff Patients

To further illustrate how comfort with technology is significant to the patient's preference of the EMR over that of a paper chart, staff members of the community health center, who utilize the EMR as a tool for their occupation, were also asked to participate in this research. Staff members of the Northwest Community Health Center who were also patients of the community health center (n=44) who were 18 years of age and who had seen their primary provider in the last 12 months were asked to complete the patient survey instrument from this study.

To underscore the impact that knowledge of the EMR has on the patient's perception of its utilization in the exam room, a crosstabulation between staff and non-staff patients was performed. When asked what chart type they would prefer their medical provider to use (see Table 28), only a quarter of the non-staff patients (27.9%) preferred electronic medical records, whereas 65.9% of the staff-patients preferred the same. Of the non-staff members, 15.6% preferred the use of paper charts, whereas only 2.3% of staff members preferred the same. When

asked if the non-staff patient had a more favorable impression of their doctor because he or she uses electronic medical records (see Table 29), one-third (35.6%) either somewhat agreed or strongly agreed. When the staff-patient was asked the same question, nearly half (47.7%) were in agreement. Furthermore, when asked if accessing the EMR improved the quality of the office visit, a majority (56.8%) of the non-staff patients either somewhat agreed or strongly agreed. Likewise, when presented with the same question, practically all (92.9%) staff-patients were in agreement. This trend can be seen across all the Likert scale questions throughout the survey. Therefore, knowledge of and use of the EMR increases the positive perception of the use of technology in the exam room.

Table 28

Crosstabulation of Patient Type Versus Type of Chart Preferred

			Which type of chart would you prefer that your medical provider use?			
			Electronic Medical Record	Paper chart	I have no preference	Total
	Non-Staff Patient	N	131	73	265	469
		% within variable	27.9%	15.6%	56.5%	100.0%
		% within Question	81.9%	98.6%	95.0%	91.4%
	Staff Patient	N	29	1	14	44
		% within variable	65.9%	2.3%	31.8%	100.0%
		% within Question	18.1%	1.4%	5.0%	8.6%
Total		N	160	74	279	513
		% within variable	31.2%	14.4%	54.4%	100.0%
		% within Question	100.0%	100.0%	100.0%	100.0%

Table 29

Crosstabulation of Patient Type Versus Positive Impression of Doctor

		I have a more positive impression of my doctor because he/she uses electronic medical records (EMR).					
		Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Total
Non-Staff Patients	N	13	22	267	84	83	469
	% within variable	2.8%	4.7%	56.9%	17.9%	17.7%	100.0%
	% within Question	86.7%	88.0%	93.7%	91.3%	86.5%	91.4%
Staff Patients	N	2	3	18	8	13	44
	% within Variable	4.5%	6.8%	40.9%	18.2%	29.5%	100.0%
	% within Question	13.3%	12.0%	6.3%	8.7%	13.5%	8.6%
Total	N	15	25	285	92	96	513
	% within Variable	2.9%	4.9%	55.6%	17.9%	18.7%	100.0%
	% within Question	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table 30

Crosstabulation of Patient Type Versus EMR improved the quality of the office visit.

			Accessing the electronic medical record improved the quality of the office visit/medical exam.					
			Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Total
	Non-Staff Patients	N	17	14	144	88	142	405
		% within Variable	4.2%	3.5%	35.6%	21.7%	35.1%	100.0%
		% within Question	89.5%	100.0%	99.3%	83.0%	87.1%	90.6%
	Staff Patients	N	2	0	1	18	21	42
		% within Variable	4.8%	0.0%	2.4%	42.9%	50.0%	100.0%
		% within Question	10.5%	0.0%	0.7%	17.0%	12.9%	9.4%
Total		N	19	14	145	106	163	447
		% within Variable	4.3%	3.1%	32.4%	23.7%	36.5%	100.0%
		% within Question	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Patient Utilization of the Online EMR Portal

Since the comprehension of and use of the EMR positively impacts the perception of the utilization of the EMR in the exam room, it is important to examine whether patient use of the online EMR portal will result in similar findings with staff patients who use the EMR. When asked, 115 of this study's participants reported that they had used an online EMR portal to manage their health records. To get a better understanding of the online portal users' perception of the EMR, a crosstabulation between online portal users and participants with a preference for the EMR was performed. Of the 115 portal users, half (52.2%) preferred the use of the EMR

over a paper chart. Furthermore, only 5.2% preferred the use of a paper chart, with one-third (34.8%) not having a preference. One-third (32.2%) of the participants of this study preferred the use of an EMR by their provider over the use of a paper chart, whereas 52.2% of the portal users preferred the EMR. Therefore, there is a significant increase in the positive perceptions of the EMR by those who use the online EMR portal.

Patient Preference of Medical Chart Types

To better understand the medical chart preference for the demographics of the study, a chi-square (χ^2) analysis was performed in SPSS on the demographic types. To perform a chi-square analysis, the following assumptions must be met. The variables must be categorical, include two or more categories, and each must have an expected frequency of five or greater. These assumptions were met for the Gender, Education, and Employment demographics tables used in the chi-square analysis below. The Age and Number of Healthcare Visits tables each include a single expected value <5. However, for tables larger than 2x2, Yates et al. (1999) state, "No more than 20% of the expected counts should be less than 5 and all individual expected counts should be greater or equal to 1. Some expected counts can be <5, provided none <1, and 80% of the expected counts should be equal to or greater than 5" (p. 734). Therefore, the Age Table (7x3 with a 4.8% <5 expected count) and the Number of Healthcare Visits Table (5x3 with a 6.7% <5 expected count) meet these expanded chi-square assumptions and are included below. The effect size was determined by interpreting Cramer's V. A Cramer's V of .10 to .29 is associated with a small effect size, a Cramer's V of .30 to .49 is associated with a medium effect size, and a Cramer's V of .10 or larger is associated with a large effect size.

Preference by Gender

A chi-square statistical test was performed in SPSS to determine if there was a significant association between the gender of the participants and the type of medical chart they preferred

their medical provider to use. The sample consisted of 512 participants, including 277 females and 235 males. Of the 159 patients who preferred the use of an EMR, 25.5% (60) were male, and 35.7% (99) were female (see Table 31). There was a statistically significant association where χ^2 (2, N = 512) = 9.87, p = .01, Cramer's V = .120, which is associated with a small effect size. See Table 32 for the chi-square test and Table 33 for Cramer's V.

Table 31

Crosstabulation of Preferred Chart Type by Gender

			Which type of chart would you prefer that your medical provider use?			
			Electronic medical record	Paper chart	I have no preference	Total
What gender do you identify as?	Male	Count	60	44	131	235
		Expected Count	73.0	34.0	128.1	235.0
		% within What gender do you identify as?	25.5%	18.7%	55.7%	100.0%
		% within Which type of chart would you prefer that your medical provider use?	37.7%	59.5%	47.0%	45.9%
		% of Total	11.7%	8.6%	25.6%	45.9%
	Female	Count	99	30	148	277
		Expected Count	86.0	40.0	150.9	277.0
		% within What gender do you identify as?	35.7%	10.8%	53.4%	100.0%
		% within Which type of chart would you prefer that your medical provider use?	62.3%	40.5%	53.0%	54.1%
		% of Total	19.3%	5.9%	28.9%	54.1%
Total		Count	159	74	279	512
		Expected Count	159.0	74.0	279.0	512.0
		% within What gender do you identify as?	31.1%	14.5%	54.5%	100.0%
		% within Which type of chart would you prefer that your medical provider use?	100.0%	100.0 %	100.0%	100.0%
		% of Total	31.1%	14.5%	54.5%	100.0%

Table 32

Chi-Square Tests for Gender

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	9.872[a]	2	.007
Likelihood Ratio	9.916	2	.007
Linear-by-Linear Association	2.486	1	.115
N of Valid Cases	512		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 33.96.

Table 33

Symmetric Measures for Gender

		Value	Approximate Significance
Nominal by Nominal	Phi	.139	.007
	Cramer's V	.139	.007
N of Valid Cases		512	

Preference by Education Level

Medical chart preference by education was also examined. A chi-square test was performed in SPSS, determining if there was a significant association between the education of the participants and the medical chart they preferred their medical provider to use. The sample consisted of 510 participants (see Table 34). There was a statistically significant association where χ^2 (4, N = 510) = 41.41, p < .001, Cramer's V = .201, which is associated with a small effect size. See Table 35 for the chi-square test and Table 36 for Cramer's V.

Table 34

Crosstabulation of Preferred Chart Type by Education Level

			Which type of chart would you prefer that your medical provider use?			
			Electronic medical record	Paper chart	I have no preference	Total
Education	Less than college degree	Count	80	56	216	352
		Expected Count	109.7	51.1	191.2	352.0
		% within Education	22.7%	15.9%	61.4%	100.0%
		% within Which type of chart would you prefer that your medical provider use?	50.3%	75.7%	78.0%	69.0%
		% of Total	15.7%	11.0%	42.4%	69.0%
	Undergraduate degree	Count	59	10	49	118
		Expected Count	36.8	17.1	64.1	118.0
		% within Education	50.0%	8.5%	41.5%	100.0%
		% within Which type of chart would you prefer that your medical provider use?	37.1%	13.5%	17.7%	23.1%
		% of Total	11.6%	2.0%	9.6%	23.1%
	Graduate degree	Count	20	8	12	40
		Expected Count	12.5	5.8	21.7	40.0
		% within Education	50.0%	20.0%	30.0%	100.0%
		% within Which type of chart would you prefer that your medical provider use?	12.6%	10.8%	4.3%	7.8%
		% of Total	3.9%	1.6%	2.4%	7.8%
Total		Count	159	74	277	510
		Expected Count	159.0	74.0	277.0	510.0
		% within Education	31.2%	14.5%	54.3%	100.0%
		% within Which type of chart would you prefer that your medical provider use?	100.0%	100.0%	100.0%	100.0%
		% of Total	31.2%	14.5%	54.3%	100.0%

Table 35

Chi-Square Tests for Education Level

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	41.413[a]	4	<.001
Likelihood Ratio	40.913	4	<.001
Linear-by-Linear Association	31.932	1	<.001
N of Valid Cases	510		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 5.80.

Table 36

Symmetric Measures for Education Level

		Value	Approximate Significance
Nominal by Nominal	Phi	.285	<.001
	Cramer's V	.201	<.001
N of Valid Cases		510	

Preference by Employment Status

Medical chart preference by employment was also examined. A chi-square test was performed in SPSS, determining if there was a significant association between the employment status of the participants and the medical chart they preferred their medical provider to use. The sample consisted of 511 participants (see Table 37). There was a statistically significant association where χ^2 (6, N = 511) = 25.66, p < .001, Cramer's V = .158, which is associated with a small effect size. See Table 38 for the chi-square test and Table 39 for Cramer's V.

Table 37

Crosstabulation of Preferred Chart Type by Employment Status

			Which type of chart would you prefer that your medical provider use?			
			Electronic medical record	Paper chart	I have no preference	Total
Employment	Employed Full-Time	Count	104	27	130	261
		Expected Count	81.2	37.8	142.0	261.0
		% within Employment	39.8%	10.3%	49.8%	100.0%
		% within Which type of chart preferred?	65.4%	36.5%	46.8%	51.1%
		% of Total	20.4%	5.3%	25.4%	51.1%
	Employed Part-Time	Count	16	7	34	57
		Expected Count	17.7	8.3	31.0	57.0
		% within Employment	28.1%	12.3%	59.6%	100.0%
		% within Which type of chart preferred?	10.1%	9.5%	12.2%	11.2%
		% of Total	3.1%	1.4%	6.7%	11.2%
	Unemployed	Count	8	7	28	43
		Expected Count	13.4	6.2	23.4	43.0
		% within Employment	18.6%	16.3%	65.1%	100.0%
		% within Which type of chart preferred?	5.0%	9.5%	10.1%	8.4%
		% of Total	1.6%	1.4%	5.5%	8.4%
	Disabled or Retired	Count	31	33	86	150
		Expected Count	46.7	21.7	81.6	150.0
		% within Employment	20.7%	22.0%	57.3%	100.0%
		% within Which type of chart preferred?	19.5%	44.6%	30.9%	29.4%
		% of Total	6.1%	6.5%	16.8%	29.4%
Total		Count	159	74	278	511
		Expected Count	159.0	74.0	278.0	511.0
		% within Employment	31.1%	14.5%	54.4%	100.0%
		% within Which type of chart preferred?	100.0%	100.0 %	100.0%	100.0%
		% of Total	31.1%	14.5%	54.4%	100.0%

Table 38

Chi-Square Tests for Employment Status

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	25.662[a]	6	<.001
Likelihood Ratio	25.725	6	<.001
Linear-by-Linear Association	10.083	1	.001
N of Valid Cases	511		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 6.23.

Table 39

Symmetric Measures for Employment Status

		Value	Approximate Significance
Nominal by Nominal	Phi	.224	<.001
	Cramer's V	.158	<.001
N of Valid Cases		511	

Preference by Age

To examine a medical chart preference by age group, a chi-square test was performed in SPSS to determine if there was a significant association between the age group of the participants and the medical chart they preferred their medical provider to use. The sample consisted of 513 participants (see Table 40). There was a statistically significant association where χ^2 (4, N = 513) = 27.74, p =.006, Cramer's V = .164, which is associated with a small effect size. The Age Table is 7x3 with a 4.8% <5 expected count. See Table 41 for the chi-square test and Table 42 for Cramer's V.

Table 40

Crosstabulation of Preferred Chart Type by Age Group

		Which type of chart would you prefer that your medical provider use?			
		EMR	Paper chart	No preference	Total
18-24	Count	9	2	15	26
	Expected Count	8.1	3.8	14.1	26.0
	% within Age	34.6%	7.7%	57.7%	100.0%
	% within Which type of chart preferred?	5.6%	2.7%	5.4%	5.1%
	% of Total	1.8%	0.4%	2.9%	5.1%
25-34	Count	36	6	51	93
	Expected Count	29.0	13.4	50.6	93.0
	% within Age	38.7%	6.5%	54.8%	100.0%
	% within Which type of chart preferred?	22.5%	8.1%	18.3%	18.1%
	% of Total	7.0%	1.2%	9.9%	18.1%
35-44	Count	43	11	50	104
	Expected Count	32.4	15.0	56.6	104.0
	% within Age	41.3%	10.6%	48.1%	100.0%
	% within Which type of chart preferred?	26.9%	14.9%	17.9%	20.3%
	% of Total	8.4%	2.1%	9.7%	20.3%
45-54	Count	26	11	44	81
	Expected Count	25.3	11.7	44.1	81.0
	% within Age	32.1%	13.6%	54.3%	100.0%
	% within Which type of chart preferred?	16.3%	14.9%	15.8%	15.8%
	% of Total	5.1%	2.1%	8.6%	15.8%
55-64	Count	21	24	57	102
	Expected Count	31.8	14.7	55.5	102.0
	% within Age	20.6%	23.5%	55.9%	100.0%
	% within Which type of chart preferred?	13.1%	32.4%	20.4%	19.9%
	% of Total	4.1%	4.7%	11.1%	19.9%

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65-74	Count	15	13	30	58
	Expected Count	18.1	8.4	31.5	58.0
	% within Age	25.9%	22.4%	51.7%	100.0%
	% within Which type of chart preferred?	9.4%	17.6%	10.8%	11.3%
	% of Total	2.9%	2.5%	5.8%	11.3%
75 and Over	Count	10	7	32	49
	Expected Count	15.3	7.1	26.6	49.0
	% within Age	20.4%	14.3%	65.3%	100.0%
	% within Which type of chart preferred?	6.3%	9.5%	11.5%	9.6%
	% of Total	1.9%	1.4%	6.2%	9.6%
Total	Count	160	74	279	513
	Expected Count	160.0	74.0	279.0	513.0
	% within Age	31.2%	14.4%	54.4%	100.0%
	% within Which type of chart preferred?	100.0%	100.0%	100.0%	100.0%
	% of Total	31.2%	14.4%	54.4%	100.0%

Table 41

Chi-Square Tests for Age Group

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	27.735[a]	12	.006
Likelihood Ratio	28.082	12	.005
Linear-by-Linear Association	5.059	1	.024
N of Valid Cases	513		

a. 1 cells (4.8%) have expected count less than 5. The minimum expected count is 3.75.

Table 42

Symmetric Measures for Age Group

		Value	Approximate Significance
Nominal by Nominal	Phi	.233	.006
	Cramer's V	.164	.006
N of Valid Cases		513	

Preference by Number of Yearly Healthcare Appointments

A chi-square test was also performed in SPSS to determine if there was a significant association between the number of medical visits in the last 12 months and the type of medical chart they preferred their medical provider to use. The sample consisted of 513 participants (see Table 43). There was a statistically significant association where χ^2 (8, N = 513) = 37.37, p < .001, Cramer's V = .191, which is associated with a small effect size. The Number of Healthcare Visits Table is 5x3 with a 6.7% <5 expected count. See Table 44 for the chi-square test and Table 45 for Cramer's V.

Table 43

Crosstabulation of Preferred Chart Type by Yearly Healthcare Visits

			Which type of chart would you prefer that your medical provider use?			
			Electronic medical record	Paper chart	I have no preference	Total
Yearly visits	1 to 3 times	Count	19	0	9	28
		Expected Count	8.7	4.0	15.2	28.0
		% within Yearly Healthcare visits?	67.9%	0.0%	32.1%	100.0%
		% within Which type of chart preferred?	11.9%	0.0%	3.2%	5.5%
		% of Total	3.7%	0.0%	1.8%	5.5%
	4 to 6 times	Count	74	38	130	242
		Expected Count	75.5	34.9	131.6	242.0
		% within Yearly Healthcare visits?	30.6%	15.7%	53.7%	100.0%
		% within Which type of chart preferred?	46.3%	51.4%	46.6%	47.2%
		% of Total	14.4%	7.4%	25.3%	47.2%
	7 to 12 times	Count	28	26	77	131
		Expected Count	40.9	18.9	71.2	131.0
		% within Yearly Healthcare visits?	21.4%	19.8%	58.8%	100.0%
		% within Which type of chart preferred?	17.5%	35.1%	27.6%	25.5%
		% of Total	5.5%	5.1%	15.0%	25.5%
	More than 12 times	Count	25	6	23	54
		Expected Count	16.8	7.8	29.4	54.0
		% within Yearly Healthcare visits?	46.3%	11.1%	42.6%	100.0%
		% within Which type of chart preferred?	15.6%	8.1%	8.2%	10.5%
		% of Total	4.9%	1.2%	4.5%	10.5%
	Don’t Know	Count	14	4	40	58
		Expected Count	18.1	8.4	31.5	58.0
		% within Yearly Healthcare visits?	24.1%	6.9%	69.0%	100.0%
		% within Which type of chart preferred?	8.8%	5.4%	14.3%	11.3%
		% of Total	2.7%	0.8%	7.8%	11.3%
Total		Count	160	74	279	513
		Expected Count	160.0	74.0	279.0	513.0
		% within Yearly Healthcare visits?	31.2%	14.4%	54.4%	100.0%
		% within Which type of chart preferred?	100.0%	100.0%	100.0%	100.0%
		% of Total	31.2%	14.4%	54.4%	100.0%

Table 44

Chi-Square Tests for Yearly Healthcare Visits

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	37.374[a]	8	<.001
Likelihood Ratio	39.075	8	<.001
Linear-by-Linear Association	3.907	1	.048
N of Valid Cases	513		

a. 1 cells (6.7%) have expected count less than 5. The minimum expected count is 4.04.

Table 45

Symmetric Measures for Yearly Healthcare Visits

		Value	Approximate Significance
Nominal by Nominal	Phi	.270	<.001
	Cramer's V	.191	<.001
N of Valid Cases		513	

Community Health Center Communication and Cybernetics

The core principle of cybernetics deals with that of a system. Systems are collections of interacting components that form something more significant than the sum of its parts while being constrained by their dependence upon other parts. The EMR is an excellent example of a system. The EMR provides communication and accessibility to medical health records for the surrounding healthcare practice, providers, specialists, and patients. The EMR is controlled by interfaces that control the type and reliability of medical information being input into the system. A feedback loop, essentially medical tests, vitals, and proper diagnoses, are fed back into the system, providing the interfaces required to provide efficacious healthcare while improving patient-provider communication. The stability of the healthcare system does not exist solely with the EMR or with the interfaces but lies between the two devices. The whole system creates

stability, achieving and maintaining the desired patient outcomes by monitoring, regulating, and controlling the interfaces, thus achieving its intended goal.

Community Health Center Communication and ANT

ANT defines everyone and everything as entities or actors and focuses on the relationships between those entities. Furthermore, ANT denies any difference between human and non-human entities, making the communication theory applicable to EMR communication research. Healthcare requires many human and non-human actors to be successful and enhance patient-provider communication. In the community health center, the actors include patients, providers, healthcare teams, labs, the EMR, and many others. ANT realizes that all the actors within the exam room are equally responsible for communication and ongoing care. To improve patient-provider communication, all the actors within the community health center are required to function together efficaciously to achieve the best possible health outcome. The EMR is a technological solution that has the capability to enhance or hinder communication.

Community Health Center Communication and DCog

DCog encompasses cognition being performed by the collective, an organized group, and that which a lone individual could not physically carry out. Effective healthcare requires coordination, cooperation, and communication from the whole healthcare team within the healthcare system. This cognition, in conjunction with technology and medical informatics, provides the required outcome. The EMR is essential to the communication process and is more than just a piece of technology utilized by the healthcare team. Without the EMR, medical equipment, test results, vitals, patient summaries, provider diagnoses, and health team communication all become disjoined health records, never creating the distributed cognition required for adequate healthcare.

Community Health Center Communication and Diffusion of Innovation

Diffusion of Innovations is an essential communication theory for understanding the adaptation and acceptance of the EMR in community health centers. The Diffusion of Innovations Theory explains the how, why, and at what rate new ideas, innovations, and technologies spread. The EMR has been instrumental in improving patient-provider communication and the ability to diagnose health concerns properly. The Diffusion of Innovation Theory's role in the adoption process of the EMR is significant. Understanding the diffusion elements and the innovation-decision process can help understand the adoption process of the EMR and help identify the roles of the individuals or groups of the adopter categories than can hasten the adoption process within the medical social system.

Community Health Center Communication and The Tipping Point

The three rules of the Tipping Point, the Law of the Few, the Stickiness Factor, and the Power of Context, provide insightful guidance for igniting an awareness epidemic, advancing the widespread understanding, adoption, and acceptance of the EMR. Only a few individuals are required to create this epidemic. Identifying, directing, and utilizing the three specific Tipping Point personalities within the community health center patient and staff population, known as the Connectors, the EMR Mavens, and the Salesmen, will establish the fuel required to ignite the EMR awareness epidemic. Furthermore, effectively packaging, presenting, and repeating messaging containing the benefits of the EMR, under the right circumstances, will create a stickiness factor, making the EMR compelling to the community health center patient population. To improve healthcare and better patient outcomes, the little things have the potential to make a big difference.

Recommendations

A patient's comprehension of the EMR and understanding of the benefits of the EMR significantly increase the patient's positive perceptions of the EMR. A more positive perception of the EMR, therefore, decreases the apprehension of having the EMR in the exam room. Furthermore, increasing the positive perceptions of the EMR decreases the barriers that the technology presents to patient-provider communication. To increase the awareness and the benefits of the EMR in the exam room, this research recommends the following: create a patient awareness campaign identifying the benefits and requirements of the EMR; create an awareness campaign for the benefits of the EMR online portal, promoting the usage of the portal to the patients; and educate providers on improving communication skills when accessing the EMR during the exam.

Promoting the EMR

Although it is unlikely that all patients will lose their total apprehension towards technology and the use of the EMR in the exam room, creating a patient awareness campaign is a practical first step. The participants of the research indicate that they already somewhat agree with the following EMR benefits: an EMR reduces medical mistakes by ensuring that all of your healthcare providers have the same information about your health history, allergies, and medications; an EMR brings down healthcare costs by reducing test duplication and making record-keeping more accurate and efficient; an EMR makes it easier for you to access your health information, including prescription history, immunizations, and test results; an EMR helps patients keep track of family health information including tests, immunizations, and upcoming appointments; an EMR enables better coordination of care, enabling doctors to collaborate and obtain second opinions; and an EMR system improves the overall quality of my care. Therefore,

adding these EMR benefits to print and online advertising, in-clinic posters, and in-clinic monitors can help improve EMR perceptions.

Promoting the EMR to the Non-technical Patient

Especially within geographies like Montana, many of the patients receiving healthcare at community health centers are either non-technical, have a discomfort with electronics, or even have an aversion to technology. Therefore, how is it possible to promote the technology laden EMR to the non-technical patient? Unlike many other industries that are required to use modern marketing advertising mediums to lure in their customers, the community health centers regularly draw in their patient population to their facilities for healthcare, services, or medical tests multiple times each year. This opportunity creates a captive audience, an audience that already knows that they will be spending the next hour or more of their time waiting for their provider, exams, labs, or prescriptions. Therefore, content with a stickiness factor can quickly grab and maintain the captive audience's attention if done properly.

Patients entering community health centers are hit with a profusion of medical education from the time they enter any given facility. Banners and placards explaining the benefits of the EMR to the nontechnical segmentation are just the start. Many community health center facilities have multimedia televisions in the reception area and in many exam rooms throughout the clinic. The availability of televisions creates a cost-effective yet efficient means of educating the patient population about the benefits of the EMR. Short video productions can take the early static visions of EMR benefits from the banners and placards and demonstrate and answer many frequently asked questions regarding the benefits and access to electronic health records. Once again, this is a captive audience, and those of a non-technical nature are less likely to be drawn to a smartphone in their pocket and thus become a willing audience to the videos and information being presented. Moreover, creating a resource within the community health center or even an

EMR information hotline could help educate the non-technical patients even further by answering questions not provided on the banners, placards, or videos. Adding this resource to all the education materials creates a multidimensional approach to educating the non-technical patient.

Promoting the Online EMR Portal

The next step to improving EMR perception is to create a campaign highlighting the benefits of the online EMR portal. This campaign will require a short technological overview that walks patients through gaining access to their health records through the online EMR portal and whom to contact with issues when doing so. Patients are already interested in the following EMR functions: checking medical records and test results, followed by requesting prescription refills, keeping track of immunizations, making an appointment or scheduling a test, paying medical bills, and looking up a family member's medical record. Therefore, clinic signage identifying these portal functions would effectively promote the use of the online EMR portal.

Educate Providers and Healthcare Teams to Improve Communication Skills

Only some individuals are proficient in communicating with others. Providers and medical staff that bring the EMR and its associated technologies into the exam room create a new environment for the patient, providers, and healthcare teams. The Frankel et al. (2005) research concluded that effective use of computers in the exam room might depend upon the providers' baseline skills that are carried forward and amplified, either positively or negatively, in their effects on patient-provider communication. Introducing technology to the exam room amplifies these communication issues. Although the EMR is designed to maintain a multitude of records, spanning many years of healthcare for the patient, the ability of the provider to instantly access the relevant data without disrupting the already delicate communication with the patient is essential. Providers will be required to improve communication skills that are, at times, already

hampered by the different demographics and culture differences already present in patient-provider communication. Educating providers with essential communication skills will help them determine where the communication barriers are most prevalent while accessing the EMR and what steps may be taken to improve crucial patient-provider communication.

Budgeting for the EMR to Achieve the Greatest Impact

When budgeting for the implementation of an EMR, several vital elements should remain in consideration for the healthcare organization. These fundamental elements include the coordination of implementation, scalability and interoperability, and design and training.

Coordination of Implementation

Coordination and collaboration are effective before, during, and after the implementation of the EMR. Adding additional healthcare facilities in the evaluation and implementation process creates a collective collaboration essential to ensuring that the EMR is functional after its implementation for all healthcare centers, specialists, and hospitals in the surrounding area. This coordination of effort ensures that all the health centers and specialists that regularly work in conjunction with each other have access to the others health center's EMR. Since EMR systems were not originally developed to be cross-platform solutions, designing, and implementing like solutions across multiple facilities can be advantageous. Attempting to interface with non-similar EMR solutions often results in patient health records that cannot be shared across entities, severely impacting patient care. If the organization is the only facility implementing a new EMR, working with other facilities in the immediate area can still be effective. Working with other facilities can help determine what EMR systems are currently being utilized and help understand the associated benefits and disadvantages of those systems. Another advantage of EMR collaboration is that it allows for increased negotiating power with EMR vendors. The larger the collaboration, the lower the final turnkey solution cost. Furthermore, the collaboration offers an

opportunity to create relationships with peers in healthcare facilities across the region, helping to improve healthcare for all patients in the region by improving communication.

Scalability and Interoperability

Understanding the needs of the patients in the community is also essential when deciding which EMR solution to implement. Determining the availability of core modules and the flexibility of the system to add additional modules over time is essential when determining which EMR meets the needs of the patient and the healthcare facility. If the EMR solution does not offer the ability to share patient medical records with other facilities, patient care can be compromised. An EMR is only as good as its ability to access critical patient medical records. Therefore, a successful new EMR implementation requires benchmarking, creating, and harnessing a technological infrastructure's capacity; breaking down barriers to quality improvement; effective information sharing; and the use of medical data across multiple facilities.

Design and Training

The design of an EMR system is a crucial requirement for its acceptance and utilization. The EMR must be designed for ease of use and its ability to input and access medical records quickly. Understanding current workflows within the healthcare facility are required before developing the modules within the EMR. If it is not easy for the healthcare provider or the healthcare team to input and access medical records, the healthcare teams will often find workarounds to the system, subverting the EMR's ability to capture vital health records required for the care of the patient. Creating training sessions before, during, and after the implementation will create comfort and familiarity with the new system before the integration of the new EMR. Furthermore, creating a parallel implementation method of slowly migrating to the new EMR

instead of an overnight switchover can help generate acceptance of the new system and allows mitigating any bugs or workflow issues with the new implementation.

The Hypotheses of this Research

This research effectively examined the role the EMR plays in patient-provider communication by using a null hypothesis to examine the first research question, how does the utilization of the EMR affect patient-provider communication within the community health center? The null hypothesis is stated as follows:

$H1_0$: The use of an EMR will have no effect on patient-provider communication within the community health center.

$H1_1$: The use of an EMR will have a positive effect on patient-provider communication within the community health center.

$H1_2$: The use of an EMR will have a negative effect on patient-provider communication within the community health center.

When examining how the utilization of the EMR impacted patient-provider communication within the community health center, one can quickly surmise that two of the three hypotheses can be correct, dependent upon the type of patient. Hypothesis **$H1_0$** states that the use of an EMR will have no effect on patient-provider communication within the community health center. This research shows that the EMR impacts patient-provider communication within the community health center, whether positively or negatively.

Hypothesis **$H1_1$** states the use of an EMR will have a positive effect on patient-provider communication within the community health center. When the patient is aware of the capabilities and understands the advantages of the EMR, the EMR is shown to positively affect patient-provider communication. Technology-aware patients embrace the EMR and utilize the functionality of the EMR from online portal access, regularly checking medical records or tests,

making an appointment or scheduling a test, requesting a prescription refill, paying medical bills, keeping track of immunizations, and other medical tasks. Patients who comprehend the functionality of the EMR understand the speed and ease with which their records can be accessed and transferred, or the speed at which medical referrals can be performed. Furthermore, these patients understand that they have quick access to their health records no matter where their life or travels may lead them.

Furthermore, hypothesis **H1**$_{2}$ states the use of an EMR will have a negative effect on patient-provider communication within the community health center. This hypothesis has also been confirmed as being true, once again, dependent upon the type of patient. When patients are uncomfortable with technology or do not have regular access to technology, they most often fail to understand why it is important in the exam room, and why the EMR is being utilized during the exam. Patients who are not comfortable with technology often feel that the provider is not listening to their issues and feel that the use of technology detracts from the office visit. Furthermore, many patients uncomfortable with technology would still like to perform common medical tasks online, but due to lack of resources, being unaware of the ability to do so, or understanding that the EMR allows for quick and easy access to their personal health records fail to examine the possibility further.

Limitations of Research

Due to the impact of ethnicity, level of education, and culture on patient-provider communication, the resultant impact of this research and the effects of the EMR on communications may not be generalized to some hospitals, clinics, or community health centers outside of the immediate area of this research in northwest Montana. Because of the nondiverse nature of the sample, with 94.5% being white, mirroring the demographics of the immediate area, the results of this research may vary greatly if conducted in areas with a larger diversity

within the population. The experiences of the patient and the provider, due to the homogeneous nature of the region, may possibly dilute the necessity to overcome the effects of race or ethnicity in patient-provider communication prior to the introduction of the EMR, and may not generalize into areas with a more diverse population. The same could be held regarding the level of education. Of the sample of this study, 32% of the participants had attended some college, 23% held an undergraduate degree, and 7.8% held a graduate degree, echoing the immediate area's demographics. Populations with significant differences in levels of education may also have a significant impact on the generalizability of the research conducted in other geographies.

Recommendations for Future Research

Communication within healthcare is essential; therefore, understanding the impacts of the EMR on this vital patient-provider communication is crucial. No matter the geography and no matter the differences in the demographics in these areas, maintaining patient-provider communication is imperative. Therefore, researchers in the healthcare and communication fields have an opportunity to continue with this type of research in different locations across the United States and the globe. Although the demographics may change with geographies, understanding the possible barriers in patient-provider communication due to the EMR or other healthcare-related technology remains essential.

Conducting qualitative video research to examine how introducing technological devices into the exam room has an impact on patient-provider communication would also be effective. The Frankel et al. (2005) research identified four domains in which EMR use in the exam room affected patient-provider communication, including visit organization, verbal and nonverbal behavior, computer navigation and mastery, and spatial organization of the exam room. Introducing computers into the exam room affects the visual, verbal, and postural connection between providers and patients. Utilizing video to examine the communication process between

providers and patients could be essential in improving verbal and nonverbal cues to help improve communication. However, adding cameras to the exam room can, in effect, change the dynamics of the physician encounter, as well.

Even though the research for Lincoln County, Montana, is concluded, there are opportunities to apply the related research questions associated with this study to other clinics, hospitals, and community health centers throughout the tri-state area of Montana, Idaho, and Washington. The instruments, requirements, and overall understanding of this research will allow this researcher to communicate directly with other healthcare partners, share the results of this study, and work with these healthcare centers to replicate this type of study in their environment and geography. This research was never meant to be a one-and-done type of study. Not only will this type of research be essential for other healthcare facilities to conduct, but it will also be beneficial to repeat this research in these health centers as technology expands and changes in the future. As time passes, EMRs will continue to morph into more patient-friendly, user-friendly, and communication-friendly applications, which will rely heavily on the ongoing improvements in technology and the new technologies that will be available in the future. The utilization of these new technologies will also have a significant impact on patient-provider communication within the healthcare setting.

Summary

The results of this research revealed that EMR systems have an impact on patient-provider communication within the community health center. At times, this impact on communication is considered as being positive, but at other times, remains negative, thus significantly impacting healthcare. Understanding the patient's comfort level with technology, access to technology, comprehension of the benefits of the EMR, and utilization of an online EMR portal can predict the patient's perceptions of the EMR. In northwestern Montana, either

due to age, education, or income levels, many patients do not have access to technology or daily access to the Internet. Without access to personal technology devices, many fail to understand the functionality and benefits of the EMR. Having a familiarity with the EMR and its intrinsic benefits helps the patient understand why this type of technology is used within healthcare and how the EMR impacts and improves the level of care each patient receives.

This study contributes to an existing body of communication research and generates ideas for new research on the effects of the EMR on patient-provider communication. There are opportunities in multiple geographies to apply this related research to hospitals, clinics, and community health centers to better understand the effect of EMR on communication. EMR systems are implemented to improve healthcare communication between patients and physicians; however, the community health center and its physicians must understand how the patient perceives technology and the utilization of the EMR in the exam room. Understanding and easing this communication barrier leads to better healthcare, patient-provider communication, and improved patient outcomes.

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APPENDIX A – Institutional Review Board Exemption

[External] IRB-FY21-22-417 - Initial: Initial - Exempt

[redacted]

Thu 1/20/2022 3:28 PM

To: Boyke, John M [redacted]; Mott, Robert K (Communication and the Arts Admin)

[redacted]

[EXTERNAL EMAIL: Do not click any links or open attachments unless you know the sender and trustthe content.]

LIBERTY UNIVERSITY.
INSTITUTIONAL REVIEW BOARD

January 20, 2022

John
Boyke
Robert
Mott

Re: IRB Exemption - IRB-FY21-22-417 EFFECTS OF ELECTRONIC MEDICAL RECORDS (EMR) ONCOMMUNITY HEALTH CENTER COMMUNICATION

Dear John Boyke, Robert Mott,

The Liberty University Institutional Review Board (IRB) has reviewed your application in accordance with the Office for Human Research Protections (OHRP) and Food and Drug Administration (FDA) regulations and finds your study to be exempt from further IRB review. This means you may begin your research with the data safeguarding methods mentioned in your approved application, and nofurther IRB oversight is required.

Your study falls under the following exemption category, which identifies specific situations in whichhuman participants research is exempt from the policy set forth in 45 CFR 46:104(d):

Category 2.(i). Research that only includes interactions involving educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of publicbehavior (including visual or auditory recording).
The information obtained is recorded by the investigator in such a manner that the identity of the human subjects cannot readily be ascertained, directly or through identifiers linked to the subjects.

Your stamped consent form(s) and final versions of your study documents can be found under the Attachments tab within the Submission Details section of your study on Cayuse IRB. Your stamped consent form(s) should be copied and used to gain the consent of your research participants.If you plan to provide your consent information electronically, the contents of the attached consent document(s) should be made available without alteration.

Please note that this exemption only applies to your current research application, and any modifications to your protocol must be reported to the Liberty University IRB for verification of continued exemption status. You may report these changes by completing a modification submission through your Cayuse IRB account.

If you have any questions about this exemption or need assistance in determining whether possiblemodifications to your protocol would change your exemption status, please email us at [redacted].

Sincerely,

[redacted]
Administrative Chair of Institutional Research
Research Ethics Office

APPENDIX B – Institutional Review Board Stamped Consent

Consent

Title of the Project: Effects of Electronic Medical Records (EMR) on Community HealthCenter Communication
Principal Investigator: John Boyke, Researcher, Doctoral Candidate, Liberty University

Invitation to be Part of a Research Study

You are invited to participate in a research study. To participate, you must be 18 years of age orolder and must have seen your primary physician within the last 12 months. Taking part in this research project is voluntary.

Please take time to read this entire form and ask questions before deciding whether to take part inthis research.

What is the study about and why is it being done?

The purpose of the study is to explore the effects of EMRs on community health centercommunication by examining patient-provider communication.

What will happen if you take part in this study?

If you agree to be in this study, I will ask you to do the following things:

1. Participate in an online survey. The survey will take approximately 15 minutes to complete.

How could you or others benefit from this study?

Participants should not expect to receive a direct benefit from taking part in this study.

Benefits to society include providing medical providers with methods of improvingdoctor/patient communication when technology is present in the exam room.

What risks might you experience from being in this study?

The risks involved in this study are minimal, which means they are equal to the risks you wouldencounter in everyday life.

How will personal information be protected?

The records of this study will be kept private. Research records will be stored securely, and onlythe researchers will have access to the records.

- Participant responses will be anonymous.
- Data will be stored on a password-locked computer and may be used in future presentations. Only the researcher and the faculty committee will have access to the electronic data. All paper copies will be kept in a locked strongbox located within a locked office at the Northwest Community Health Center. Only the researcher will haveaccess to the paper documents. After three years, all electronic records will be deleted and all physical records will be shredded.

Does the researcher have any conflicts of interest?

The researcher serves as an Information Technology Manager at Northwest Community Health Center. To limit potential or perceived conflicts, the study will be anonymous so that the researcher will not know who participated. This disclosure is made so that you can decide if thisrelationship will affect your willingness to participate in this study. No action will be taken against an individual based on his or her decision to participate or not participate in this study.

Is study participation voluntary?

Participation in this study is voluntary. Your decision whether or not to participate will not affectyour current or future relations with Liberty University or Northwest Community Health Center.If you decide to participate, you are free to not answer any question or withdraw at any time prior to submitting the survey without affecting those relationships.

What should you do if you decide to withdraw from the study?

If you choose to withdraw from the study, please exit the survey and close your internet browser.Your responses will not be recorded or included in the study.

Whom do you contact if you have questions or concerns about the study?

The researchers conducting this study are John Boyke. You may ask any questions you havenow. If you have questions later, **you are encouraged** to contact him at [redacted].You may also contact the researcher's faculty sponsor, Dr. Robert K. Mott, at [redacted].

Whom do you contact if you have questions about your rights as a research participant?

If you have any questions or concerns regarding this study and would like to talk to someone other than the researchers, **you are encouraged** to contact the Institutional Review Board,[redacted]

Disclaimer: The Institutional Review Board (IRB) is tasked with ensuring that human subjects research will be conducted in an ethical manner as defined and required by federal regulations. The topics coveredand viewpoints expressed or alluded to by student and faculty researchers are those of the researchers and do not necessarily reflect the official policies or positions of Liberty University.

Your Consent

Before agreeing to be part of the research, please be sure that you understand what the study isabout. You can print a copy of the document for your records. If you have any questions aboutthe study later, you can contact the researcher using the information provided above.

APPENDIX C – Survey Consent

Welcome to the Electronic Medical Record (EMR) Survey

Thank you for participating in the EMR survey. Your feedback is important. After you have read the consent form below, please click the link to proceed to the survey. Doing so will indicate that you have read the consent information and would like to take part in the survey.

Consent

Title of the Project: Effects of Electronic Medical Records (EMR) on Community Health Center Communication

Principal Investigator: John Boyke, Researcher, Doctoral Candidate, Liberty University

Invitation to be Part of Research Study

You are invited to participate in a research study. To participate, you must be 18 years of age or older and must have seen your primary physician within the last 12 months. Taking part in this research project is voluntary.

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1. Participate in an online survey. The survey will take approximately 15 minutes to complete.

How could you or others benefit from this study?

Participants should not expect to receive a direct benefit from taking part in this study.

Benefits to society include providing medical providers with methods of improving doctor/patient communication when technology is present in the exam room.

What risks might you experience from being in this study?

The risks involved in this study are minimal, which means they are equal to the risks you would encounter in everyday life.

How will personal information be protected?

The records of this study will be kept private. Research records will be stored securely, and only the researchers will have access to the records.

Participant responses will be anonymous.

Data will be stored on a password-locked computer and may be used in future presentations. Only the researcher and the faculty committee will have access to the electronic data. All paper copies will be kept in a locked strongbox located within a locked office at the Northwest Community Health Center. Only the researcher will have access to the paper documents. After three years, all electronic records will be deleted and all physical records will be shredded.

Does the researcher have any conflicts of interest?

The researcher serves as an Information Technology Manager at Northwest Community Health Center. To limit potential or perceived conflicts, the study will be anonymous so that the researcher will not know who participated. This disclosure is made so that you can decide if this relationship will affect your willingness to participate in this study. No action will be taken against an individual based on his or her decision to participate or not participate in this study.

Is study participation voluntary?

Participation in this study is voluntary. Your decision whether or not to participate will not affect your current or future relations with Liberty University or Northwest Community Health Center. If you decide to participate, you are free to not answer any question or withdraw at any time prior to submitting the survey without affecting those relationships.

What should you do if you decide to withdraw from the study?

If you choose to withdraw from the study, please exit the survey and close your internet browser. Your responses will not be recorded or included in the study.

Whom do you contact if you have questions or concerns about the study?

The researchers conducting this study are John Boyke. You may ask any questions you have now. If you have questions later, you are encouraged to contact him at [redacted]. You may also contact the researcher's faculty sponsor, Dr. Robert K. Mott, at [redacted].

Whom do you contact if you have questions about your rights as a research participant?

If you have any questions or concerns regarding this study and would like to talk to someone other than the researchers, you are encouraged to contact the Institutional Review Board, [redacted].

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Disclaimer: The Institutional Review Board (IRB) is tasked with ensuring that human subjects research will be conducted in an ethical manner as defined and required by federal regulations. The topics covered and viewpoints expressed or alluded to by student and faculty researchers are those of the researchers and do not necessarily reflect the official policies or positions of Liberty University.

Your Consent

Before agreeing to be part of the research, please be sure that you understand what the study is about. You can print a copy of the document for your records. If you have any questions about the study later, you can contact the researcher using the information provided above.

APPENDIX D – Survey Questions

Electronic Medical Record (EMR) Survey

* 1. In the past 12 months, how many times have you been to the Northwest Community Health Center (NWCHC) for a healthcare appointment?

- ◯ I have not seen a medical, behavioral health, or dental provider at NWCHC
- ◯ 1 to 3 times
- ◯ 4 to 6 times
- ◯ 7 to 12 times
- ◯ More than 12 times

* 2. Of those visits to the Northwest Community Health Center for healthcare, how often did you see a provider other than your primary care physician?

- ◯ Always saw my primary care physician
- ◯ Saw my primary care physician most of the time
- ◯ Saw other healthcare providers more than my primary care physician
- ◯ Was unable to see my primary care physician
- ◯ Don't Know

* 3. How did the COVID-19 pandemic impact the number of healthcare visits you made to the Northwest Community Health Center?

- ◯ My number of healthcare visits increased slightly
- ◯ My number of healthcare visits increased significantly
- ◯ My number of healthcare visits did not change
- ◯ My number of healthcare visits decreased slightly
- ◯ My number of healthcare visits decreased significantly
- ◯ Don't Know

* 4. How often do you use any of the following?

	Daily	Weekly	Monthly	Have not used.
Personal computer/laptop	◯	◯	◯	◯
Tablet/iPad device	◯	◯	◯	◯
Web-enabled mobile phone (smartphone)	◯	◯	◯	◯

* 5. Do you currently keep track of your or your family's medical history, either on paper or in a computerized or online record? [SELECT ALL THAT APPLY]

- ◯ Yes, on paper
- ◯ Yes, on a personal computer
- ◯ Yes, using an Internet site or mobile application
- ◯ No, I do not maintain my own health records

* 6. Does your healthcare provider currently use an electronic/computerized medical record (EMR) or a paper chart?

- ◯ Electronic medical record
- ◯ Paper chart
- ◯ Don't Know

* 7. Please rate your level of agreement with the following statements.

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
a. A paper chart is more secure than an electronic medical record.	◯	◯	◯	◯	◯
b. An electronic medical record is more accurate than a paper chart.	◯	◯	◯	◯	◯

* 8. Which type of chart would you prefer that your medical provider use?

- ◯ Electronic medical record
- ◯ Paper chart
- ◯ I have no preference

9. For what reason(s) would you prefer that your doctor use an electronic medical record?

* 10. Did your healthcare provider use any of the following during your last office visit/medical exam?

- ◯ Computer/laptop
- ◯ Mobile phone
- ◯ Both a computer and a mobile phone
- ◯ Neither a computer nor a mobile phone
- ◯ Don't Know

* 11. Did your healthcare provider access your electronic medical record or use a computer during your last office visit/medical exam?

- ◯ Yes
- ◯ No
- ◯ Don't know

* 12. How often did your healthcare provider access your electronic medical record or use a computer during your last office visit/medical exam?

- ◯ Only at the beginning or end of the office visit/medical exam
- ◯ Once or twice during the office visit/medical exam
- ◯ Throughout the office visit/medical exam
- ◯ Don't know

* 13. Please rate your level of agreement with the following statements about your healthcare provider accessing your medical record during your visit/medical exam.

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
Accessing the electronic medical record was important to the office visit/medical exam.	○	○	○	○	○
Accessing the electronic medical record improved the quality of the office visit/medical exam.	○	○	○	○	○
Accessing the electronic medical record detracted from the office visit/medical exam.	○	○	○	○	○
I was able to communicate with my doctor/medical provider while he/she was accessing the electronic medical record.	○	○	○	○	○

* 14. Thinking about the possible benefits of your doctor using an electronic medical record (EMR) system, please indicate the importance of the following potential benefits for you.

	Not very important	Slightly important	Important	Very important	Extremely important
An EMR reduces medical mistakes by ensuring that all of your health care providers have the same information about your health history, allergies, and medications.	○	○	○	○	○
An EMR improves communication with your doctor, by allowing you to send and receive online messages.	○	○	○	○	○
An EMR brings down health care costs by reducing test duplication and making record-keeping more accurate and efficient.	○	○	○	○	○
An EMR makes it easier for you to access your health information, including prescription history, immunizations, and test results.	○	○	○	○	○
An EMR helps patients keep track of family health information including tests, immunizations, and upcoming appointments.	○	○	○	○	○
An EMR enables better coordination of care, enabling doctors to collaborate and obtain second opinions.	○	○	○	○	○
An EMR system improves the overall quality of my care.	○	○	○	○	○

* 15. Please rate your agreement with the following statements about your doctor's use of an electronic medical record (EMR).

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
I have a more positive impression of my doctor because he/she uses electronic medical records (EMR).	◯	◯	◯	◯	◯
I feel more confident about the care my doctor provides because he/she uses electronic medical records (EMR).	◯	◯	◯	◯	◯

* 16. Please rate your agreement with the following statements about your healthcare provider using a computer during an office visit/medical exam.

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
It is necessary for my healthcare provider to use a computer in the exam room during the office visit/medical exam.	◯	◯	◯	◯	◯
My healthcare provider is able to listen to my healthcare concerns while using a computer during the office visit/medical exam.	◯	◯	◯	◯	◯
I find myself distracted when my healthcare provider uses a computer during the office visit/medical exam.	◯	◯	◯	◯	◯
My healthcare provider appears to be distracted when using a computer during the office visit/medical exam.	◯	◯	◯	◯	◯
Having a computer in the exam room has no impact on my ability to communicate with my healthcare provider	◯	◯	◯	◯	◯

* 17. Have you ever used a website or web portal to access an electronic medical record maintained by a doctor or hospital?

◯ Yes

◯ No

◯ Don't know

* 18. How frequently do you access an electronic medical record for yourself or a family member?

- ◯ I have only accessed it once or twice
- ◯ Once every few months
- ◯ Once or twice a month
- ◯ Weekly
- ◯ Daily
- ◯ Don't know

* 19. Approximately how long ago did you first start using an online medical record?

- ◯ Within the past 6 months
- ◯ 6 months to 1 year ago
- ◯ 1 to 2 years ago
- ◯ 3 to 5 years ago
- ◯ More than 5 years ago
- ◯ Don't know

* 20. Which of the following have you ever done online? [CHOOSE ALL THAT APPLY]

- ☐ Request a prescription refill
- ☐ Make/confirm an appointment or schedule a test
- ☐ Check medical records or test results
- ☐ Send a message to a physician or nurse
- ☐ Complete paperwork prior to an appointment
- ☐ None of the above
- ☐ Look up or manage health information for a child or other family member
- ☐ Pay medical bills
- ☐ Keep track of immunizations and preventive screening tests
- ☐ Monitor fitness activities, diet, or other healthy behaviors

* 21. For what reasons have you not tried to use an online medical record? [SELECT AS MANY AS APPLY]

- [ ] My doctor/hospital does not offer an online health record
- [ ] I don't know where/how to set up an online health record
- [ ] I am concerned about the privacy of my medical information
- [ ] I don't need to access my health information outside of my doctor's office
- [ ] I prefer to manage my health information offline
- [ ] I am not very comfortable using computers or the Internet
- [ ] Other (please specify)

* 22. If you had access to an online medical record, how interested would you be in the following activities? Please use a scale from 1 to 5, where 1 means you are not at all interested and 5means you are very interested.

	Not at all interested 1	2	3	4	Very Interested 5
Request a prescription refill	○	○	○	○	○
Make an appointment or schedule a test	○	○	○	○	○
Check medical records or test results	○	○	○	○	○
Send a message to a physician or nurse	○	○	○	○	○
Complete paperwork prior to an appointment	○	○	○	○	○
Look up or manage health information for a child or other family member	○	○	○	○	○
Pay medical bills	○	○	○	○	○
Keep track of immunizations and preventive screening tests	○	○	○	○	○
Monitor fitness activities, diet, or other healthy behaviors	○	○	○	○	○

Other (please specify)

* 23. Thinking outside of healthcare now, which of the following activities do you regularly do on the internet? [CHOOSE ALL THAT APPLY]

- [ ] Banking, bill payment, stock purchases, or other financial transactions
- [ ] Shopping (e.g. Amazon, eBay, individual store sites, etc.)
- [ ] Access social media (e.g. Facebook, YouTube, TikTok, etc.)
- [ ] Selling items on eBay or other auction sites
- [ ] None of the above

Demographics

The next few questions will help us group your responses with other people who complete this survey.

24. What gender do you identify as?

- ◯ Male
- ◯ Female
- ◯ Other (please specify)

25. What is your ethnic background? [CHOOSE ALL THAT APPLY]

- [ ] White
- [ ] Asian - Eastern
- [ ] Asian - Indian
- [ ] Hispanic or Latino
- [ ] African-American
- [ ] Native-American or Alaskan Native
- [ ] Native Hawaiian or Pacific Islander
- [ ] Other (please specify)

26. What is your age?

- ◯ 18-24
- ◯ 25-34
- ◯ 35-44
- ◯ 45-54
- ◯ 55-64
- ◯ 65-74
- ◯ 75 and Over

27. Which category includes the highest level of education that you have completed so far?

- ◯ Less than high school
- ◯ High school diploma or GED
- ◯ Some college
- ◯ Associate's (2 year) degree
- ◯ Bachelor's (4 year) degree
- ◯ Master's degree
- ◯ Doctoral degree

28. What is your current employment status?

- ◯ Employed Full-Time
- ◯ Employed Part-Time
- ◯ Contract/Temporary
- ◯ Seeking Opportunities
- ◯ Unable to Work/Disabled
- ◯ Retired