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Identifying Physicians' User Experience (UX) Pain Points in Using Electronic Health Record (EHR) Systems

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Identifying Physicians' User Experience (UX) Pain Points in Using Electronic Health Record (EHR) Systems

by
Elizabeth Arceneaux

A Dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy
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Approval Page

We hereby certify that this dissertation, submitted by Elizabeth J. Arceneaux conforms to acceptable standards and is fully adequate in scope and quality to fulfill the dissertation requirements for the degree of Doctor of Philosophy.

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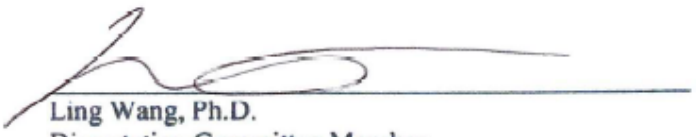

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Healthcare institutions have migrated to online electronic documentation through the means of Electronic Health Record (EHR) systems. Physicians rely on these systems to support their various clinical work processes, such as entering clinical orders, reviewing essential clinical data, and making important medical decisions using reporting analytics. Although EHR systems appear to be useful and have known advantages over paper records, studies suggest there are persistent user interface design problems that may hinder physician productivity. The study focused on the research problem that EHR system designs create productivity problems for physician users who frequently report that system workflows are inefficient and do not map to their clinical process needs.

Although researchers have examined EHR system adaptation and user interface design with various stakeholders, research is limited on the lived experiences of physicians who use the system. A few studies have focused on quantifying the factors that describe the phenomena of "meaningful use" of EHR systems. A qualitative approach to studying the phenomenon of physicians' use of EHR systems is understudied and is relevant to investigate given EHR systems have become commonplace tools in clinical settings. An interpretive phenomenological analysis (IPA) study was conducted with the goal to discover what emergency room physicians describe as the "pain points" of their user experiences with EHR systems, which may include many different experiences to be uncovered, and their perspectives about how they manage the difficulty of system tasks and demands.

Eight participants who represented a purposeful sample were recruited from one hospital in the Southeast region of the United States and participated in semi-structured interviews with open-ended questions. The data derived from the personal lived experiences of the participants were reviewed and analyzed through a step-by-step analytical process to develop five super-ordinate themes: *Historical Chart Review, Inadequate Note Documentation, Difficult Order Entry, Patient Throughput Barriers, and Poor System Performance.* The findings reveal consistencies with previous research that suggests physicians experience mental burden and burnout using EHR systems due to task complexity, task demand, and inefficiencies of system design. The findings have multiple implications for information technology (IT) system designers, healthcare administrators, and physician end users. This study provides future research opportunities to investigate the experiences of individuals who work in a different specialized area of the hospital, such as the intensive care unit (ICU).

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Chapter 1

Introduction

Background

While some hospital organizations still use paper documentation (Arditi, Rège-Walther, Durieux, & Burnand, 2017), Electronic Health Record (EHR) systems are implemented to better align with current patient care practices, government mandates, and aid clinicians with data continuity (Adler-Milstein & Huckman, 2013; Kohli & Tan, 2016). The 2009 Health Information Technology for Economic and Clinical Health (HITECH) Act was implemented by the United States government as a way for clinicians to improve patient care and show "meaningful use" of EHR systems (Rathert, Porter, Mittler, & Fleig-Palmer, 2019). According to Rathert, Porter, Mittler, and Fleig-Palmer (2019), the term meaningful use is best described as a core set of goals that healthcare professionals must achieve by performing electronic medical functions in the system.

Providers can demonstrate meaningful use by documenting a patient's vital signs, reviewing and updating a patient’s history of illness, verifying home medications, and maintaining an active allergy list (Guo, Chen, & Mehta, 2017; Kim et al., 2019). In addition, government officials have desired for providers to focus on meaningful use by improving the coordination of care among providers and the quality of care they provide (Bui, Hansen, Liu, & Tu, 2018). EHR systems are known to be advantageous over paper records because they provide the ability to reduce medical errors and integrate health data through multiple systems (Ozair, Jamshed, Sharma, & Aggarwal, 2015). According to Bardhan, Chen, and Karahanna (2020)

and Xu et al. (2019), EHR systems can also be instrumental in disease management and provide predictive-modeling algorithms to identify patients who need services.

Although organizations have adopted EHR technology, the success of the HITECH Act is still unclear because major barriers remain that are related to the user experience of electronic health systems (Reisman, 2017). For instance, Patterson, Anders, and Moffatt-Bruce (2017) and Reisman (2017) indicated that physicians often experience mental burden and burnout using EHR systems due to task complexity, task demand, and the inefficiencies of system design. Several functions of the system can require multiple parts of data to flow together. One example is the computerized physician ordering entry (CPOE) function that support providers in entering and maintaining procedure and medical orders for patients (Angst, Wowak, Handley, & Kelley, 2017). The CPOE functionality can be complex and challenging because the data flows through various inputs and outputs before the patient's order actually becomes active (Patterson et al., 2017). Patient care may also be affected when a physician does not have the extra time to enter an order into the system and the task is delegated to someone else (Shanafelt et al., 2016).

Despite the increased demand for EHR system use, several studies have shown these systems to be a hindrance to physician productivity and the time they spend with their patients (Adler-Milstein & Huckman, 2013; Asan, Smith, & Montague, 2014; Mazur et al., 2016; Tutty, Carlasare, Lloyd, & Sinsky, 2019). Due to the vast amount of data transferred among systems, physicians spend extra time entering data and interpreting the output (Mazur et al., 2016). Consequently, they are prone to spending more screen time and less face time with patients. Yates (2020) indicated that primary care physicians use about 37% of their working hours performing tasks in the system rather than interacting with their patient. Other studies reveal that physicians have unfavorable views regarding the amount of time they spend on clerical tasks that

are directly related to patient care (Shanafelt et al., 2016; Willard-Grace et al., 2019). This research is in line with Barrett and Stephens's (2017) study that found providers to prefer paper and computer-based workaround strategies to save time and become more efficient in their work.

Pollack and Pratt (2020) reported that many EHR systems are inadequately designed and do not contribute to the cognitive abilities and needs of various physicians. They support the notion that physicians have little support to make important clinical decisions after searching through multiple sections of the system to find patient information and synthesize results. Other studies have examined how mentally challenging clinical care is and how the excessive stimulation from computer systems demand additional tasks that can lead to cognitive overload (Ariza, Kalra, & Potts, 2015). Horsky and Ramelson (2016) found that EHR systems often have design limitations that could prompt clinicians to use workarounds, adding an extension to their workflow and to their workday. Due to the nature of clinical work, physicians often change priorities and shift their goals to meet evolving task demands (Horsky & Ramelson, 2016).

EHR design issues stem from a lack of fixed series of steps and task needs in the system, poorly sustained documentation, lack of intuitiveness, and a poor fit for provider needs (Ariza et al., 2015). For instance, the act of viewing and writing clinical progress notes under a time constraint can be a challenging task that involves preliminary patient management direction (Rizvi et al., 2017). Physicians and residents alike view the act of writing progress notes to be a daunting task that is extremely repetitive and dependent upon usability design constraints of the system (Rizvi et al., 2017). Rizvi et al. (2017) noted that it is especially challenging for providers to view information on multiple screens to document medical progress notes when the information on the chart constantly updates. Ratwani, Fairbanks, Hettinger, and Benda (2015) also found that there have been missed opportunities with EHR system design because providers

feel that interfaces are difficult to read, displays are confusing, and icons lack consistency. The system navigation scheme is also known as a usability challenge with EHR systems because providers must browse through different screens and sections to get an adequate mental picture of the patient's current condition (Roman, Ancker, Johnson, & Senathirajah, 2017). Since providers spend a good amount of time interacting with the system, usability requirements and issues related to cognitive workflow are important aspects of EHR interface design.

Organizational factors are another consideration when physicians interact with EHR systems. According to Dalal et al. (2019), healthcare organizations have worked with experts in the human factors (HF) and systems engineering (SE) domain in an effort to validate health care processes and improve the implementation of new EHR systems. Although experts in both domains have been increasingly recognized, few studies have assessed the value in deploying HF and SE methods by teams with varied backgrounds to support large EHR implementations (Dalal et al., 2019). Salwei et al.'s (2019) study emphasized the need for workflow analysis during the human centered design (HCD) process to identify positive and negative impacts on provider workflows. According to Carayon et al. (2014), the Systems Engineering Initiative for Patient Safety (SEIPS) model is an example of a human factors system model that organizations can follow to define work processes. This dynamic model clearly established the interactions between the work systems that consist of technology and tools, the organization, the person, tasks, and the physical environment that link to patient care processes and outcomes (Carayon et al., 2014). The person in the middle of the work system is often known as the person on the patient's care team that consist of physicians, nurses, and other team members (Carayon et al., 2014).

Alternatively, there are some organizations that have a hybrid work system where providers function in two different ways by documenting on paper as a workaround and documenting in an electronic system (Blijleven, Koelemeijer, & Jaspers, 2019). Blijleven, Koelemeijer, and Jaspers (2019) reported that providers who use both methods are at an increased risk for providing less than safe, quality care, and efficient care. For instance, a physician will purposefully write relevant patient information on paper while performing a patient's exam then return later to transcribe the same data into the system (Blijleven et al., 2019). Furthermore, Blijleven et al. argued that the delay in documentation has an impact on patient safety when the EHR database becomes an unreliable data source in normal and emergency situations.

The research by Blijleven et al. (2019) contrast with Barrett and Stephens's (2016) study that indicated the use of paper and electronic workflows illustrate provider efficiencies and awareness. In this case, research revealed that paper workarounds led to positive employee perceptions and allowed individuals to accomplish crucial tasks that were otherwise difficult to accomplish (Barrett & Stephens, 2016). Due to the lack of options in the system, the work processes were different amongst clinicians and each person performed their own tasks as they saw fit. Babbott et al. (2013) and Barrett and Stephens agree that provider efficiency and resilience could be achieved if providers use a fully functioning EHR system with workplace processes that match. When a fully functioning system is in place, it is possible for clinicians to be aware of the array of tasks required for each patient's visit (Babbott et al., 2013; Barrett & Stephens, 2016).

Problem Statement and Goal

Although EHR systems appear to be useful and have known advantages over paper records, previous studies suggest there are persistent user interface design problems that may hinder physician productivity (Kroth et al., 2019). The study focused on the research problem that EHR system designs create productivity problems for physician users who frequently report that system workflows are inefficient and do not map to their clinical process needs (Meigs & Solomon, 2016). Although researchers have examined EHR adaptation and user interface design with various stakeholders (Park, Chen, & Rudkin, 2015; Taieb-Maimon, Plaisant, Hettinger, & Shneiderman, 2017), research is limited on understanding the lived experiences of physicians who use the system.

A few studies have focused on quantifying the factors that describe the phenomena of "meaningful use" of EHR systems (Bui et al., 2018; Kim et al., 2019). A qualitative approach to studying the phenomenon of physicians' use of EHR systems is understudied and is relevant to investigate, given EHR systems have become commonplace tools in clinical settings. An interpretive phenomenological analysis (IPA) approach as defined in Smith, Flowers, and Larkin (2009) was conducted with the goal to discover what emergency room physicians describe as the "pain points" of their user experiences with EHR systems, which may include many different experiences to be uncovered, and their perspectives about how they manage the difficulty of system tasks and demands. According to Fong, Hettinger, and Ratwani (2017), emergency room physicians are often interrupted as they practice patient care, in which many occur while they are performing tasks on a computer.

EHR systems were not originally built for environments that were consistent with usability standards and did not consider opportunity-cost factors and time pressures like

healthcare (Kellogg, Fairbanks, and Ratwani, 2017). As more processes began to evolve, electronic records expanded to consist of additional data such as patient demographics and hospital operation information (Kohli & Tan, 2016). Although these systems have evolved over time, usability considerations such as goal-oriented directed activities and interfaces that respond to time pressures have been disregarded by designers (Kellogg et al., 2017). Physicians routinely struggle to complete workflow tasks due to insufficient navigation designs that could lead to an increase in physical and cognitive demands (Roman et al., 2017).

The need for EHR systems received a large push from the government towards an electronic health information exchange (HIE) and several organizational desires for potential cost-saving benefits (Ozair et al., 2015; Reisman, 2017; Bui et al., 2018). Although policymakers and healthcare professionals have viewed HIE to be the solution to isolated and fragmented healthcare data, EHR systems have not reached their full potential (Bui et al., 2018). According to Bui et al. (2018) and Kohli and Tan (2016), there are social and organizational challenges that affect EHR development and its widespread use. Prior to the implementation, the system must support the primary goals of the operational stakeholders. The user goals of the system may be different for different stakeholders who use the same system (Bui et al., 2018; Kohli & Tan, 2016). The study involved a qualitative inquiry of physician users' lived experiences of using EHR systems, specifically focusing on their stories and reflections on their user experiences with EHR systems. The qualitative investigation, through interviews, aimed to identify the "pain points" physicians perceive to be related to the usability of EHR systems and how task demand and task difficulty influence a physician user’s day-to-day performance.

Hudson, Kushniruk, Borycki, and Zuege’s (2018) study used a mixed method of questionnaires and a think aloud method to explore physician satisfaction with critical care EHR

systems. Their findings concluded that implementing an EHR system could lead to undesirable technological changes that can limit a clinician's productivity and work efficiency. One example that Hudson et al. (2018) observed was the dissatisfier from physicians who expressed concern with the amount of time it takes for the system to respond when they try to complete a task. Hudson et al. also found that providers find the screen layout and organization to be unfavorable, which often leads them to use workflow workarounds. Although Hudson et al. explored physician satisfaction through the use of questionnaires and think aloud methods, there is a gap in research on what parts of the system prove to be most challenging for physician users.

In addition, Mazur et al. (2016) studied EHR usability and behaviors of physician users and suggest for future research regarding user task data and the perceived workload of physicians in a real clinical environment. Taieb-Maimon et al. (2017) also suggested that future research be conducted in a real clinical setting where users naturally perform system tasks and deal with actual system errors. To address part of this research gap, which is to discover what physicians describe as real medical scenarios in the context of their user experiences with EHR systems, the scope of the study involved a qualitative inquiry of participants who have at least one-year experience in working with an EHR system.

The study builds on the previous research by Mazur et al. (2016) and Taieb-Maimon et al. (2017) by investigating not only what current problems exist in EHR system design, but also investigating how physician users manage the difficulty of system tasks and demands. While prior research has produced some quantitative and qualitative data to reveal significant patterns of task demands and task difficulties of EHR system use, there is a lack of qualitative research that examines both deeper and broader aspects of the physician user experience. By achieving a deeper and contextual account of a physician user's experiences and perspectives,

recommendations can be established and used for healthcare organizations who implement EHR systems.

Research Questions

The overarching, grand tour research question was:

What are the "pain points" that physicians describe as their lived experiences with EHR system use?

To focus on the grand tour research question, semi-structured interviews were conducted of eight emergency room physicians who have experience using an EHR system. An interview guide (see Appendix A) provided structure to the interview by including open-ended interview questions to help facilitate natural engagement and interaction between the interviewer and the participants as they shared their own account of EHR system use (Smith, Flowers, & Larkin, 2009). The interview guide assisted in maintaining focus on the grand tour question, and included such sub-questions as:

1. How do physician users describe how they perform routine clinical tasks in the system?
2. How do physician users describe how they experience system task functions that are difficult to perform?
3. How do physician users describe aspects of the system that do not meet the needs of physician users?

The study followed an interpretive phenomenological analysis (IPA) approach that investigates how people make sense of what occurs in their life and the phenomenon being explored (Smith et al., 2009). In particular, IPA research employs a phenomenology, idiographic, and double hermeneutic process. According to Peat, Rodriguez, and Smith (2019), phenomenology methods are concerned with how things appear to a person, whereas idiographic methods provide

an in-depth personal account of single cases in a person's unique space. The double hermeneutics method pertains to first, how participants interpret the meaning of their life, then second, the researcher who attempts to decode that meaning (Peat, Rodriguez, & Smith, 2019).

Relevance and Significance

The study is significant because the problem spans across multiple healthcare organizations where safety concerns and patient risk exposures are prevalent (Green, Brandt, & Miller, 2018; Priestman et al., 2018; Shanafelt et al., 2016). Research reveals that certain usability flaws in system design can lead to safety issues or hazards that are associated with EHR implementations (Green et al., 2018). In an attempt to address this issue, several studies have explored the usability aspects of EHR systems. For example, Green, Brandt, and Miller (2018) reviewed current usability issues, namely about how well EHR systems relate to safety analysis techniques and design guidelines. As a result, Green et al. suggested that organizations must first prioritize the safety issues found in usability testing, followed by focusing on the finding and not the fix. Green et al. also proposed that organizations measure the dimensions of EHR usability through a series of benchmark thresholds applied to each measure of effectiveness, efficiency, and satisfaction. Although this study was relevant for addressing usability principles in EHR system design and safety procedures, Green et al. pointed out a need to further evaluate safety into usability test scenarios that occur post system implementation.

Additional studies found that EHR systems impede a physician's productivity because they have to search for pertinent information in different parts of the chart and spend time on suboptimal workarounds while taking care of a patient (Kroth et al., 2018; Pine & Chen, 2020). Research revealed that clinicians transcribe notes on paper at the patient's bedside to maintain eye contact and enhance the patient-provider experience (Pine & Chen, 2020). According to

Kroth et al.'s (2018) study, further research is needed to measure provider satisfaction, stress levels, and patient care outcomes. Other studies have suggested the importance of an integrated system design to improve the workflow of collaborative patient care teams (Murphy, & Reddy, 2017). Murphy and Reddy (2017) used a qualitative approach to evaluate the technological and human factors that influence patient related information problems (PIPs) found among care teams. Their research revealed that care team members such as physicians, nurses, and pharmacists all share a prominent role in continuously collecting and updating a patient's information during their hospital stay. Murphy and Reddy's findings argued the need to improve organizational policies and accountability for managing PIPs that occur within collaborative care teams.

According to Sittig and Singh (2017), a sociotechnical system best describes the role between individuals and technology where culture, organizational processes, and technology must connect. For instance, everyone who is involved in a patient's care are impacted by the system content, organizational policies, external regulations, and the measurement and monitoring of the clinical data. Sittig and Singh suggested that each component be analyzed through their dependencies and interaction amongst each other. They also concluded that when one aspect of the sociotechnical system changes, other parts of the system change as well. Carayon (2017) and Sittig and Singh (2017) both proposed the need to examine user experience requirements and important patient safety factors when integrating health care processes in EHR systems.

Stance of the Researcher

The researcher has personal experience working in healthcare informatics for over ten years and for many of those years implementing EHR systems. As someone who works as a

Senior EHR Application Analyst for a specialty hospital in Southwest, Texas, it is the researcher's job to routinely illicit business requirements, map internal clinical processes to system specifications, and provide on-going application support for subject matter experts (SMEs) in the emergency department (ED). Designated SME users are a collection of pharmacists, physicians, and nurses who act as a domain expert in their field. In addition to having a daily working relationship with ED SMEs, the researcher facilitates a monthly SME meeting to cover outstanding break/fix application issues, validate new build design, and demonstrate application enhancements from the application vendor.

The researcher's passion for healthcare informatics has led her to learn more about usability and what physician users view as "pain points" of their user experiences with EHR systems. Rather than evaluating numerical measurements, the researcher chose a qualitative approach to study user observations to understand complex situations and difficult workflows (Lazar et al., 2017). Kohli and Tan (2016) indicate that the expertise of information system (IS) researchers can help healthcare organizations establish technical data standards and the design of human computer interaction (HCI) interfaces to help facilitate the effectiveness of EHR systems.

Barriers and Issues

Hospital environments are typically fast-paced and physicians' time is extremely valuable. Previous research reported that physicians constantly face challenges with their time constraints because they have to quickly assess patients and review data to make sound clinical decisions (Sultanum, Brudno, Wigdor, & Chevalier, 2018). Numerous studies have used simulated environments and survey data as reasonable methods in identifying system design limitations due to the availability of participants (Mazur et al., 2016; Mosaly et al., 2017; Pollack & Pratt, 2020). The researcher experienced a similar issue with the recruitment of participants

due to their availability of time and resources. Several of the physicians work 12-hour shifts which varied between day and night shifts. The researcher avoided this barrier by offering participants various interview times and days over a 45-day time period. Other studies revealed that although there are some clinicians that participate in EHR usability studies, they do not give statements about healthcare during interviews or observations if they do not trust that technology will improve it (Tobler et al., 2017). The researcher limited this barrier by ensuring anonymity of responses and provided full disclosure to the participants prior to the interviews.

EHR design issues have also been difficult to assess where there are system limitations such as larger records that present scalability challenges, visualization challenges with aggregate data, and lack of system-to-system integration (Patterson et al., 2017; Sultanum et al., 2018). Other studies indicate that although user acceptance is typically requested through the system development design process, users can be reluctant to participate in research if they have high financial expectations or if they are not fully aware of the study (Hoffman, Benda, Fairbanks, & Auguste, 2017). Although the study may have had the same constraints, the researcher included a financial reward in the study recruitment letter. The researcher also ensured that those who were recruited through their leadership was contacted via email.

Assumptions, Limitations, and Delimitations

Although previous research highlights the benefits of EHR adoption and usability (Barrett & Stephens, 2016), other studies have reported consistent usability issues that impede a clinicians' workflow (Priestman et al., 2018). According to Priestman et al. (2018), usability issues that stem from poor system integration, inefficient workflows, and patient interaction continue to be a major concern for clinicians. The researcher anticipated that eight participants also working at the researcher's place of employment, would embrace the idea of sharing their

user experience and parts of the system that are viewed as pain points. Cajander and Grünloh (2019) indicate that instruments such as interviews can help measure a user's perception of how satisfying a system is. Therefore, the researcher assumed that physician users would provide an honest account of their day-to-day user experience through a semi-structured interview.

There were also a few limitations that may have impacted the validity of this study. The purposeful sample was limited to one hospital within Southeast, Texas and the sample included emergency room (ER) attending physicians who have used an EHR system for at least one year. The sample of physicians was also limited to physician "champions" who have technology knowledge and serve as an advocate to promote a useful EHR system (Gui et al., 2020). In addition, the approval for the research on-site was another limitation. According to Wagstaff et al. (2014), the deeply rooted personal experiences that IPA studies require, may cause issues for researchers who seek ethical approval for new research proposals, particularly to conduct them in places where they are employed. This limitation was especially true for the researcher who had to obtain a lengthy approval from the organization's institutional review board (IRB) (see Appendix B) where she was required to work under a current licensed faculty member. The licensed faculty member is an attending physician who works in the ER and agreed to serve as the on-site supervisor of the research.

The researcher delimited the study in a few ways. First, the study only included one type of physician (attending physician) instead of those who are residents, fellows, or midlevel providers. The study also purposely included a small sub-group of emergency room physicians who have experience using an EHR system for at least one year. According to Smith et al. (2009), a small, purposively-driven sample is suggested for researchers to commit to a particular

sense of detail. Interviews were only conducted with these participants to assist the researcher with a manageable and controlled study.

Definition of Terms

ASAP: The Epic Systems Corporation (Verona, WI) developed an application module named "ASAP" as part of an electronic health record (EHR) system to be used by a hospital's emergency department (ED) (Newman, 2017).

Clinician: The term clinician is used synonymously with the term physician in this study. A clinician is a physician or other qualified medical professional who is involved in the treatment of a patient's care (Zahabi et al., 2015).

CPOE: Computerized physician order entry is an application feature of an EHR system that allow a physician or other ordering provider to directly enter medical orders to be carried out for a patient (Taieb-Maimon et al., 2017). The orders can include medications, lab tests, radiology tests, or other medical procedures.

ED: A hospital's emergency room (ER) is often known as the emergency department where many providers practice medicine in the emergency medicine specialty (Neri et al., 2015).

EHR: The term EHR is identified as an electronic health record that stores longitudinal health information about an individual in a computerized format (Johnston, Johnston, & Crowle, 2011).

EMR: The term EMR is known as an electronic medical record that acts as a digital version of a patient's paper medical chart (Zahabi et al., 2015). According to Johnson et al. (2011), the main difference between an EHR and an EMR is the interoperability platform, the ability to share data across organizations. An EMR is typically used within one organization, whereas an EHR is used across multiple health care organizations.

HITECH: The Health Information Technology for Economic and Clinical Health Act is a federal law that was signed in 2009 to promote the meaningful use of EHR systems as used by physicians. The three stages of meaningful use are characterized as 1) physician use of an HER system to track a patient's clinical conditions, (2) the expansion of standards from the first criteria and the focus of areas such as disease management, transitions of care, clinical decision support, and quality measurements, and (3) physician use of an EHR system to improve the privacy and safety concerns that are associated with the electronic transmission of patient health information (Mennemeyer, Menachemi, Rahurkar, & Ford, 2016).

IPA: Smith (2017) indicates that an interpretative phenomenological analysis (IPA) is a qualitative research method that was developed within the psychology domain to examine a person's lived experience (as cited in Smith, 1996).

LDAP: The Lightweight Directory Access Protocol is an industry standard application protocol that is used to help distribute security services and user management over an Internet Protocol (IP) network (Sari & Hidayat, 2006).

UX: The user experience (UX) is a concept that describes how an individual engages with a product (Feng & Wei, 2019).

Summary

Issues related to the implementation and organizational use of EHR systems were introduced. Electronic documentation is considered to be advantageous over paper records, yet various research studies have suggested that EHR systems are a hindrance to physician productivity and the time they spend with their patients (Adler-Milstein & Huckman, 2013; Asan et al., 2014; Mazur et al., 2016; Tutty et al., 2019). Although research studies have examined EHR adaptation and user interface design with various stakeholders (Park, et al., 2015; Taieb-

Maimon et al., 2017), research is limited on understanding the lived experiences of physicians who use the system. This chapter also provided a brief examination of the relevance and significance of EHR systems based on usability flaws in system design that could lead to patient safety issues or clinical hazards (Green et al., 2018; Priestman et al., 2018).

In addition, the stance of the researcher section explained the researcher's healthcare informatics experience that spans over a period of ten years. Throughout those years, the researcher has maintained a close working relationship with pharmacists, physicians, and nursing users who work in the emergency room (ER). This chapter also included the barriers and issues that previous studies have encountered and how the researcher overcame those barriers. Physicians constantly face challenges with their time constraints because they have to quickly assess patients and review data to make sound clinical decisions (Sultanum et al., 2018). The researcher avoided those barriers by offering various interview times over a 45-day period. Additional studies have indicated that physicians do not like to express their true feelings about healthcare if they do not trust that technology will improve it (Tobler et al., 2017). The researcher limited this barrier by ensuring anonymity of responses to interview participants. Last, an explanation of assumptions, limitations, and delimitations were described. As usability issues remain to be a major concern for physicians (Priestman et al., 2018), the researcher assumed that the participants would be willing to share their user experiences with the EHR.

Chapter 2

Review of the Literature

Introduction

Ease of use is defined as the degree in which an individual believes that using a particular system would be free of effort (Davis, 1989). Along the same lines, EHR usability can be described as how useful, usable, and satisfying the system is to a user as they attempt to accomplish goals and tasks in their work domain (Hudson et al., 2018). According to Kaipio et al. (2017), a provider's attitude and acceptance of EHR systems could suggest a close relationship to system usability, especially ease of use and how the integration of data should match a user's day-to-day workflow. Kaipio et al. (2017) found that there is a prevailing mismatch between the clinical work a provider does and the computer system.

According to Dalal et al. (2019), system designers must define problems, assess potential barriers, and understand user workflows to consider a system useful. Several EHR users view different functions of the system to be useful yet very difficult to use (Dalal et al., 2019). Along the same lines, Dobrzykowski and Tarafdar (2016) proposed that for systems to be deemed efficient, the user must not only enter data into the system but also share the information. Information sharing can enhance physicians' performance since it exemplifies coordination among physicians and the hospital nursing staff (Dobrzykowski & Tarafdar, 2016). In this chapter, a literature review of EHR usability is presented along with an explanation of the user experience (UX), and an introduction to the interpretive phenomenological analysis (IPA) research approach.

EHR Usability: Ease of Use

According to Hudson et al. (2018), an EHR system is considered useful if the user of the system finds it to be satisfying and supports their primary workflow. The system is also considered useful if it contains only the necessary functions for a user to complete their job (Priestman et al., 2018). The study by Salwei et al. (2019) about embedded EHR clinical decision support (CDS) tools used in the emergency department (ED), provide an example of physician workflows and the integration of usable technology. Providers can use CDS tools to assist in clinical decision-making at the point of care, some of which can be life-threatening (Salwei et al., 2019). Salwei et al. investigated the lack of CDS implementation in the ED due to poor usability and failed workflow integration. They evaluated two different CDS based scenarios using an existing risk-scoring website and a new CDS created from human-centered design (HCD) and human factors (HF) principles. Both scenarios were constructed in a "playground" simulated environment to mirror the real EHR system. Salwei et al.'s findings suggest that workflow analysis throughout the HCD process can support positive and negative impact on a clinician's workflow. Their research brings attention to the assumption that there is value in examining a user's day-to-day workflow and how an EHR system supports that need.

Grabenbauer, Fruhling, and Windle (2014) explored a gap in research where the cognitive workflow of a physician user and EHR use is limited. The purpose of Grabenbauer et al. (2014)'s study was to introduce a usability evaluation method that was robust but flexible enough to understand the complexity of a physician's cognitive workflow as they use an EHR system. Although there are different approaches to test usability, Grabenbauer et al. used a multi-faceted usability evaluation (MUE) tool based on a cognitive walkthrough that allowed participants to demonstrate their day-to-day processes, complete a usability survey, and describe

their user experience of using an EHR system. Grabenbauer et al. also created a usability evaluation to allow participants to document a patient's medical status, enter orders for lab and diagnostic procedures, update the patient's active medication list, and enter a patient's discharge information. According to Kaipio et al. (2017), several of the clinical tasks a clinician performs in an EHR system should be user intuitive and efficient enough for record-keeping and retrieving information.

To capture the effectiveness, efficiency, and user satisfaction of the system, Grabenbauer et al. (2014) created an observation scorecard. On the scorecard, system effectiveness was based on the user deserting the task or whether the user was able to complete the correct workflow within a certain time frame. Grabenbauer et al. measured efficiency based on the variation of time it took for a user to complete a task versus the allotted time given in a scenario. Grabenbauer et al. also considered any steps the user deviated from and asked post interview questions for users to share their perceptions of EHR usability and satisfaction. Hudson et al. (2018) indicated that efficiency and effectiveness are both considered to be significant factors for EHR users. For example, research has shown that primary care physicians are prone to increased levels of stress as they conduct routine tasks in the system (Hudson et al., 2018). Hudson et al. further emphasized that EHR systems must meet the demands of a user's environment to allow them the flexibility to complete a task quickly and seamlessly.

Although the clinical scenarios appeared to be promising based on the EHR usability guidelines published in the National Institute of Standards and Technology (NIST), Grabenbauer et al.'s (2014) findings revealed that some tasks did not match with the user's normal workflow nor were they perceived as relevant. Another drawback of the study was the access limitations to the system and the lack of properly aligned clinical test data that did match with an NIST based

scenario (Grabenbauer et al., 2014). Thus, non-medical users who were not trained did not have access to the system and were unable to accurately design the test data. Grabenbauer et al. suggested future research on streamlined test scenarios that are built by actual domain experts from interdisciplinary groups such as nursing, emergency medicine, and clinicians who work in family practice. The authors also did not provide results from the usability survey, specifically the post-walkthrough interview data which further necessitates a need for additional qualitative research.

Further research studies (Baird, Davidson, & Mathiassen, 2017; Guo, Chen, & Mehta, 2017) have highlighted the experience of 'click burden' that physicians go through as they complete a series of extra steps to review a patient's medical history and current test results. Guo, Chen, and Mehta (2017) reviewed a case study that highlighted the attempt of physicians at a New York based hospital to improve the EHR experience with better methods of medical documentation, patient chart review, ordering, and an increase on patient safety. Guo et al. (2017) pointed out that a simple task of a physician reviewing a preliminary radiology result and adding it to their progress note begins with (1) clicking on the radiology tab, (2) choosing the test, (3) opening the report, (4) selecting the test, (5) copying the text, (6) returning to the progress note, and (7) pasting the text into their note.

On the same token, Baird et al. (2017) found that providers loathe the idea of multiple clicks to open different screens to view a patient's recent lab results. To mitigate 'click burden' and view previous and current lab data on the same screen, Baird et al. proposed that providers become privy to workarounds by entering a free-text lab value for the patient's current lab result onto the lab summary screen. Their study revealed this workaround to be helpful to providers as they maintain standards of care in managing a patient's lab data.

Guo et al. (2017) indicated that physicians compile other types of patient data the same way that they compile radiology results in order to create a narrative with the patient. The data that is added to a clinician's progress note include but are not limited to vital signs, laboratory (pathology) results, and a patient's diagnosis history. Thus, to reduce documentation time, the physicians at the New York based hospital partnered with an EHR vendor to create a new mobile platform for instant mobile documentation (Guo et al., 2017). Providers were able to view the patient's chart, transcribe notes, and place orders quickly from their mobile device.

Another improvement that physicians worked toward was reducing the need to scroll through an enormous amount of data to accurately find what they need. For instance, Guo et al. revealed that current lab results in the system flowed into a table format that consisted of empty cells even when there was no result available. The providers also collaborated with their EHR vendor to have abnormal lab values auto-populate and appear in the cells as color-coded. Guo et al. further emphasized the need for EHR vendors and designers to reduce 'click burden' and the amount of scrolling to allow physicians more time with their patients.

In the same manner, Rathert et al. (2019) investigated the usability benefits and challenges that nursing and physician users experience while using an EHR system. Rathert et al. (2019) pointed out a similar challenge as Guo et al. (2017) in which some system interfaces have deeply nested user menus where clinicians have to constantly scroll to review information and treat their patients. Kim et al. (2019) noted that EHR systems have transformed a patient's medical record from a meaningful document that once provided a complete medical background of the patient, to a tool that captures data along unrelated pathways for billing purposes.

According to Rathert et al. (2019), physicians do not have trust in the historical patient data because they believe other providers do not actually read historical medical notes.

Rathert et al. found that the copy and paste functionally has been a common method for physicians to enter data, which may actually contribute to medical documentation errors. Rathert et al. explored the following research questions: (1) how do clinicians experience the EHR system and the role it plays in care coordination? and (2) what role does provider trust play in care coordination while clinicians use an EHR system? Rathert et al.'s (2019) findings revealed six themes known as EHR benefits and six themes known as EHR challenges. In response to EHR benefits, clinicians expressed that having a healthcare system that displays multiple patient care encounters is better than sifting through several hundreds or thousands of papers.

Clinicians also indicated that they appreciate the ability to retrieve patient information without having to enter the exam room. Rathert et al. labeled the corresponding themes as: (1) ease of retrieving information, (2) ease of accessing real time information, (3) ease of confidential information sharing, (4) ease of receiving reminders and alerts, (5) ease of reviewing patient data ahead of time, and (6) ease of reviewing historical and trending data. Although the findings revealed several benefits of EHR use, many of the clinicians reported that EHRs' full potential has been unfulfilled due to its lack of interoperability and standardization (Rathert et al., 2019). The clinicians expressed frustrations around the fact that different hospitals use different systems, there is too much on-screen information that is irrelevant, constant system updates, the on-going need for system training, and the loss of information when certain data is transposed (Rathert et al., 2019). Rathert et al. revealed that the corresponding themes for the challenges included: (1) lack of standardization, (2) increased workload, (3) the overreliance of technology, (4) lack of patient-provider relationships, (5) insufficient training, and (6) the mistrust in information.

In response to care coordination, over half of participants revealed that insufficient training was the reason for their communication and care coordination barriers. Several clinicians expressed that their organization required them to learn EHR processes on the job which they believe is dangerous given the need to focus on clinical care at the same time. Rathert et al. (2019) also noticed that participants contradicted their answers later in their interviews by citing that inaccurate data, absence of timely data, and unclear notes posed a risk to their care delivery. Once Rathert et al. discovered the contradictions, they returned to their initial coding of trust and re-evaluated participant responses. After the re-analysis, Rathert et al. recognized a subtheme labeled "acquiescent trust" which meant that participants wholeheartedly trust information in the system. Both nursing and physician users implied or verbally stated that if they mistrust the information in the system it would imply that they are questioning another clinician's professionalism. Rathert et al. further noted that many participants displayed nonverbal cues which indicates that they were uncomfortable with the topic of trust.

Navigation

Navigation is also an important contributor of EHR usability because physicians often navigate through various screens to access patient information (Coleman et al., 2020; Roman et al., 2017). Hundt, Adams, and Carayon (2017) examined system navigation by eliciting feedback from a network of individuals such as information technology (IT) analysts, human factors researchers, trainers and nursing users who had usability evaluation experience. The feedback revealed that there were several heuristic violations of consistency and language that made it difficult for users to navigate and complete tasks. Examples of consistency violations included the use of nonstandard abbreviations, messages that were inconsistent as users hovered over them, and inconsistent use of conventions that varied amongst screens (i.e. closing a screen

using the "X" button or selecting the "Close" button) (Hundt, Adams, & Carayon, 2017). Hundt et al. also noted that language violations were found where the terms located on legends were not user intuitive (i.e. terms such as exception list, alerts, and general rows). Known violations are mostly identified as vendor design constraints (Hundt et al., 2017).

Coleman et al. (2020) investigated a gap in research on how to better understand the physician-EHR interaction, specifically around navigation and workflow patterns. They used a direct observational method to identify ways that intensive care unit (ICU) physicians perform electronic chart review. Coleman et al.'s findings revealed a deeper understanding on how physicians experience frustration with finding a patient's key medical information scattered across different screens and their common transition patterns. Several users have common starting points but often navigate differently as they review a chart. Coleman et al. also found that physicians infrequently look at the vital signs tab but often review other nursing documentation in the flowsheet section of the chart. Coleman et al. proposed redesign and further research to understand how physicians interact with EHR systems in the live environment. Coleman et al. also recommended an extension of this work to be researched in different areas of the hospital.

Order Entry

In addition to navigating through the system, physicians perform other tasks such as entering orders to be carried out for their patients. Computerized Physician Order Entry (CPOE) is a module built within the EHR system where providers enter orders such as medications, labs, imaging, and radiology orders (Park, Chen, & Rudkin, 2015). It is important for the CPOE component of the system to be efficient since entering orders can slow down a provider's productivity, increase their workload, and lead to system-induced medical errors (Park et al.,

2015). Although medical errors exist, Kim et al. (2019) indicated that order entry can improve a physician's work process by eliminating misplaced orders and ambiguities related to ineligible handwriting of orders written on paper. Kim et al. also proposed that order entry can play a role in the improvement of patient safety and medical outcomes.

Ejaz, Khan, and Khan (2019) explored the use of CPOE and the way physicians experience the usage of order sets built around medication prescriptions, imaging, and lab orders. Although the usage of CPOE has promoted readable and transferrable orders among healthcare entities, Ejaz et al. found that physicians resist the adoption of CPOE if the technical infrastructure does not meet their workflow needs. Ejaz et al.'s research was investigated on an international level and they pointed out that CPOE should be developed with advanced guidelines and a key focus on minimizing the chance for user error. Their proposed framework included a knowledge base that contains disease components, a CPOE generation tool, a generalized physician ordering system based on medical specialty, a second EHR repository, and a self-learning statistical analysis tool. In addition, Ejaz et al.'s proposed framework catered to the needs of physician users and the aspects of medication, imaging, and lab ordering. They concluded that current and post CPOE adoption should be a focal point of continuous research and analysis.

The Joint Commission Agency for Healthcare Accreditation has sent out several reports to organizations indicating that technology-related adverse events and deaths have occurred (Sittig and Singh, 2017). The highlight of their report indicated that health information technology (HIT) staff may not have been aware of the events when first identified. However, once HIT staff are aware of an incident, the Joint Commission expects for a multidisciplinary team to investigate how the technology could have played a role in the context of the underlying

workflow and adverse event (Sittig and Singh, 2017). Taieb-Maimon et al. (2017) investigated a gap in research where the recognition of wrong-patient errors through the use of CPOE functionality are understudied. A key component of physician order entry is first identifying the right patient. Patient identification has been a common theme for CPOE errors and patient safety events due to order screens having very little differentiation other than patient demographic data (Taieb-Maimon et al., 2017). Providers also have to manage the time it takes for them to perform ordering tasks in the system. Taieb-Maimon et al. proposed that there could be a number of reasons why wrong-patient errors occur, including providers who confuse one patient with another or those that select the wrong patient from a list by mis-clicking.

Taieb-Maimon et al. (2017) addressed the problem by exploring improvements in usability and design manipulations to evaluate the ease of use for physician ordering. Taieb-Maimon et al. framed the investigation by blanking out the entire screen except highlighting the patient's name, including the patient's photo, or combining both the highlighted name and the photo. Although Taieb-Maimon et al.'s study was limited to the providers performing a limited number of tasks, their findings indicate that users prefer visual indicators and feedback about the patients they select to help them detect any errors prior to entering orders. In addition, users expressed that having a patient photo on every screen could enhance different recovery methods when they make a mistake and serve as a memory aid for detecting the correct patient's identity (Taieb-Maimon et al., 2017). Overall, the findings were consistent with previous studies (Green et al., 2015; Hundt et al., 2017) that demonstrated it is possible to minimize recognition rates of wrong-patient CPOE errors through interface design manipulation. Taieb-Maimon et al. concluded that the addition of patient photos and highlighted names could largely minimize errors in the medical domain and provide potential life-saving benefits.

Other research studies have examined how organizations implement best practice advisory alerts (BPAs) in the system and how physicians perceive the ease of use of these alerts in their everyday job roles (Chen et al., 2018). According to Chen et al. (2018), a user's behavioral intention (BI) reflects how new technology is going to be used and how users accept the technology. Chen et al. also indicated that BI can be influenced by a user's attitude, perceived usefulness, and their perceived ease-of-use of the new technology. The study's findings suggested that the use of BPAs has helped physicians de-escalate a patient's antibiotic use and alert them with medical advice when ordering new medications (Chen et al., 2018). Findings also revealed that physicians view BPAs useful for supporting their day-to-day clinical decision making and helping them identify highly susceptible emergency patients.

Task Demand, Task Difficulty, and Performance

Qualitative and mixed studies have given insight on physician user's experience with EHR systems, particularly around data visualization and user adaptation (Sultanum et al., 2018; Tobler, Colvin, & Rawlins, 2017). Sultanum, Brudno, Wigdor, and Chevalier (2018) proposed that there is very little research that focuses on a cohesive and all-inclusive understanding of how clinical text works best with clinical summary visualizations. To address this gap, Sultanum et al. (2018) explored how clinical text is used in day-to-day clinical practice, the format of clinical text, and the tasks that facilitate the use of clinical text. They also investigated the difficulties that physicians face with retrieving information from clinical overview reports when records are longer and task demands are higher.

Sultanum et al. (2018) contended that there are time consuming tasks that consume a physician's time on task which could potentially impact performance. Once a provider opens up a patient's chart, the first thing they quickly look for is information about the patient. According

to Sultanum et al., unstructured automated text has been known to slow a physician down when a physician attempts to review an overview of the patient's medical history. To examine the phenomenon of how physicians use clinically relevant text to view patient data, Sultanum et al. developed a formative qualitative study and a text-visualization prototype that allowed users to work under real world conditions. The findings revealed that physicians view clinical text in a structured succinct way by first preparing and studying records, then consulting with the patient, and lastly wrapping up and consolidating their documentation (Sultanum et al., 2018).

Physicians also shared that they use clinical text in three main scenarios for new patients, recurrent patients, or follow-up patients via consultation. The most common challenge physicians called out was their time constraints and the additional reading overhead. Sultanum et al. (2018) suggested future work to examine different styles of workflow in other medical specialties besides general practitioners, pediatricians, gastroenterologists and orthopedic specialists. Sultanum et al. also suggested future work on physician's insights about collaboration and the coordination of care across specialties. Other studies have found that specific tasks, an individual's capabilities, and technology characteristics are related to the cognitive effort, behavior, and performance of different types of people (Mosaly et al., 2017). For instance, physician users have been compared to air traffic controllers who often have an increased number of planes under control but also experience an increase in cognitive effort and a decrease in performance (Edwards, Gabets, Mercer, & Bienert, 2017; Mosaly et al., 2017). EHR usability has been compared to different domains as a tool to demonstrate the different levels of mental effort and task difficulty.

User Experience (UX)

The user experience (UX) is a concept that describes how an individual engages with a product (Feng & Wei, 2019). UX is context and dependent driven which may be indicative of a user's internal expectations, features of a system, and the setting in which a user's interaction occurs with a system (Feng & Wei, 2019). There are also several fundamental UX research principles where: (1) UX employs a holistic view of the user-product interaction, (2) UX highlights practical and pleasurable values and (3) UX draws attention to the context of where the system is used (Feng & Wei, 2019). Researchers often use both quantitative and qualitative approaches to measure UX based on their research goals.

Research by Pine and Chen (2020) and Park, Lee, and Chen (2012) have shed a light on UX of ED physicians and residents as they transcribe medical notes in the electronic medical record (EMR). Park et al. (2012) focused on the workflow of note documentation prior to system implementation, during, and after implementation. Park et al. used a qualitative field study to observe clinical documentation completed in various areas of the ED: the waiting room, the triage area, nursing stations, and other areas throughout the unit. In addition to observations, semi-structured interviews were conducted to understand how both types of clinical users felt as they documented notes and facilitated other interactions in their work environment. Park et al. discovered that physicians used different artifacts (paper charts) and the EMR to aid them with note documentation. Pine and Chen's study aligned with Park et al.'s findings that revealed paper charts have not completely disappeared after EHR implementation. Although there are misalignments related to patient movement and how information flows with paper-based systems, there are still many instances where digital systems move out of sync with clinicians (Park & Chen, 2020).

Park et al. (2012) also found that residents and attending physicians view note-intensive tasks differently. For instance, residents have note-intensive tasks such as documenting a patient's physical exam, medical treatments, and a patient's consultation. Park et al. also noted instances where residents review information and start documentation in advance, before they talk to the patient. Residents expressed that their workload increased after the system implementation, since most of their documentation is done on the front end and physicians add to their documentation later. In contrast, Park et al. found that attending physicians have less note-intensive tasks and more clinical-decision tasks that require less computer interaction. They also found that there is adequate support in the system for attending physicians and their clinical-decision tasks such as reviewing and updating a patient's treatment plan, interpreting order results, and making key decisions to admit, transfer or discharge a patient.

Both studies by Pine and Chen (2020) and Park et al. (2012) declared that there should be future support for EMR system design that encompasses both the clinical-decision tasks and note-intensive tasks. Neri et al. (2015) argued that it is difficult to find the balance between designing a system that is both customizable and useable to different types of users. Other UX studies (Chen, Pourchon, Gaumont, De Grandpré, & Léger 2019; Getto, 2015) have placed attention on the negative relationship between an application's features and the needs of a user, known as a user's "pain points." Pain points are problems that typically occur as users struggle or come to a stopping point while attempting to complete a task successfully (Chen et al., 2019). Although user tests can be expensive, Chen et al. (2019) advocated for future research to evaluate user interactions with a system and the pain points users experience in their individual journey. Chen et al. further posit that this usability evaluation can provide invaluable feedback to system designers.

Introduction to Interpretive Phenomenological Analysis

The interpretive phenomenological analysis (IPA) is a research method used for qualitative, experiential, and psychological research (Smith et al., 2009). IPA uses a foundation based on theoretical views from the philosophy of knowledge that consist of phenomenology, hermeneutics, and idiography (Smith, 2017). IPA closely follows the lead of philosopher Edmund Husserl who advised those working in phenomenological research to examine the everyday flow of a person's lived experience (Smith et al., 2009; Husserl, 1927). Phenomenology can be described as a deep journey that explores how people experience life and the various aspects of their experience (Smith et al., 2009). In addition to Husserl, other well-known philosophers such as Heidegger, Merleau-Ponty, and Sartre contributed to the foundation of IPA (Smith et al., 2009). Smith et al. indicated that Heidegger, Merleau-Ponty, and Sartre further enhanced Husserl's work by insisting that researchers examine a person's life as they are immersed in relationships, linguistics and culture, project developments and concerns.

The next theoretical meaning of IPA is hermeneutics, known to be a theory of interpretation. According to Boden, Larkin, and Iyer (2019), IPA researchers have a commitment to give participants a voice by creating a clear, third-person, and psychological description of the participant's view. Thus, the IPA perspective must be interpretative to allow the initial description of the participant's views to be analyzed into a deeper and more theoretical context (Boden et al., 2019). Smith et al. (2009) noted that one must understand the importance of the hermeneutic circle that encompasses the relationship among the part and the whole levels of data. In essence, the hermeneutic circle affords researchers the ability to perform an iterative analysis and interpret the meaning of data from different levels (Smith et al., 2009). The third theoretical part of IPA is influenced by idiography where researchers have a commitment to

thoroughly analyze and understand a particular phenomenon (Smith et al., 2009). IPA has been known to be unique in nature due to its idiographic commitment and in-depth focus on the particular experience and not on aggregated data (Peat et al., 2019; Smith, 2017). Peat et al. (2019) indicated that the idiographic nature of IPA allows researchers to examine small or singular case studies to learn a great deal about a group of people or a single person in their own setting.

Background of IPA

The phenomenological philosophy approach by Edmund Husserl garnered IPA with ideas as to how to best examine the various aspects of the human experience (Natanson, 1973; Smith et al., 2009). Husserl believed that phenomenology involves the careful examination of an experience by the way that it occurs, in its own terms (Smith et al., 2009). Husserl also argued that we must disregard our ordinary stance of man, known as our *natural attitude*, to examine the everyday human experience (Husserl as cited in Natanson, 1973). Consequently, to immerse in phenomenology, Husserl contended that we must disengage from our ordinary routines and focus on the experiences we take for granted (Husserl as cited in Natanson, 1973).

Although IPA has a rich history in phenomenology, hermeneutics, and idiography, the more recent advancement was birthed from Johnathan Smith's (1996) publication in *Psychology and Health* (as cited in Smith et al., 2009). Smith proposed that an approach to research in psychology can be captured through experiential and qualitative means and still be very much relevant in mainstream psychology. Although IPA began in the health psychology domain, it was later expanded to areas such as clinical, counseling, and educational psychology (Smith et al., 2009). IPA has also been used to further examine cognitive disciplines that reside in the human and social sciences domain. While studies have examined EHR usability through the lens of

qualitative inquiry (Kaipio et al., 2017; Noteboom, Bastola, & Qureshi, 2012), current research has yet to utilize IPA as a qualitative approach in EHR usability studies.

Kaipio et al. (2017) evaluated two cross-sectional surveys that outlined physicians' experiences while they used an EHR system. Kaipio et al. used a questionnaire to assess repeated data that was initially collected in 2010. The goal was to assess the overall user experience and note the differences over a four-year timeframe. The findings revealed that the majority of surveyed physicians still report system inadequacies where they are unable to conduct their work tasks in an efficient way. Kaipio et al. also indicated that physicians found ways to overcome their problems and use workarounds that eventually led to more issues. Even though Kaipio et al. urged that questionnaires were the best way to gather subjective experiences from clinicians, conducting an interview through an IPA approach allows a researcher to engage in dialogue and ask more questions as needed (Smith et al., 2009).

Noteboom et al. (2012) investigated how the positive and negative physician user experience impacts a physician's adaptation process. This research was led by qualitative inquiry from a case study with an effort to explain how physicians routinely interact with an EHR system. Noteboom et al. indicated that adaptation with new technology often occurs in collective relationships when affiliates of the group learn how the technology impacts their work relationship and the work environment. Noteboom et al. also found that information technology affects a person's work environment and their work relationship. If technology is to be considered flexible, it is easier for people to use technology and have their needs met (Noteboom et al.). Study findings revealed that physicians were dissatisfied with the system due to mismatched work processes, work practices, and the decline in the amount of time they spend

with their patients. Findings also revealed that physicians need to change how they work, modify their thought process, and complete additional data entry tasks.

In addition to negative experiences, physicians shared positive experiences in which they felt the EHR system helps them save time in the data retrieval of old lab results, old dictations, etc. The system also helps physicians save time with decision support by reviewing a patient's chart that has all the relevant information on it (Noteboom et al., 2012). According to Noteboom et al., it is difficult to investigate physician interaction because it is complex and often context specific. However, qualitative methods such as interpretivism can produce rich explanations to discover relationships and meanings (Noteboom et al., 2012).

IPA Concepts and Terms

It is imperative to note the important terms and definitions in IPA research. The first term known as bracketing is which according to Groenewald (2014), a researcher must "bracket" his or her presumptions and insert themselves into an individual's life as a self-experiencing interpreter. Phenomenological studies place emphasis on how an individual perceives objects and events, rather than explaining the phenomena according to a predetermined conceptual, categorical, and scientific criterion (Pietkiewicz & Smith, 2014).Throughout the analysis phase, there are also terms known as descriptive, linguistic, and conceptual comments that can aid in capturing notations on a transcribed data (Smith et al., 2009). Smith et al. indicated that descriptive comments are exploratory in nature and often identified by key words or phrases, whereas linguistic comments identify the language used and how the content of the interview was presented. For instance, participants can use the word "horrified" to describe shock on a massive scale (Smith et al., 2009). Conceptual comments are those that are interpretive in nature and pertain to the overarching meaning of the participant.

According to Smith et al. (2009), there are processes that are helpful in the analysis of data. The processes consist of: *abstraction,* the process of identifying patterns among themes and grouping alike themes; *subsumption*, which occurs when an emergent theme joins with a series of related themes; *polarization*, which identifies opposite relationships to determine themes; *contextualization,* used to identify contextual or narrative elements to help define and understand a theme; *numeration,* which examines how often an emergent theme appears throughout a transcript; and lastly *function,* which can be used to review the relationship of thoughts and meanings of participants to allow a deeper interpretation of data. Smith et al. suggest that researchers use more than one method of analyzing data to move to a higher level of analysis and understanding.

IPA Versus Other Qualitative Methods

Qualitative methodologies used in EHR studies provide an in-depth explanation of how technology influences medical practice and the way physicians interact with technology in their environment (Park, Lee, & Chen, 2012). Unlike other qualitative methodologies, IPA allows participants to share their own perspective of an experience, as well as give room for researchers to interpret that experience (Wagstaff et al., 2014). Thus, in IPA studies, the researcher draws upon a hermeneutics process where they interpret the meaning of what may be hidden in the participant's shared experience (Wagstaff et al.). Although both the researcher and participant share a unique role, the IPA method follows the notion that the participant's experience and the interpretation of that experience remain subjective (Jeong & Othman, 2016).

According to Kellogg, Fairbanks, and Ratwani (2017), the design of an EHR system must be built through a user-centric design that includes the cognitive needs of the physicians at the forefront. Although Kellogg et al. indicated that cognitive-based design is currently not

integrated well with EHR commercial designs, there is room for researchers to examine healthcare and the user experience of physicians as they use an EHR system. In this case, IPA is ideal in that it also focuses on idiography, the particular details of an experience (Smith et al., 2009).

Summary

This chapter included a descriptive overview of literature on EHR system usability, the user experience (UX), and an introduction to the IPA approach. The researcher described EHR usability concerns regarding ease of use, navigation, order entry, and issues with task demand, task difficulty, and performance for physician users. A thorough examination of ease of use was explored along with the degree in which physician users value the ability to document information and share data with other clinicians. Hudson et al. (2018) indicated that an EHR system is useful if the user of the system finds the system to be satisfying and supports their primary workflow. They also indicated that users find the system useful if it contains only the necessary functions for a user to complete their job.

Other research has proposed that several of the tasks a clinical user performs, should be user intuitive and efficient enough to record the data and retrieve it (Kaipio et al., 2017). Navigation is also an important contributor of EHR usability because physicians often navigate through various screens in attempt to access patient information in a timely manner (Roman et al., 2017). In addition to navigating through the system, physicians perform other tasks such as entering orders to be carried out for their patients. In the case of order entry, wrong-patient errors that occur through CPOE functionality are understudied (Taieb-Maimon et al., 2017). This chapter described research that suggests there are a number of reasons why wrong-patient errors occur, including limits in system design and the time it takes for a physician to perform ordering

tasks (Taieb-Maimon et al., 2017). Qualitative and mixed method studies were also described to provide insight on a physician user's experience with EHR systems, particularly around data visualization and user adaptation that relates to task demand and task difficulty (Sultanum et al., 2018; Tobler, Colvin, & Rawlins, 2017). This chapter also addressed how specific system tasks relate to the cognitive effort, behavior, and performance of physician users.

The researcher shared several UX research principles that pertain to the holistic view of the user-product interaction, the practical and pleasurable views of a user, and the context in which the user uses the system. Research by Pine and Chen (2020) and Park et al. (2012) revealed that resident and attending physicians experience the transcription of electronic medical notes differently. Residents have note-intensive tasks, whereas physicians have clinical-decision tasks that require less interaction (Park et al., 2012). In addition, the researcher provided an explanation of the negative relationship between an application's features and the needs of a user, known as a user's pain points. Chen et al. (2019) indicated that pain points typically occur when users struggle or come to a standstill while attempting to complete a task successfully.

An introduction to the IPA approach was explored along with the theoretical views from the philosophy of knowledge that consist of phenomenology, hermeneutics, and idiography (Smith, 2017). IPA began in the health psychology domain, but was later expanded to areas such as clinical, counseling, and educational psychology (Smith et al., 2009). The IPA method has also been used to explore further disciplines in human and social sciences. Although research has captured EHR usability through the lens of qualitative inquiry (Kaipio et al., 2017; Noteboom et al., 2012), current research has yet to utilize IPA as a qualitative approach in EHR usability studies. This chapter also explored an explanation of IPA concepts and research that favors the IPA methodology over other qualitative methodologies.

Chapter 3

Methodology

Introduction

A phenomenological study emphasizes how individuals describe their lived experiences of certain phenomenon (Creswell & Poth, 2018). The researcher used an IPA approach to understand the personal meaning of a phenomenon for participants who share the same experience (Smith et al., 2009).

Aim

The aim of this study was to discover what emergency room physicians describe as their pain points of their user experience with EHR systems. While different qualitative methods focus on different facets of the human experience, IPA studies examine understanding and exploring the experiences shared by its participants (Tuffour, 2017). There is significance in EHR system use and the notion that these systems impede a physician's productivity (Kroth et al., 2019). The IPA approach helped the researcher reveal what the experience feels like to the individual and how the individual makes sense of their experiences (Smith et al., 2009). The goal was to discover what emergency room physicians describe as the "pain points" of their user experiences with EHR systems, which included many different experiences to be uncovered, and their perspectives about how they manage the difficulty of system tasks and demands. Therefore, the overarching grand tour research question was:

What are the "pain points" that physicians describe as their lived experiences with EHR system use?

The interview guide helped facilitate the main focus on the grand tour question and included sub-questions as:

1. How do physician users describe how they perform routine clinical tasks in the system?
2. How do physician users describe how they experience system task functions that are difficult to perform?
3. How do physician users describe aspects of the system that do not meet the needs of physician users?

Rationale for Choosing the Method

IPA has been a commonly used tool in healthcare to observe a variety of topics from the clinical user perspective (Chen et al., 2018). Smith et al. (2009) suggested that the primary reason a researcher should select IPA over a different qualitative method is to be consistent with the epistemological view of the research question. The research question in an IPA study is implicitly formed based on what the researcher assumes the data can reveal (Smith et al., 2009). Smith et al. further noted that IPA typically requires researchers to identify and understand two different aspects of the participant's account: (1) the main concern in the participant's world and (2) the experiential claims that the participant makes in order to develop a phenomenological interpretation. The IPA approach also allows researchers to create an analytic interpretation of the participant's experience and may also go beyond the participant's sense-making and understanding (Smith et al., 2009).

Participant Selection

Sampling

According to Smith et al. (2009), a sample size of three to six people is ideal in an IPA study to allow the researcher to focus on a small number of cases and benefit from quality and

not quantity. The types of clinicians chosen to participate in this study included attending physicians, who have a medical doctor (MD) degree and actively practice medicine in the emergency department (ED). Sample selection was obtained through purposeful and snowball sampling techniques. The snowball sampling method occurs when participants are selected through referrals (Smith et al., 2009). Once the research proposal was approved by the Institutional Review Board (see Appendix B), the researcher contacted the emergency medicine leadership for participant referrals. Research suggests that snowball sampling is best for identifying cases of interest from samples of people who know other people that share similar commonalities (Palinkas et al., 2015). Snowball techniques can be used until saturation is reached, when no additional data or new themes emerge (Flick, 2014).

Recruitment of Participants

To gain insight of the EHR experience as lived by physicians, the researcher selected fifteen physician participants through her own personal contacts at The University of Texas MD Anderson Cancer Center. The researcher emailed a formal invitation to the participants (see Appendix C) at the beginning of December, 2019. Within a 5-day timeframe, eight participants responded, one participant declined, and six participants did not respond to the formal invitation (see Table 1). The participants represented the profile identified, including the core criteria of emergency room attending physicians who were identified as physician champions and have used an EHR system for at least one year.

Of the eight participants, two participants were asked to be pilot participants. The researcher explained the role of the pilot participants and requested their feedback on any ambiguities or problematic questions that occurred during the interview. The pilot participants were informed that their feedback would be instrumental in streamlining the interview questions.

Table 1

Participant Recruitment

Number of Invitations Sent	No Response	Respondents that Declined	Interviews Conducted
15	6	1	8

Data Collection

The researcher followed general steps for data collection that involved the use of semi-structured interviews and an interview guide (see Appendix A). Interviews are typically used in qualitative studies to allow the interviewer the opportunity to use a basic script to guide them and use open and closed interview questions for proper dialogue (Preece, Rogers, & Sharp, 2015). One-on-one interviews also tend to give the participants the freedom to think, express themselves, and be heard (Smith et al., 2009). An interview guide is typically used to help facilitate conversational dialogue and the sharing of thoughts and experiences of participants (Smith et al., 2009).

Interview Process, Setting, and Instrumentation

Interview Process

To prepare for the interview, the researcher informed the participants of the time commitment and ensured that they understood the style of the interview. Smith et al. (2009) indicated that the word "interview" is used in many contexts and should be clearly explained to participants. The researcher also asked the participants where they would prefer the interview to take place, as a comfortable and familiar place is usually preferable (Smith et al., 2009). Prior to each interview, the researcher completed the following steps: greeted the participant, discussed informed consent forms (see Appendix D), evaluated study procedures, answered any questions, and assured the participants that they could stop the interview at any time.

The researcher also asked each participant to log into the EHR shadow environment to help guide the conversation and allow the participant to describe their experiences and pain points of using the system. The EHR shadow environment is a copy of the real (live) environment that each participant can access without having any impacts to real data. The participants had access to the shadow environment through Lightweight Directory Access Protocol (LDAP) authentication, a role-based user authentication security method that validates whether the user has the appropriate credentials to access the system (Gallant, 2010). According to Lazar, Feng, and Hochheiser (2017), contextual inquiry begins with observing a user's workflow to help the researcher gain implicit knowledge about the user's day-to-day work procedures. Contextual inquiry also allows the researcher to focus on specifics rather than generalizations (Lazar et al., 2017). Once the researcher and participant were ready to proceed, the researcher started the audio recording and conducted the semi-structured interview.

Setting

The study was conducted via face-to-face interviews in the participants' office or conference room. It is not practical to interview physicians while they are actively working, as interruptions in the emergency department (ED) could cause serious patient safety consequences (Fong, Hettinger, & Ratwani, 2017). Smith et al. (2009) suggest that not only the interview setting be comfortable and familiar, it must be reasonably quiet and clear of interruptions. The face-to-face interview also helped the researcher capture rich nonverbal cues such as body language, mannerisms, and dress (Oltman, 2016). In the clinical setting, the participants use an EHR system known as Epic. The Epic Systems Corporation operate as a major EHR software vendor that is comprised of several individual modules designed for clinical and operational use

(Newman, 2017). Epic has become a technological giant in healthcare because the user interface and platform are integrated for almost every area of health care (Newman, 2017).

In particular, the participants of this study use the emergency room (ER) module named "ASAP". The ASAP module specializes in ER visit management and has components such as ER bed occupancy tracking and patient documentation solutions to help providers deliver patient care (Monica, 2017). The participants logged into the Epic ASAP module (shadow environment) to align with the semi-structured interview goals. Holden (2011) contends that the use of a semi-structured interview instrument used in conjunction with an EHR system will provide insight on topics that are not otherwise easily observed or easily recalled by the participants' memory or reflections on experiences during interview discussions.

Instrumentation

The researcher used an interview guide (see Appendix A) to help facilitate a relaxed interaction with each participant and allowed them to share a detailed account of their user experience (Smith et al., 2009). It is important for the questions and prompts on the schedule to have open formulations that do not allude to the participant's experiences or those that influence them toward certain answers (Smith et al., 2009). Smith et al. (2009) suggested that the interview start with a question that is open-ended to allow the participant to recall a specific episode or experience, which could encourage the participant to talk at great lengths. Pietkiewicz and Smith (2014) also noted that it is important for the researcher to be comfortable with moments of silence throughout the interview to allow the participant and interviewer to reflect on the phenomena. The researcher pilot tested the interview guide (see Appendix A) on two people that fit the sample profile. According to Chenail (2011), it is common for researchers to use pilot interviews to assess the quality of an interview procedure and to identify potential biases of the

researcher. The researcher used the pilot study to identify any ambiguities and problematic questions and make adjustments as necessary (Chenail, 2011). The pilot participants fit the sample profile by: (1) being an emergency room attending physician who have used an EHR system for at least one year and (2) considered a physician champion by their leadership. The researcher also maintained a neutral attitude throughout the interview and used the interview guide below to allow for a natural flow of conversation.

Interview Guide

1. Reflecting on your experiences with using EHR systems, what do you think about pain points, problems that occur when you reach a standstill while attempting to complete a task?

   Prompts: What is the largest challenge you are currently facing? How do you manage these difficulties?

2. Describe your experiences with EHR systems.

   Prompts: How did you feel? Where were you? What happened? Have you documented patient care on paper before? How was that experience compared to using an EHR now?

3. Tell me about the features you dislike about the current EHR system you use.

   Prompts: Describe why you dislike those features in the system. What features do you find the most cumbersome to use?

4. Tell me about the features you like about the current EHR system you use.

   Prompts: Describe why you like those features in the system.

5. Describe the ways in which the EHR system influences the way you manage patient care.

Prompts: What tasks do you perform? What features of the system do you use? Why do you use those? Tell me about the clinical tasks you perform outside of the EHR system.

Prompts: Can you describe the amount of time it takes for you to complete those tasks? What features of the system are congruent with the clinical workflows outside of the system?

6. Describe how using an EHR system impacts your daily reporting throughput metrics and performance.

   Prompts: What is your process for quickly treating a patient and dispositioning them for discharge or admission? Are there any systemic workflow issues that you feel strongly about? What do you feel could be done differently?

7. What additional information would you like to share about your experiences using an EHR system?

Data Analysis

In the case of data analysis, a verbatim record of interview data is imperative for the researcher to interpret the meaning of a participant's experience and study the phenomena (Smith et al., 2009). The researcher hired a third-party transcription service to transcribe all of the words spoken by every participant who participated in the interview. The recorded audio from the interviews were fully transcribed to include verbal and non-verbal sounds such as laughter and significant pauses (Smith et al., 2009). To ensure accuracy and reliability of the transcriptions, the researcher asked the participants to review the transcripts (see Appendix E) from the interview to address any discrepancies or issues they feel necessary to clarify. The researcher provided the participants a one week-timeframe to review the transcripts and provide feedback.

According to Groenewald (2014), it is important that the researcher perform a ‘validity check’ by asking each participant to verify if the interview was captured correctly.

Transcription

Once the data was transcribed and validated for accuracy, the researcher used the NVivo software to create and organize files for data collection. According to Smith et al. (2009), the use of existing computer software can help a researcher with the organization and coding of data directly into text or digital recordings. The researcher also became more familiar with the data by reading the transcript, reviewing any documented margin notes, and making note of additional transcript details that stood out (Creswell & Poth, 2018). Smith et al. also suggested that it is helpful for a researcher to immerse in the original data by listening to the audio recording while reading the transcript at least once. The researcher re-read the transcript to facilitate active engagement with the data and developed an appreciation for the rapport and trust that was built throughout the interviews (Smith et al., 2009). Smith et al. revealed that repeated reading can highlight more detailed sections and possible contradictions and paradoxes that occurred during the interview.

Initial Coding

After the re-reading of the transcript, the researcher performed an initial coding to become more familiar with the transcript and identify ways in which the participants described an issue or experience (Larkin & Thompson, 2012). The researcher took a clean version of the transcript, read through it again and wrote initial thoughts about potential themes or metaphors that may have stood out (see Figure 1). Smith et al. (2009) also indicated that it is important for the researcher to have an analytic dialogue with each line of the transcript by making notes as to what words, phrases, and sentences mean to the researcher and participant. The intent of initial

coding is for the researcher to note their initial ideas in order to proceed with a systematic and constant research focus (Larkin & Thompson, 2012).

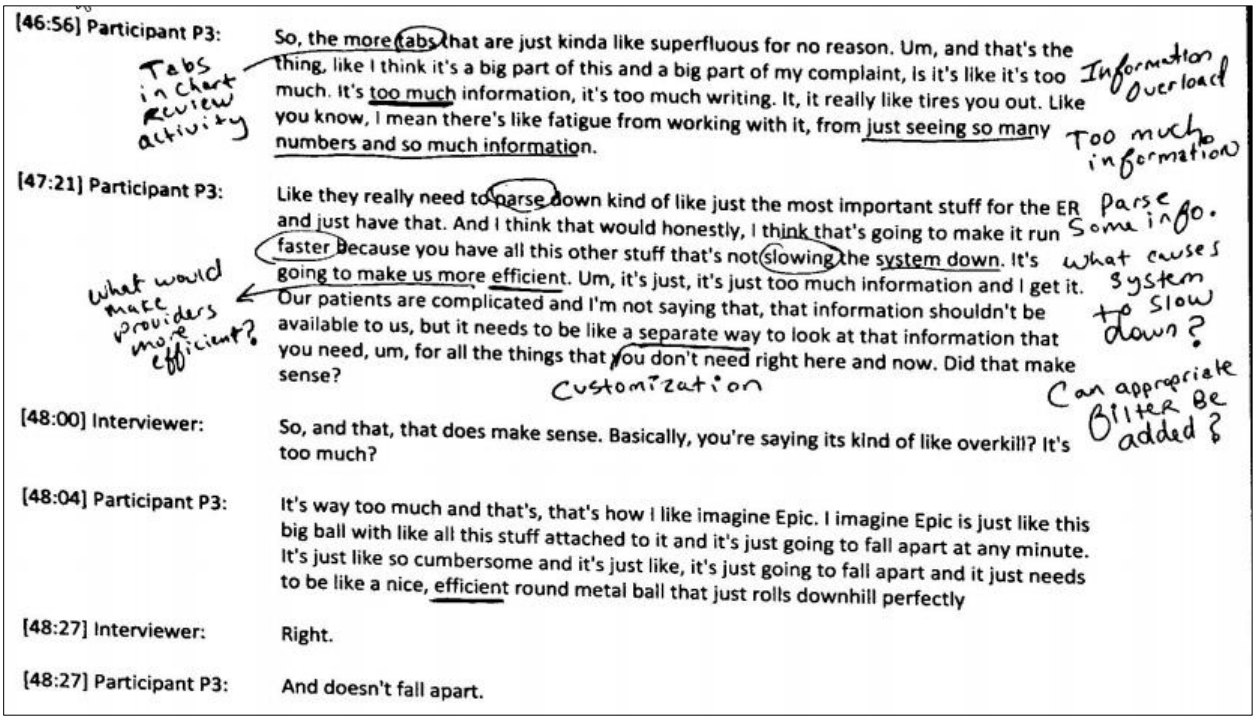


Figure 1. Example of Initial Coding on Transcript

Development of Emerging Themes

After the transcribed data were coded through the NVivo software, the researcher attempted to identify emerging themes by grouping statements together and mapping interrelationships of data (Smith et al., 2009). According to Smith et al. (2009), in this stage the participant's experiences are fragmented through a re-organization of data. The researcher embraced the hermeneutic circle by analyzing parts of the interview and also the whole interview which both became a new whole towards the end of the analysis (Smith et al., 2009). Larkin and Thompson (2012) noted that it may be useful for researchers to group data around items that matter (objects of concern) and items that have meaning (experimental claims). In the essence of developing themes, Groenewald (2014) indicated that there may be an overlap in clusters of data

depending on the nature of the phenomena. Although an overlap may occur, Groenewald (2014) also proposed that the researcher investigate the various clusters and develop central themes.

Connection Across Themes

The core of qualitative data analysis is to describe and classify the data into codes or categories, which could result in a detailed description of what the researcher interprets (Creswell & Poth, 2018). After emergent themes were identified, the researcher compiled all of the themes together and focused on a structure that allowed the most important aspects of the participant's experience to shine through (Smith et al., 2009). The themes were then compiled in chronological order and also printed out to help maintain focus at the local level (Smith et al., 2009). Abstraction was also used to help identify the patterns among emergent themes and help to organize those themes into larger units (Creswell & Poth, 2018).

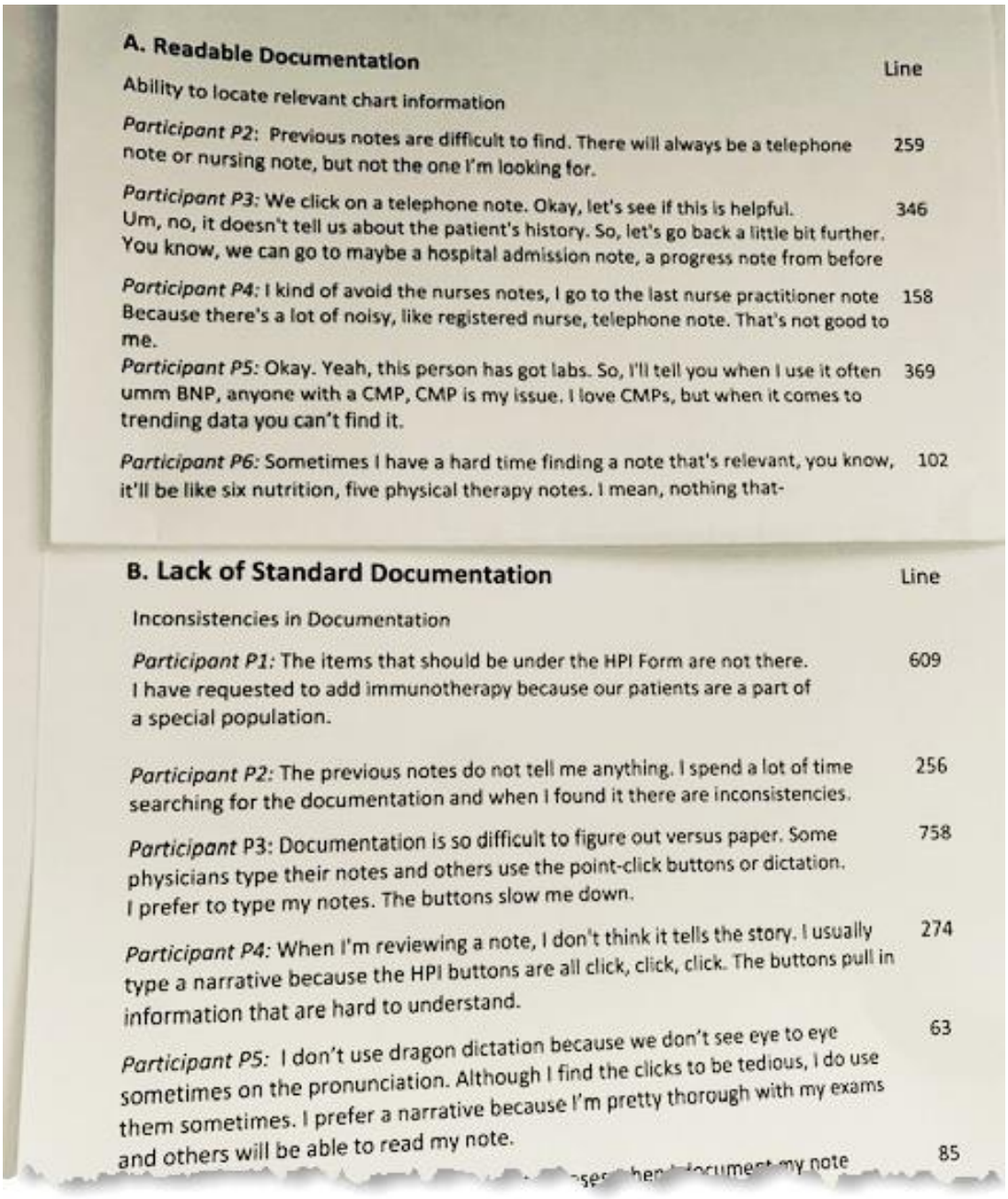
Moving Case-by-Case

The researcher had a unique transcript for each interview and continued the analysis process on a case-by-case basis. As the researcher moved forward, it was critical that the ideas that emerged from the first analysis to the next were bracketed aside (Smith et al., 2009). Smith et al. contend that researchers are greatly influenced by the data they have already received but they must remember that new themes may develop with each subsequent case. The researcher continued through the iterative process until saturation was reached.

Patterns Across Cases

Once every case was analyzed, it was imperative for the researcher to look for patterns across cases in order to move to a more theoretical view of analysis (Smith et al., 2009). The researcher printed a table of the emergent themes and displayed them on a large surface to help identify connections across cases and determine which themes were most effective (see Figure 2)

(Smith et al., 2009). In addition, the researcher compiled a table to demonstrate nested themes and super-ordinate themes for each participant (Smith et al., 2009). A composite summary also served as an overall reflection on the context of which themes emerged (Larkin & Thompson, 2012).



A. Readable Documentation — Line

Ability to locate relevant chart information

Participant P2: Previous notes are difficult to find. There will always be a telephone note or nursing note, but not the one I'm looking for. — 259

Participant P3: We click on a telephone note. Okay, let's see if this is helpful. Um, no, it doesn't tell us about the patient's history. So, let's go back a little bit further. You know, we can go to maybe a hospital admission note, a progress note from before — 346

Participant P4: I kind of avoid the nurses notes, I go to the last nurse practitioner note Because there's a lot of noisy, like registered nurse, telephone note. That's not good to me. — 158

Participant P5: Okay. Yeah, this person has got labs. So, I'll tell you when I use it often umm BNP, anyone with a CMP, CMP is my issue. I love CMPs, but when it comes to trending data you can't find it. — 369

Participant P6: Sometimes I have a hard time finding a note that's relevant, you know, it'll be like six nutrition, five physical therapy notes. I mean, nothing that- — 102

B. Lack of Standard Documentation — Line

Inconsistencies in Documentation

Participant P1: The items that should be under the HPI Form are not there. I have requested to add immunotherapy because our patients are a part of a special population. — 609

Participant P2: The previous notes do not tell me anything. I spend a lot of time searching for the documentation and when I found it there are inconsistencies. — 256

Participant P3: Documentation is so difficult to figure out versus paper. Some physicians type their notes and others use the point-click buttons or dictation. I prefer to type my notes. The buttons slow me down. — 758

Participant P4: When I'm reviewing a note, I don't think it tells the story. I usually type a narrative because the HPI buttons are all click, click, click. The buttons pull in information that are hard to understand. — 274

Participant P5: I don't use dragon dictation because we don't see eye to eye sometimes on the pronunciation. Although I find the clicks to be tedious, I do use them sometimes. I prefer a narrative because I'm pretty thorough with my exams and others will be able to read my note. — 63

— 85

Figure 2. Example of Identifying Patterns Across Cases

Presentation of Results

According to Smith et al. (2009) the last stage of the IPA approach is for the researcher to present a full narrative account of the study findings. The findings are presented through transcript extracts, a narrative summary of the emerging themes, and several visual illustrations to help the reader navigate through the findings. The purpose of each transcript extract and the analytic interpretation of the data was to allow the researcher to give an account of what the data is like and also make a case for what the data means (Smith et al., 2009). Visual images can help deepen the analysis of data as a whole, by helping the reader establish a dialogue between what was said and what was revealed visually (Boden, Larkin, & Iyer, 2019).

Quality Control

Internal and External Validity

Assessing the validity in qualitative research is an important consideration that should be evaluated (Smith et al., 2009). Although there are a considerable number of rules that are used to assess the quality or validity in qualitative studies, this study followed the criteria of Yardley (2000). Yardley indicated that there are four principles that researchers must follow to evaluate the quality of qualitative research: (1) sensitivity to context, (2) commitment and rigor, (3) transparency and coherence, and (4) impact and importance (as cited in Smith et al., 2009). The researcher showed sensitivity to context by allowing the participants to verify the verbatim transcript of the interview to ensure that the researcher's interpretation was correct. The researcher also presented awareness of the existing EHR literature in relation to the topic of investigation which also help demonstrate sensitivity to context (Smith et al., 2009).

The researcher demonstrated commitment and rigor throughout the data collection and analysis phases of research. As the researcher interviewed each participant, attention and focus

was made on listening to the participants carefully and making sure that the participants were comfortable (Smith et al., 2009). Rigor was demonstrated as the researcher probed and picked up cues from the participants during the interview and also made sure the data was sufficiently interpreted in the analysis stage (Smith et al., 2009). To demonstrate transparency and coherence, the researcher ensured that the details of the report were coherent and easy to follow. To conclude, Yardley indicated that the true validity lies in whether the research is deemed useful and reveals something interesting to the reader (as cited in Smith et al., 2009). The researcher aspired to create a study that has impact and importance that will add to the existing body of knowledge.

Reflexive Bracketing and Journaling

According to Husserl (1927), an important aspect of phenomenology is for researchers to 'bracket' or put aside familiar ways of living and focus on the essence of reflecting upon the given phenomenon. Smith et al. (2009) note that it is especially important for researchers to leave the research world and come to the hermeneutic circle of the participant's world. The researcher achieved bracketing by removing personal bias and any influencing factors during the interviews and subsequent follow-up interviews. The researcher also took steps to record thoughts, ideas, and any opinions in a journal that are related to the study that could possibly help with the interpretation of data (Smith et al., 2009).

Ethical Considerations and Compliance

The researcher obtained informed consent materials and Institutional Review Board (IRB) approval through the academic institution (Nova Southeastern University) and through the site's institution (The University of Texas MD Anderson Cancer Center). Ethical considerations are a dynamic process that must be carried out throughout the data collection and analysis of data

(Smith et al., 2009). The researcher ensured that the covered topics were explained to each participant and reiterated the informed consent during the interview to help ease into emerging sensitive issues (Smith et al., 2009). Participants were also reminded that they had the right to withdraw their information all throughout data collection, until the data analysis phase (Smith et al., 2009).

Due to the nature of each participant sharing their personal accounts of their experiences with EHR system use, each participant was assured of confidentiality. To protect the privacy of all participants, the names of each participant were replaced as pseudonyms. The raw interview data was entered and stored on a private network drive available to the researcher and the assigned research chair at the site's institution. The data is being stored for as long as the IRB requires at both institutions. Once the study was completed, the audio recordings were erased as required by the institution.

Resources and Feasibility

The following resources were needed to conduct the study:

1. Access to emergency room physicians at the identified institution. This was achieved through a personal working relationship of the researcher and referrals.

2. Access to a private location to conduct the interviews. The researcher achieved this by asking the participants what setting was most comfortable and convenient for them.

3. An audio recording device was used to capture interview data with approval from the participants.

4. Transcription services were acquired through a local transcription company.

5. The NVivo software was used to organize and code interview data.

Summary

The usability of EHR systems and pain points as experienced by physician users cannot be fully understood unless explored from the perspective of physician users who experience it.

Previous research has indicated that although different qualitative methods focus on different facets of the human experience, IPA studies take a closer look at understanding and exploring the experiences that are shared by its participants (Larkin et al., 2006). The general steps that the researcher followed for data collection involved the use of semi-structured interviews and an interview guide. The researcher established rapport and engaged with the participants throughout the interviews to ensure a comfortable and open interaction. After the interviews were completed, audio files were transcribed and coded. To ensure accuracy and reliability of the transcriptions, the researcher asked participants to review the extracts from the interview to address any discrepancies or issues they feel necessary to clarify. The researcher also ensured the quality of data through the use of internal and external validity. Reflexive bracketing also occurred as the researcher removed personal bias and any influencing factors during interviews and subsequent follow-up interviews.

Chapter 4

Results

Introduction

The purpose of applying the method of interpretative phenomenological analysis (IPA) was to discover what emergency room (ER) physicians describe as the "pain points" of their user experiences with EHR systems. While exploring their experiences, the researcher derived a better understanding of the “pain points” physicians perceive to be related to the usability of EHR systems and how task demand and task difficulty influence a physician’s day-to-day performance. The researcher also aimed to achieve a deeper and contextual account of a physician user’s experiences and perspectives. According to Mazur, Mosaly, Moore, and Marks (2019), the future design of EHR should be optimized where non value-added interactions with physicians are eliminated. Thus, the researcher conducted this study to provide usability and design recommendations for organizations who implement EHR systems.

The overarching grand tour research question used to guide this study was:

What are the “pain points” that physicians describe as their lived experiences with EHR system use?

The sub-questions helped facilitate the main focus on the grand tour question:

1. How do physician users describe how they perform routine clinical tasks in the system?
2. How do physician users describe how they experience system task functions that are difficult to perform?
3. How do physician users describe aspects of the system that do not meet the needs of physician users?

Chapter 4 presents a conceptual view of the lived experiences of emergency room physicians through their own words. An interpretative review is presented based on the responses of the participants in the semi-structured interviews. The following provides a review of data collection methods, a review of themes and coding, and a summary of findings.

Data Analysis

The data analysis was constructed based on the IPA methodology as defined by Smith et al. (2009). The IPA methodology consisted of initial and re-reading of the transcripts, initial noting, the development of emergent themes, searching for connections across the emergent themes, moving to the next case, and identifying patterns across cases. The process included the development of codes generated from the interview data, visualizing the data, and coding the data into single and multiple nodes based on the connections across themes. The consistent improvement of concepts and themes helped the researcher create an exploratory narrative to interpret the experience of emergency room physicians.

Interviews

After each participant agreed to proceed with the study, the researcher worked with their administrative assistant for scheduling. The pilot interviews were scheduled for two days during the middle of December, followed by the remaining interviews staggered throughout the last two weeks of December. The researcher spent 20 minutes prior to each interview to allow the participant the opportunity to review the informed consent form and ask questions. The researcher also explained to each participant the role of their participation and ensured them that their feedback would not be shared with their leadership. Every participant signed the informed consent form and did not have any questions prior to moving forward. Each participant received a full signed and scanned copy of their consent form.

The researcher conducted eight semi-structured interviews in person. Seven out of eight interviews were conducted outside of the emergency room in each participant's office. One of the interviews was scheduled in a conference room located outside of the participant's office where they felt the most comfortable. The interviews spanned between 45-60 minutes in length (see Table 2). The shortest interviews involved both pilot participants, P1 and P2. Both participants expressed that the first interview question was vague and did not allow them an opportunity to walk through their normal workflow. They also voiced the importance of starting the conversation with an open dialogue of how they begin their work day. Once the pilot interviews were completed, the researcher noted their concerns, submitted the audio files for transcription, and allowed the participants to review the transcripts for accuracy. The pilot interviews allowed the researcher to improve the quality of the interview questions by adding an additional question and adjusting the sequence of the questions to allow for a natural flow of conversation (see Appendix A).

Table 2

Average Length of Interview in Minutes

Participant	**Interview Length**
P1	45
P2	35
P3	53
P4	50
P5	49
P6	60
P7	47
P8	60
Average	**49.8 minutes**

The demographic profile of the participants was characterized by gender, EHR experience, and paper charting experience (see Table 3). A few participants shared that they have worked with various types of EHR systems at other organizations, where each system was different in nature. Although every participant has used an EHR system for several years, they also have paper charting

experience. Prior research revealed that physicians often have mixed feelings about EHR systems versus paper charting due to the time pressures to complete documentation (Kroth et al., 2018; Priestman et al., 2018).

Table 3

Demographic Data Content

Participant	Gender	EHR Exp. (Yrs.)	Paper Charting Exp?
P1	Male	5	Yes
P2	Female	5-10	Yes
P3	Male	2-3	Yes
P4	Female	5	Yes
P5	Female	2-3	Yes
P6	Female	5-10	Yes
P7	Male	5	Yes
P8	Female	5-10	Yes

Transcription

Each interview was transcribed by REV.com, a professional third-party transcription service. The turnaround time for each pilot interview was 20 hours. The turnaround time for the remaining interviews ranged between 14 and 24 hours depending on the length of the interview. To confirm clarity and accuracy, the researcher listened to the audio files and read the transcripts concurrently. After an initial review of the audio and transcription files, the researcher noticed that a few of the transcripts lacked in quality. There were several annotations in the transcript for crosstalk and moments of silence that were not captured correctly. The researcher spent several hours listening to the audio again and re-transcribing large portions of the interview data from two transcripts.

The researcher rated the quality of the interviews and provided feedback to REV.com. In response, the company offered to re-transcribe the data and/or provide a credit toward new transcriptions. Due to the comprehensive review and amount of time the researcher spent on correcting the transcripts, she accepted the credit toward a new transcript and moved forward.

Transcripts were emailed to the participants within a one-week timeframe of the interviews to allow the participants to review and provide clarifications. Of the eight participants, three participants reviewed their transcripts and provided feedback. Two participants expressed concern about the number of times they used filler words in their interview but otherwise felt that their transcript was accurate. The other participant did not express any concerns about their speaking style and confirmed the accuracy of their transcript.

Data Coding

After the participants were given an opportunity to confirm the accuracy of their transcripts and provide clarifications, the researcher re-read the transcripts and performed an initial level of analysis. As suggested by Smith et al. (2009), the researcher applied an initial noting on each transcript and wrote down keywords and phrases that stood out during each interview. As the researcher began to actively engage with the data, exploratory comments were written alongside the margin of each printed transcript (see Table 4). The initial level of analysis allowed the researcher to avoid superficial reading and focus on the context of the participant's experience and concerns (Smith et al., 2009). It was imperative for the researcher to complete this first level of coding to summarize large segments of data and serve as a foundation for second level coding (Elliott, 2018).

In addition to exploratory notes, the researcher highlighted text and wrote linguistic comments alongside the transcript margin to indicate when a participant's tone of voice changed or when there were moments of silence or laughter (Smith et al., 2009). Once the initial noting was completed, the researcher imported the transcript files into the NVivo 12 qualitative software for further analysis. The initial notes on each transcript were cross referenced with the files loaded into NVivo. The *annotation* feature of NVivo helped the researcher organize the exploratory comments and observations that were written on each transcript (see Figure 3). Although Smith et al. (2009)

advocate for hard copy materials during the data analysis process, it is also common for researchers to use both a computer and hard copy material.

Table 4

Example of Initial Noting of Transcripts

Original Transcript	Exploratory Comments
[19:43] ***Interviewee****:* When I look at this note, I know what I said because, well I said it right? So, if I come back up, for me this is going to make sense because I've talked to these people… But for anybody else, it's just a freaking checklist. And then you know, to me that is useless. If I read that off of somebody else's note, it's useless.	Progress note documentation is inadequate and hard to follow. What is missing in the documentation? The patient's story is hard to read
[20:17***] Interviewer***: Okay... So, the smart form templates and the clicks create data, which is dynamic data. But for reading it, and trying to understand the patient's story it is hard to understand or read?	–point & click buttons are meaningless. What is missing from the note? Why is the note hard to read?
[20:31] ***Interviewee:*** Yeah…but, I'm trying to get more efficient…. I hate it because…. have you ever read Dr. ****'s note?	Provider efficiency is a big deal.
There is never an assessment and plan and he just clicks through everything and then he's done…And, when I go back to see one of his patients, it's like "oh shit, what did he think"?	There is a balance between writing a note that is legible and being efficient.
… What was he thinking when he saw this patient? And so, I try with my note not to do that.	Providers are unable to read each other's notes.

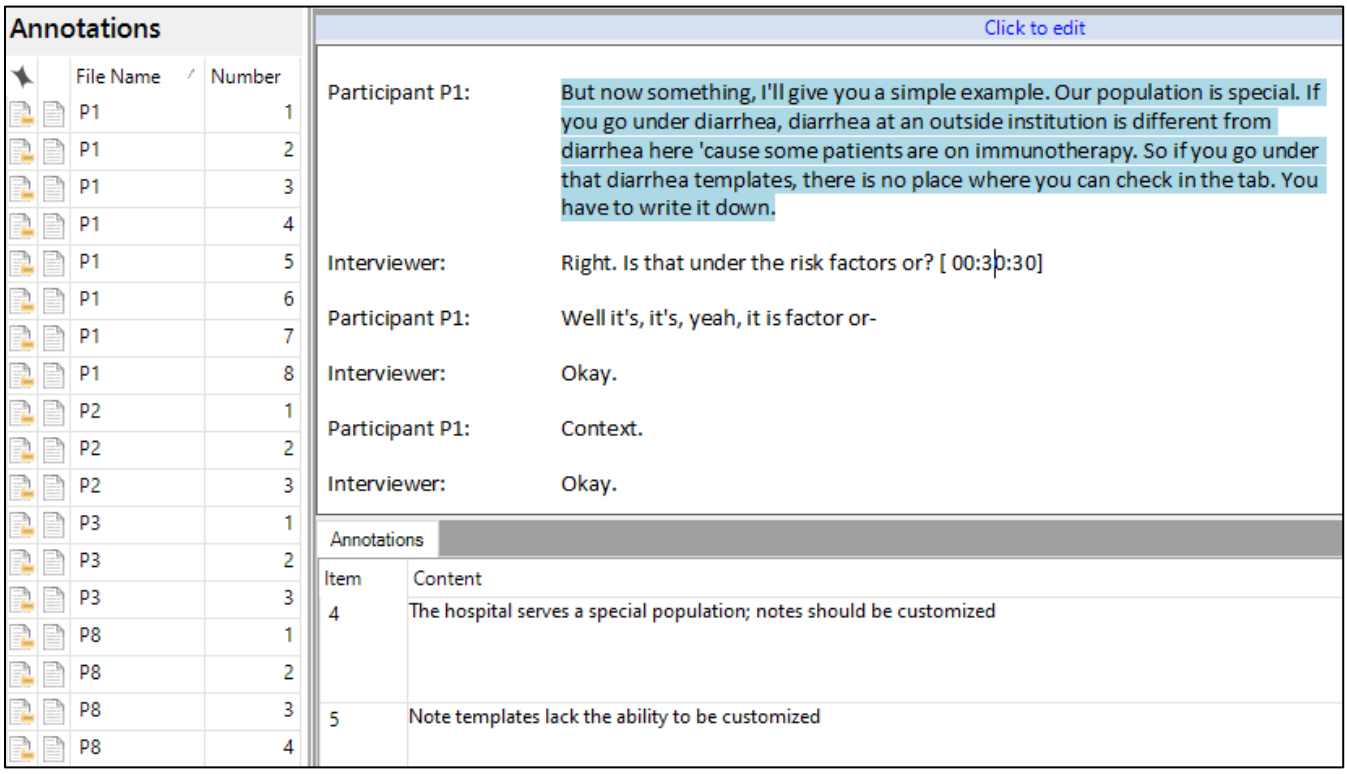


Figure 3. Example of Annotations in NVivo Software

During the next stage of analysis, the researcher embraced a different process to examine exploratory comments further and identify emergent themes. The *node* feature in the NVivo software allowed the researcher to organize the initial notes and exploratory comments into parent and child nodes according to levels of hierarchy (Edhlund & McDougall, 2019). Once the nodes were created, the researcher enabled a feature in NVivo called *coding stripes*. As each body of text was added to a node, coding stripes represented the least and most dominant themes in the data (see Figure 4). As themes continued to emerge, “drag-and-drop” coding was used to add the desired text to each corresponding node (Edhlund & McDougall, 2019). This process allowed the researcher to break up the narrative flow of the data and identify emergent themes.

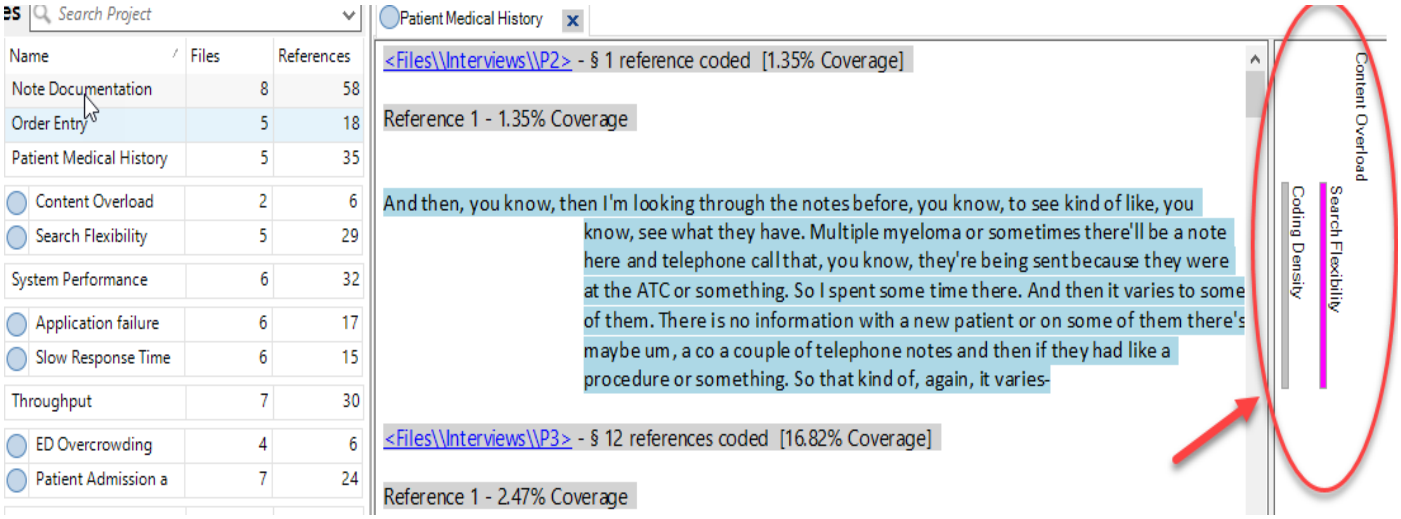


Figure 4. Example of Coding Stripes in NVivo Software

Once each transcript was reviewed again, the researcher became further immersed in the data and added an additional level of interpretive noting. As new ideas were presented, the researcher improved the codes and themes throughout the analysis (see Table 5). According to Elliott (2018), the coding process is continual and requires the researcher to refine and revalidate earlier codes. This process allowed the researcher to facilitate a fluid process of engaging with the data and reaching an additional interpretive level of analysis (Smith el al., 2009).

Table 5

Node Classifications

Name	Sources	References
Patient Medical History	5	35
Content Overload	2	6
Search Flexibility	5	29
Paper Documentation	8	19
Accessibility	2	3
Readability	6	16
Patient-Provider Experience	2	4
Face-to-Face Interaction	2	4
Note Documentation	8	58
Dictation	3	6
Mobile/Tablet Charting	6	11
Assessment and Plan	3	5
History of Present Illness (HPI)	7	23
Physical Exam	2	2
Review of Systems (ROS)	1	3
Lack of Customization	4	8
Order Entry	5	18
Lab orders	3	12
Medications	2	5
Lack of Customization	1	1
Alerts	1	4
Medication Warnings	1	4
Throughput	7	30
Patient Admission and Handoff	7	24
ED Overcrowding	4	6
System Performance	6	32
Application Failure	6	17
Slow Response Time	6	15

As themes emerged throughout the data, the researcher followed an additional process to identify connections across the themes. As suggested by Smith et al. (2009), the master list of themes were reviewed and ordered in chronological order as they appeared throughout each transcript. Afterwards, data abstraction allowed the researcher to identify patterns between the themes and group similar themes together (Smith et al., 2009). This iterative process allowed the

researcher to develop an initial set of super-ordinate themes at a higher level. Once the researcher reached a comfortable level of abstraction, the contextual elements of each interview were reviewed. For example, the interview with participant P4 revealed a series of key events: the moment she described opening up a chart to search for historical medical information, her retrospective account of not being able to find historical progress notes, and her disclosure about the inaccuracy of a patient's home medications. According to Smith et al., contextual elements can highlight emergent themes that are shaped by a participant's account of particular key moments that have occurred. This process continued as the researcher moved through each transcript individually and ensured to mentally set aside any preconceived ideas that emerged.

Next, the researcher followed a numeration method as defined by Smith et al. (2009) to identify patterns in the data by examining the number of times a theme is supported. The researcher accomplished this through the use of NVivo's *word frequency query* feature to locate frequently used words or concepts (see Figure 5). The researcher particularly focused on frequently used words and their stemmed words (i.e. talks, talking) that were at least four or more letters in length. In addition, words that had a weighted percentage of at least .5% were represented as the most frequently used words among participants (Feng & Behar-Horenstein, 2019). Words that were meaningless and did not contribute to the analysis were disregarded.

Word	Length	Count	Weighted Percentage (%)	Similar Words
patient	7	521	1.83	patient, patients, patients'
note	4	339	1.19	note, noted, notes
look	4	307	1.08	look, looked, looking, looks
order	5	277	0.97	order, ordered, ordering, orders
times	5	252	0.88	time, timed, times, timing
thing	5	244	0.86	thing, things
system	6	242	0.85	system, systemic, systems
think	5	234	0.82	think, thinking, thinks
back	4	182	0.64	back, backed
mean	4	178	0.63	mean, means
well	4	174	0.61	well, 'well
really	6	164	0.58	really
taking	6	156	0.55	take, takes, taking
coming	6	153	0.54	come, comes, coming
kind	4	146	0.51	kind
click	5	145	0.51	click, clicked, clicking, clicks
cause	5	142	0.50	cause, 'cause
chart	5	142	0.50	chart, charting, charts

Figure 5. Word Frequency Query in NVivo Software

As a last step, the researcher reviewed the preliminary list of themes and the patterns across cases. It was instrumental for the researcher to create a master table of themes and review the connections of data as a whole (Smith et al., 2009). This process allowed the researcher to develop a master list of super ordinate themes based on patterns that were prevalent across cases (see Table 6). According to Jeong and Othman (2016), patterns can be grouped according to commonalities and nuances shared across the core number of themes.

Table 6

Development of Super Ordinate Themes

Super Ordinate Themes	Pattern	Emergent Themes
1. Historical Chart Review	Ability to Locate Relevant Notes Ability to Locate Lab Results Ability to Locate Home Meds. Inadequate Filters Inconsistent Documentation	Accessibility Readable Documentation Lack of Customization Content Overload
2. Note Documentation	Inconsistent Documentation Inadequate Note Template Mobile Charting Dictation	Readable Documentation Lack of Customization Lack of Standard Documentation Coping with Efficiency Patient Handoff
3. Patient Throughput Barriers	Patient Discharge Patient Admission Ability to Locate Home Meds. Inconsistent Documentation Inadequate Note Template Skewed metrics	Coping with Efficiency Lack of Standard Documentation ED Capacity Patient Handoff
4. Poor System Performance	Ability to place orders Ability to write notes Skewed metrics	Accessibility Coping with Efficiency Slow System Response Application Failure
5. Difficult Order Entry	Ability to place orders Hard to Find Med. Orders Hard to Find Lab Orders	Coping with Efficiency Accessibility Lack of Customization Lack of Standard Terminology Slow system response

Journaling and Bracketing

As part of the IPA process as defined by Smith et al. (2009), the researcher created a journal to record her thoughts, set aside ideas, and document any opinions related to emergency room physicians and their user experiences with EHR systems. In an effort to reduce bias, researchers are

encouraged to bracket previous notions or experiences prior to any engagement with participants and reveal them throughout the research (Peat et al., 2019). To align with IPA standards, bracketing occurred throughout several phases of the research including the moments prior to data collection. For instance, an initial journal entry read:

> "It is an honor to work with these physicians again. Although I was here during the initial Epic implementation, this experience is different. Each provider will have their own thoughts and views on how they use the system. Their experience is completely different from mine and I should view it as such. I honestly do not know what to expect or how each interview will go."

During each interview, the researcher listened to each participant carefully and used the interview questions to guide the process rather than use it as a strict requirement (Smith et al., 2009). This allowed the researcher to maintain open-ended questions by asking focused questions that were not leading and allowed each participant to express themselves freely. Bracketing and journaling also occurred throughout the transcription process. Once the transcripts were reviewed and clarified for accuracy, the researcher journaled her thoughts and bracketed ideas about what took place in each interview.

A separate journal entry read:

> "After the first pilot interview, I found myself wondering if my questions were arranged in such a way that allowed the participant to open up and express himself clearly. After the first question, the participant took a long pause before answering the question. There were several other pauses along the way that were combined with his confused gestures."

After a few adjustments to the semi-structured interview guide and a subsequent interview, another journal entry read:

> "At the beginning of the P3 interview, there was a problem after the participant signed into the EHR shadow environment. We immediately noticed that there were no patients on the 'waiting for provider' Track board view. This issue immediately slowed the pace of the interview because the first question was changed after the pilot interviews: "Describe your workflow when you log in to the EHR system at the beginning of your shift." The question was difficult for the participant to answer because there were no patients waiting to be seen. This served as a self-reminder for

> me to have realistic patients and scenarios mocked up in advance. The interview moved forward as the participant selected a patient who already had a provider assigned to their treatment team. For the next interview, I will be sure to arrive a patient to the emergency room and have realistic data such as a patient's chief complaint and arrival documentation. It is also helpful to room the patient in order for the participant to see the patients under the 'waiting for provider' view. This was definitely a lesson learned."

This iterative process continued throughout the data organization and data analysis phases. Each interview case was reviewed and evaluated one by one to allow the researcher to refrain from drawing primary conclusions. According to Smith et al. (2009), it is imperative to treat each case individually and bracket emerged ideas before moving on to another case. Thus, the researcher continued to journal her thoughts throughout the reporting of data to stay in tune with the user experiences described in the semi-structured interviews. The constant process of journaling allowed the researcher to 'free code' and write down initial thoughts that would minimize bias wherever found (Chenail, 2011). According to Chenail (2011), if thoughts are not recorded prior to the interview and afterwards, potential thoughts or feelings that may have led to bias may be missed.

Findings

The data from eight semi-structured interviews were reviewed and analyzed using a step-by-step analytical approach as described in the data coding section in Chapter 4. The analytical approach was adapted from Larkin and Thompson (2012) and modeled after the IPA methods as described by Smith et al. (2009). The researcher began with the initial coding of each transcript through the use of exploratory and linguistic comments. In addition to coding by hand, the researcher used the NVivo qualitative software to complete the following: organize the initial notes and comments, create parent and child nodes according to relationship, review the most and least dominant themes in the data, identify connections across themes, and develop super-ordinate themes according to themes and patterns found across cases. After a thorough analysis process, there were five major findings in this study:

1. *Historical Chart Review* – As a necessary first step in obtaining the 'story' of the patient, physicians find it difficult to review relevant historical chart information. It is pivotal for a physician to review historical information about a patient such as home medications, clinical progress notes, and lab results.
2. *Inadequate Note Documentation* – Although clinical note documentation can be automated through the use of dictation software and note templates, physicians are displeased with the tools available and how note documentation is inadequate and hard to follow.
3. *Difficult Order Entry* – The ability for physicians to place clinical orders in the system requires a considerable amount of effort and time. Most specifically, lab and medication orders were identified as hard to find and difficult to order.
4. *Patient Throughput Barriers*– Patient throughput in the emergency department (ED) is difficult to maintain due to patient admissions and inconsistent handoff documentation. Although the group of ED physicians have admitting privileges, there is limited capacity to adequately treat critically emergent patients and patients that need to be admitted. In addition, physicians are overwhelmed with inconsistent handoff documentation for admitted patients that are completed within and outside of the system.
5. *Poor System Performance* – Application failure and poor system performance are disruptive as physicians practice patient care on a daily basis. The biggest challenge occurs after a physician has worked a 10-12-hour work shift and they attempt to sign a progress note or place advanced imaging orders for a patient. Furthermore, the performance of the system is associated with the ability of how physicians cope with skewed metrics and efficiency.

Data Visualization

In addition to coding data and identifying themes, the researcher used the NVivo software to visualize data and analyze how frequent words were used by participants. The term *patient* and

similar words such as *patients* or *patients*' occurred a total of 521 times (see Figure 6). In addition to *patient*, the words *note (339), look* (307), and *order* (277) occurred frequently. The frequency of these words can be viewed as significant because participants were able to describe their lived experiences and core functions of the EHR system.

*Figure 6***.** Word Cloud based on NVivo Analysis of Coded Nodes

Super-Ordinate Themes

Super-ordinate themes were developed from a thorough analysis process that began with line-by-line data coding, an organization of the data, and a sufficient interpretation of the participant's narratives. The super-ordinate themes were established through a step-by-step approach of understanding the meaning of the data, identifying patterns through the use of themes, destructing the themes into a series of codes, and a reflection of the researcher's own perceptions through the use of journaling (Larkin & Thompson, 2012). The researcher followed an iterative process of revising the codes as cumulative patterns were discovered across the data.

As the quotes of participants are presented in the next section, the terms provider and clinician are interchangeable with the term physician. The participants are labeled only by pseudonyms to protect their identity, P1, P2, P3, and so forth.

Historical Chart Review

As a necessary step in obtaining the 'story' of the patient, the providers find it difficult to review relevant historical chart information. According to Mazer, Storage, Bereknyei, Chi, and Skeff (2017), clinicians must obtain a patient's medical history to formulate a narrative about the patient and co-process the illness experience. The participants described the start of their typical workday with: (1) logging onto the system, (2) checking the 'waiting for provider' track board view, (3) assigning themselves to a patient's treatment team and (4) reviewing the patient's acuity level. Subsequently, the participants select the patients who have the most acute acuity level and begin reviewing their medical history as an important tool in the management of their care.

Five of the participants expressed disappointment with locating relevant progress notes, home medications, or previous lab results due to the excessive number of mouse-clicks and unorganized information. The experiences appear to align with Baird et al.'s (2017) and Guo et al.'s (2017) findings that highlight a need to reduce 'click burden' while physicians attempt to review a patient's historical medical information. P2 shared:

> "…Um, I do like when [the system] is easily readable…'Cause here I used to remember how this is and where I had this and I would just look at that once…. Maybe two weeks [ago] when we got the upgrade.
>
> …Now it's just more clunky…. you have to go up here and look to get this…Um, and then our tabs are different too….
>
> So, this, is not as easy 'cause I would normally have it here. So, you gotta go here and find the reports, which I use a lot. So, it took a lot to just go here to get what I'm looking for…
>
> I'm also looking through the notes to see…see what they have. Multiple myeloma or sometimes there will be a note here and telephone call that says they're being sent

> here because they were at the ATC [Ambulatory Treatment Center] or something. So, I spend some time there. And then it varies to some of them. There is no information with a new patient or on some of them there's maybe um, a couple of telephone notes and then if they had like a procedure or something. So that kind of, again, it varies- “

The participant had a difficult time explaining how her tools used to be compared to how they are now. A prevailing concern was that she could no longer find specific historical reports that were once easy to find. The historical reports often contain a patient’s clinical information such as progress notes, medications, lab results, and other pertinent information (Kohli & Tan, 2016). According to Kohli and Tan (2016), it is essential for clinicians to have the ability to make an inclusive review of factors that can possibly impact an individual’s health. After the interview, the researcher wrote down her personal reflection regarding P2’s comment that appeared interesting:

> “I forgot about the software pilot initiative that was rolled out to a few physicians in the emergency center. There are only a handful of physicians who have an updated version of the software where the patient header is different. The new version has caused the icons to shift and look noticeably different. P1 and P2 have the same version. Something to keep in mind.”

P3 expressed:

> “So, you go to chart review, you go to notes. Let's ignore that the patient was like, just here in discharge…. So, then we have to go back to find the last attending note about this patient. We click on a telephone note. Okay, let's see if this is helpful. Um, no, it doesn't tell us about the patient's history. So, let's go back a little bit further. You know, we can go to maybe a hospital admission note or a progress note from before….
>
> So, then let's say I want to know what the patient's previous glucose was. I'd love to be able to just click on it and look at it…. But instead of just giving me glucose, it gives me everything. And so, there's no way to trend from here. Like if I wanted to trend it, I have to go back. So, you know, if I assume that a patient has had multiple BNPs I'll look at the historical data from it. But if the BNPs were really few and far between it's absolutely not helpful….
>
> I've also had instances where I've ordered tests and they don't show up under results review and they don't show up on the workup tab.… I had a colleague look at it and he was like, "No, you're an idiot. Look, it's right here." But he couldn't find it either. I don't like that it's a bunch of clicks and this is my biggest thing with that, is its way

> too many wasted clicks. It's a lot of wasted time clicking on things. Like when I click on results review, I want it to come up the same way every time and it doesn't."

P3 was asked a follow-up question as to whether scrolling would be difficult if labs were always expanded. He responded, "No, I'd rather scroll than click a thousand times." Thereafter, he described his experience of looking up a patient's home medications:

> "I would almost say that I like that you can look and see what their meds are, but the med list is not always accurate and the extra clicks are really annoying. The fact that I have to unclick current meds only, which I would like it to be unclicked first…For instance, let's say a patient and I need to know if they've been on antibiotics previously. So, I have to unclick current meds only, then I have to click on antibiotics….
>
> Okay. Let's say I want to look at their pain meds. It loads them, okay? Sometimes it will have loaded stuff let's say from like down here and I have to click on load all records now to be able to see what they've been on…. Um, because I had to press, "Load all records now." Extra clicks, extra time wasted. And it's dangerous because you might not see something if you didn't click that button."

P4 reinforced participant P3's thoughts as she expressed similar concerns:

> "When I open the synopsis tab for chart review, imaging is the default that opens. Our patients tend to have a lot of imaging, so I wish it was, uh, closed. I don't like it because it's too much noise. I wish I could customize it but don't think I can. I mainly use synopsis to review the chart for microbiology. To find out the patient's cultures and I like this for past cultures…. And then, chemotherapy, I look at this to find out what they're on and when they last received it. This is how I have, you know, worked it into my process…
>
> I also feel that we should have one summary report that has everything similar to what the observation unit uses. Their report lists the pain assessment, problem list, medications, all in one deal…. If I want to review home meds, I may try to do that before I go in the room. It depends if they have pain and it depends on their complaint."

The components of chart review reveal how emergency room physicians experience certain system tasks that are difficult to perform. Although digitized data such as lab test results and a list of home medications could be a rich source of data for clinicians, it should be combined into a common analyzable format (Berger, Curtis, Smith, Harnett, & Abernethy, 2016). Participant P5 expressed:

> "I think to be honest, one of my biggest pain points, and I don't know that this is an Epic thing, is med reconciliation. Um, a lot of the times the nurses are like, "Well, I put in the home meds," but then I don't know how to check and find them. Maybe it's just 'cause I don't know how to use. So, when I do go to reconcile, of course I don't know what they've done. And again, this is maybe more of a human factor than an Epic factor.
>
> But I just wish there was an easier way without me having to go into here... But even to bring them up to the screen I just wonder if they're accurate. That's my only issue with them. I don't know if when I do see it, if they've been updated or not- I guess to, to take the job out of that and other people might disagree, but I would prefer to have a quick and easy way of, here are the meds where doctors can check them- If you choose to."

P5 described an ongoing issue of medication reconciliation and the ability to find accurate home medications as needed. The participant suggested that nurses may not play their role of adding home medications to the patient's chart. According to Boncella et al. (2014), someone plays an integral role in manually updating the patient's home medications, while another person reconciles the medication list. Boncella et al. noted that home medications can also be acquired through outpatient pharmacies, a primary care physician, or through the patient/family interview. Given these similarities, P5's experience reflects a common thread with Boncella et al.'s findings which suggest the accuracy of home medications may not be an EHR problem but a problem with the source of information. Participant P5 also shared her experience with reviewing historical labs:

> "So, I'll tell you when I use chart review often and um, anyone with a CMP, CMP is my issue. I love CMPs, but when it comes to trending data, I don't find it very useful because it's all over the place. So that's when I'll go to results review… So here, here's the CMP one. So, if I wanna see if this glucose is a baseline, you know, I'll go here, and it's just hard to track. So, for this glucose, I don't even know where this glucose is, so I've gotta start tracking, and then this disappears… So now I don't know if this is it, I don't know what this 24 is, and I don't know if I'm comparing it to the 6 or the 29. So that's when I'm like okay, yeah… It's also difficult to trend my belly labs…by the time I find the next belly is, you know- I've lost it, I don't know what's back there, 'cause they're all over the place. Even though they're all done 10 hours ago, I don't know why they show up differently."

The researcher generated an NVivo word tree of the term "see" which exemplifies

connections between words in several interviews that represent the participant's ability to see historical information in the system (see Figure 7).

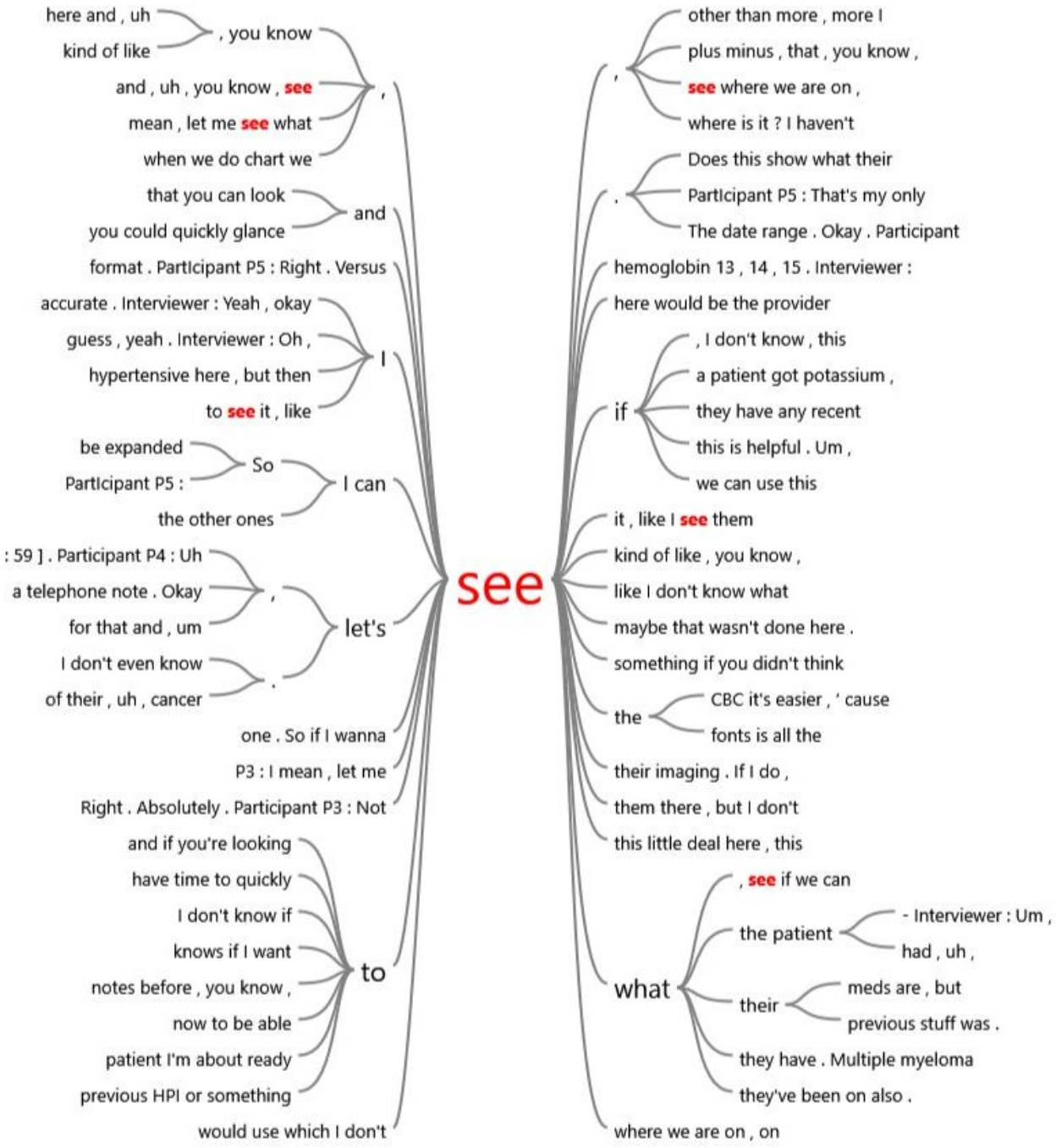


Figure 7. NVivo Word Tree of the Term "See".

Participant P6 provided a conceptualization of how important it is to view a historical medical note, a patient's home medications, and lab results:

> "Sometimes I have a hard time finding a note that's relevant, you know, it'll be Like 6 nutrition, 5 physical therapy notes. I mean, nothing that really tells me about the patient. Often times if they've been hospitalized, I'd like to document what happened in the last hospitalization. That's the background I'm looking for. I don't really use any of the filters…. all I would really need is progress notes…. I kind of glance through to see what I think is important.
>
> "…. You know, it's important to me to know that the patient has spinal meds 'cause she came in with back pain. But I usually have to hunt for that information anyway. So, you kind of have to talk to the patient and get a sense of what the problem is and then go back and hunt. So, you probably need those details somewhere, but, where? I don't know. I mean is there a place where you could quickly glance and see what the patient is on? Well, the pharmacists help us here. So, I've learned how to use that…"

The participants overwhelmingly expressed concern with finding lab data and viewing home medications that are accurate and easy to find. A NVivo generated word tree of the term "look" represents the associations between words in the different interviews that reveal the participant's plight in viewing historical patient data (see Figure 8).

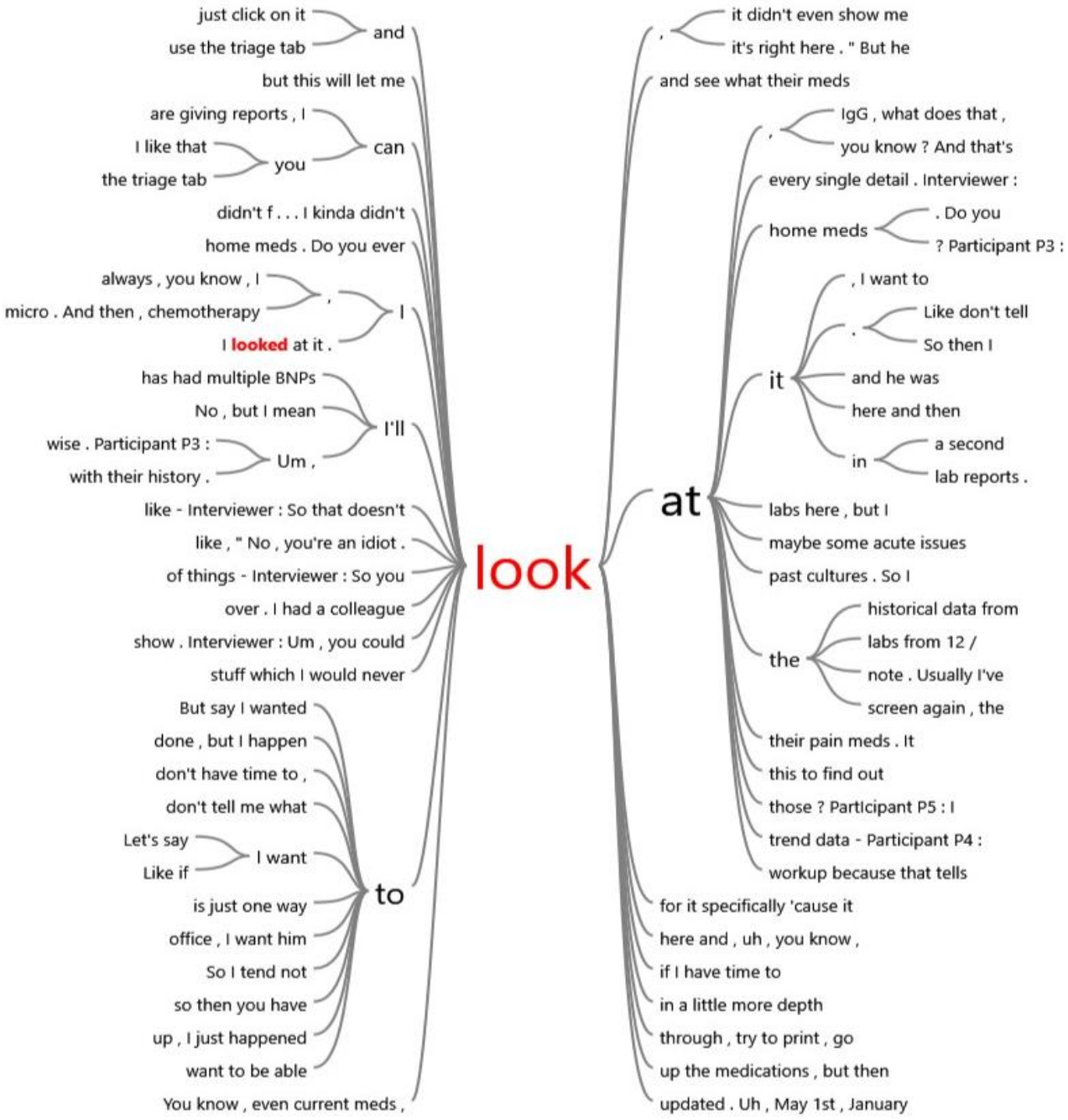


Figure 8. NVivo Word Tree of the Term "Look".

Inadequate Note Documentation

Every participant expressed they were displeased with clinical note documentation. As part of the progress note, the History of Present Illness (HPI) can be described as a communication method for gathering the patient's knowledge of illness and shaping it into a mutually agreed

narrative form (Mazer, Storage, Bereknyei, Chi, & Skeff, 2017). Followed by the Review of Systems (ROS) and Assessment and Plan (A&P), one is comprised of a series of questions to assess an inventory of the body systems and the other reveals a clinician's impression of the patient's diagnosis and summary of care (Brown et al., 2014). Participant P1 was particularly displeased with the inability to customize the HPI or ROS note templates based on the organization's oncology focused patient population and a patient's chief complaint. He shared:

> "Why you don't let the provider customize his HPI or his review of systems? And to have his own list of templates by chief complaint? So, you have already set up a template for abdominal pain and this and that, by why the physician, cannot customize it for himself? But here you're providing like a template and we just use it. Why don't you make it like a kind of cafeteria style? The provider pick whatever he feels is important for his documentation and generate his own template… he can still use yours but if he builds his own, that will make him go faster with his note and all of this….
>
> So, I'll give you a simple example. Our population is special. If you go under diarrhea, diarrhea at an outside institution is different from diarrhea here 'cause some patients are on immunotherapy. So, if you go under that diarrhea template, there is no place where you can check the tab (immunotherapy). You have to write it down. Immunotherapy is considered a risk factor or context.
>
> So, but you see, this is one example, but if you look at how our organization is different from the outside. For instance, if you take all of these patients who are on study protocol. By allowing flexibility, you allow a provider who's more expert in this protocol to put relevant information there that we'll have to review it every time. Which for outside hospitals it's different. They have a different population. So why only limit him to what you put in this template which goes into the hospital problem?"

P2 also expressed unique views about note documentation:

> "Sometimes the clicks are, um to much... The clicking just sometimes annoys me cause I like to just dictate…. I mean…I know you can go in here and do your clicks and you could do it like that….but my note for HPI is set up differently…. Um, there's a lot of these buttons, which this is easier, but then when you're trying to review the chart, this doesn't help me to figure out what happened to the patient. So, here's a patient. So now on here I would put my assessment and plan…. And yeah. So I dictate- 'cause the typing, that takes forever."

P3 expressed similar views about point-click buttons but prefers to type a narrative:

> "Um, so yeah, the HPI tab, I don't use the buttons. I used to use the buttons, but they slowed me down a lot on the forms for like the different systems, um, complaints or whatever. I just write it all up. So if for instance, the patient is hypomagnesemic, you know, I'll be like, magnesium is low repleted…I also wish there was an easier way to add the impression…And then you have to wait for it to load and type it in."

On the same token, Participant P4 described her use of narrative text and her distaste for point-click buttons:

> "Usually I do a narrative for my HPI because I find the HPIs that are all you know... click, click, click…are hard to read when I'm reviewing one and for me, I don't think it tells the story…. Narrative is also better than dictation... That is the way I like it personally and I know a lot of people use dictation…but this is what helps me, and that's the way I do my thinking on the patient.
>
> And then…before I sign my note, this is when I'd make sure, I have a disposition. Because a lot of our notes, if you've ever been through our notes, are very inadequate. You know, it is a problem because people don't put the clinical impression, they may do it, but they sign their note and if you sign your note and go back and do it, they don't refresh it. Well, I think that the system, every time you open your notes, should refresh and pull in the most recent thing. So that would be one improvement on, because we have to physically remember to do all that…. So, it's a lot of clicks to manually refresh."

Participant P5 shared her thoughts on dictation software and the use of narratives for note documentation:

> "Sometimes I dictate and use Dragon, but other times Dragon and I don't see to see eye to eye on my pronunciation sometimes….and I don't use many of the buttons or smart phrases. I'm more of a writing person…. I write through my narrative. These are the only two clicks that I always do. Some stuff just shows up and I don't even touch it. I don't remove them, I just kind of leave them there. I'd like to think I'm pretty thorough with my exams. Like I'll go through pain level one through ten, Sharp, radiates to the leg, what, everything else that they're asking me here- So if I'm already writing it here, I feel like the buttons are redundant, and wasting my time. So, I don't ever do this.
>
> Which makes it hard for the coders, but it's easier for me. And I tell you what, and the reason I don't find them useful is because when I've read others people's chart that only use this, it doesn't make a paragraph to me. I still have no idea why the patient's

> here. The story doesn't flow. So I'd rather have a story that flows here in my mind, so that even if I come back to my chart two years later, I know what was going on. Instead of following a one, one word- To me that, that when I see those charts, I find them useless. I don't like my charts to be useless even to me later, so I don't use these.

Narrative text can be viewed as more reliable and understandable when viewing the patient's story (Brown et al., 2014). In the same manner, Participant P6 stated:

> "I hate the note forms. First of all, I don't do the clicks. I don't, I can't… when I look back at an HPI form I have no clue what, what really happen. I just find when I read other notes... like that, I just ... I just, I don't get any information from them. And because they're always asking questions, I find irrelevant, like what is the nature of the chest pain? Is it stabbing? Has it been there four hours or 48 hours? Um, a lot of questions that I find irrelevant. And I don't get the whole story...
>
> And also, when you write your assessment and plan or your assessment, you add your impression here but a lot of times people's impressions are very quick. And sometimes I just feel like things get lost and all the words is like a repeat…. you see the same notes cut and pasted, cut and paste ... you know…people talk about that all the time and you don't know what's new…. It just, things get lost in translation…
>
> Sometimes it is very clear and very detailed. I would want my oncologist to have all of that at his fingertips. For me, I just need to know they have, a few things and I don't need all of that."

The providers voiced that they prefer to dictate or write narratives for their HPI and A&P notes. They also expressed the inadequacies of notes that were transcribed from point-click buttons or those that have copy paste text. Although copy and paste functionality can enhance efficiency throughout clinical documentation, the recurrent copy and pasting of notes could pose a risk of entering data on the incorrect chart (Tsou et al., 2017). Participant P7 expressed his views on medical documentation in this country:

> "I mean note documentation is tedious, you know in many other countries without the such focus on documentation for insurance purposes there's no need for all of this. Okay, so like in the far east or even Japan, their medical records are very brief. It's for the purpose of the physician making decisions. Okay, it's not for the purpose of the insurance. So, the throughput for the patients would be very fast, in the clinic they can see like ten minutes per patient. In the ER they would see many many more patients than we do."

Participant P8 also shared:

> "I dislike the fact that in order to make this a billable thing, you have to go through and click…and make it a system that makes it difficult for the person to understand what you're thinking. And the reason that I put all those comments in my impression and plan is because I pull that impression and plan into my note. Right? And otherwise, you know, when I look at people who had just click through the MDM, I can't understand what you're thinking.
>
> If you say here's a problem and here's what I did, that is something I can understand. But when you come down to MDM, dyspnea, new problem, some level of acuity, blah, blah, blah- ... you didn't explain and I don't know in the end that the guy had a pneumonia until I go back and look at his imaging.
>
> So, it may be very good for billing, but it is not good for communication and patient care and unless you, you make it that way-...'cause I don't think this system communicates. It may be great for billing, but it's not set up to communicate unless you happen to be one of those people who lives by check boxes."

The participants described the Medical Decision Making (MDM) portion of their note as the place they document the details and contributing aspects of a patient's care. They indicated that the MDM can have an influence on the level of service charge. Although some participants expressed thoughts about billing and note documentation, most were interested in sharing their experiences about the inadequacies in the patient's story. According to Mazer, Storage, Bereknyei, Chi, and Skeff (2017), it is important for appropriate handoffs to occur since there are occasions where the physician who obtains the history may not necessarily be associated with the patient's ongoing care. In general, note documentation is an integral part of the physician's job and has an impact on patient care (see Figure 9).

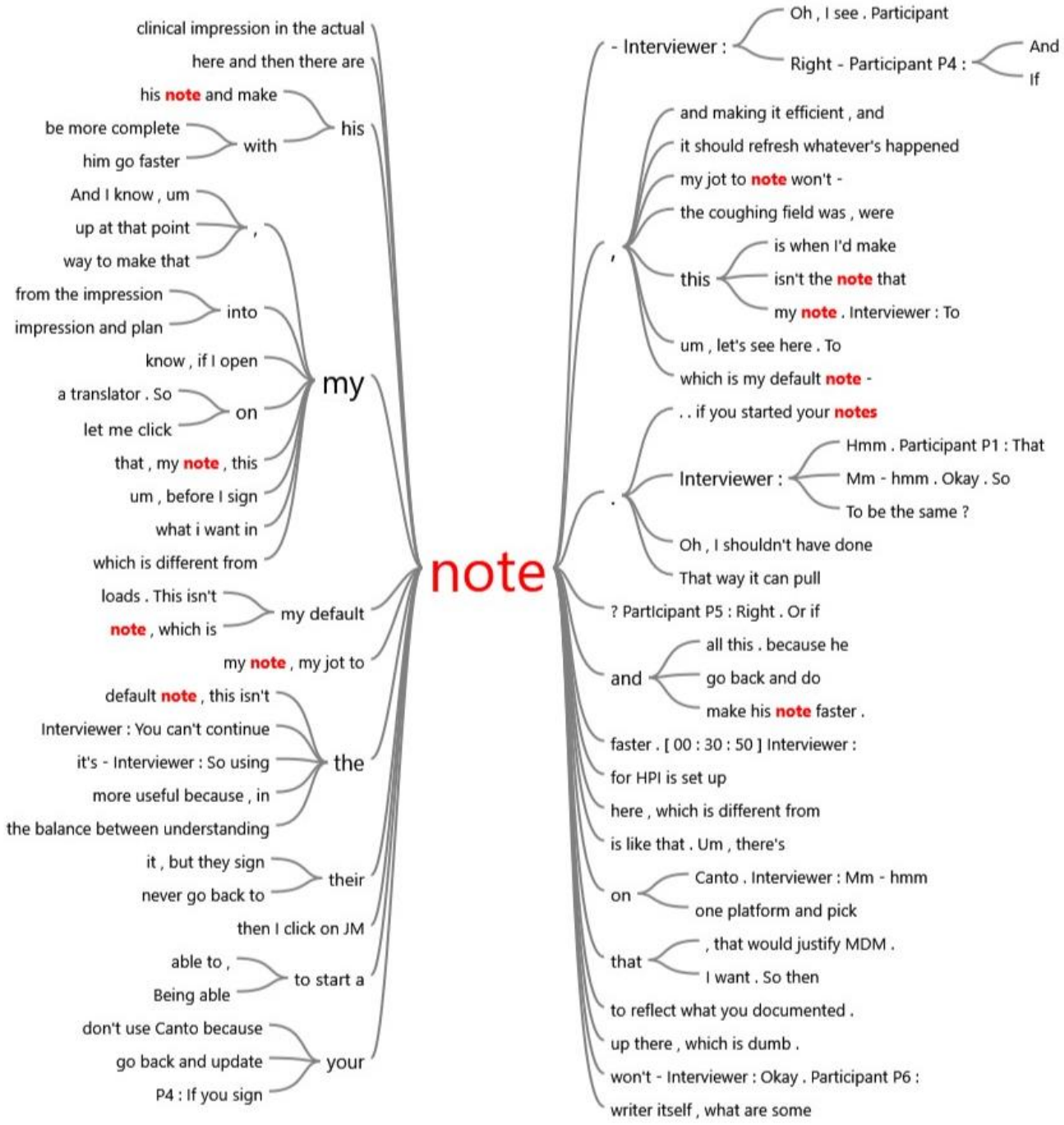


Figure 9. NVivo Word Tree of the Term “Note”.

Difficult Order Entry

Five of the emergency room attending physicians believe that clinical order entry requires a considerable amount of effort and time. The physicians particularly experience difficulties when trying to search for individual medication, lab, or imaging orders. Although they expressed content with templated order sets and order panels that are grouped together based on chief complaint, the primary difficulties occur as physicians attempt to find orders using a variety of keywords and multiple search methods. Participant P1 conceptualized his experience with order entry:

> "What I find most frustrating is that, if I'm looking to search something that is not in here, I know there is a help button here but it doesn't help answer my question usually. And if something is misspelled, the system is not smart enough to give me choices. Like, you know, Google or something like that. If I miss one letter, it doesn't find it. So, I think this is an issue with the system. This happens when you search for anything in the system. Unless I spell it, one hundred percent correct, the system doesn't find it…It should be a smarter system where it could suggest different words from the misspelling…. It can waste your time. So, I think the system should be smarter to give you options like if you misspell pneumonia…
>
> If I don't find an order for whatever blood test, I have to spell it correctly to find and that takes time. I'll give you one example. It took me forever to find serum ketone. If I put ketone, there is ketone in the urine. Unless you put beta, something like a specific name, it won't show up. So, you put ketone and there is no serum ketones… You have to put beta hydroxy. ...So, for someone who wants serum ketone, the system should give me a choice. Are you looking for serum ketone or urine ketones? So, unless I put beta hydroxy it won't pull up, and I bet you if you asked our physicians, half will not find it….
>
> So, you see how long it takes me to find it? Why doesn't the system give me the choice? So, it makes me feel like I'm working for Epic instead of Epic working for me."

In a similar manner, Participant P3 expressed:

> "We click on our order tab and then we have our quick lists (order panels) which for the most part is pretty good…But accessing my own is not an easy task. It doesn't

> show up. If I make my own, I haven't found a way to get it onto this screen. So, it's more clicks to get to it.
>
> If you're looking to see if a patient got potassium, you have to order it by that and then, you know, maybe you're not sure which form of potassium. So, it's going to be spelled different…It's very inefficient in my opinion."

As both participants agreed that searching for orders is an arduous task, Park et al. (2015)'s findings also suggest that entering orders can slow down a provider's productivity and increase their workload. Participant P5 offered her perspective and compared her ordering experiences to paper orders:

> "With paper orders, somebody could write it next to me and I would just sign it. It was that easy. But um, sometimes it's hard to find things here. I forget, but I was looking for something specific and it wasn't easy to find… I'll give you an example ... ESR…You type in ESR and it might not be there. You have to type sed rate. Whereas otherwise it won't show up- ESR won't show up. So, on a piece of paper, I would just write ESR, everybody knew what ESR was. I didn't have to write sed rate. Because sometimes, again, if you type in like BNP alone, it won't show up. You have to type in proBNP for it to show up. So that's kind of a pain in the butt."

Along the same lines, medication orders are difficult to enter. Real life examples of ordering a medication in different forms is reflected in Participant P6's summation:

> "So, I could order a medication three times in three different ways…I could order, you know, oral Dilaudid here, IV Dilaudid here and lollipop Dilaudid ... So, I could order three formulations of the same, uh, heavily sedating drug.
>
> So, I've saved a few, starred them to make them my favorites, but then the wrong one pops up when I try to search for it. Like I usually want 40 milli equivalents PO but it comes up as the IV so, you know, like if I put in potassium, like it'll pull up my last favorite. Okay? But oh, I want the IV, so now I do have to go to the whole list and find the IV. Okay, where is the IV here?"

Participant P6 reinforced Patterson et al. (2017)'s study that suggests medication orders with similar effects (IV and Oral meds) are not always easily listed in the system. Participant P7 highlighted similar thoughts and expanded on the ability to search for

nursing orders:

> "For some stuff that's difficult to find, it might be helpful if we have a place where they allow us to free text. There are certain orders like, let's say I want the nurse to administer a medication a particular way, I mean there is ways to do it but I have to find an appropriate order for nursing. For instance, a flush feeding tube order, do they have that? It would be nice if it's something that you know is not very specific and now it's okay free text, okay let's say if I want to put the patient in Trendelenburg.... Okay so how do I type Trendelenburg? Which means to put the patient head down.
>
> …Oh, the other thing is non-formulary drugs. They are difficult to find. And even if I want to order and make a non-formulary request, you can't even find it…The drug is not in the database. If it's a problem, I just call pharmacy. Well most of the time, a lot of time it's the name of the way to enter it. So, most of the time the pharmacist would be able to find it."

As the participants have expressed, the task of finding clinical orders in the system is not an easy feat (see Figure 10). Regardless of how difficult it is to find orders, they strongly voiced that they could still not go back to paper charting.

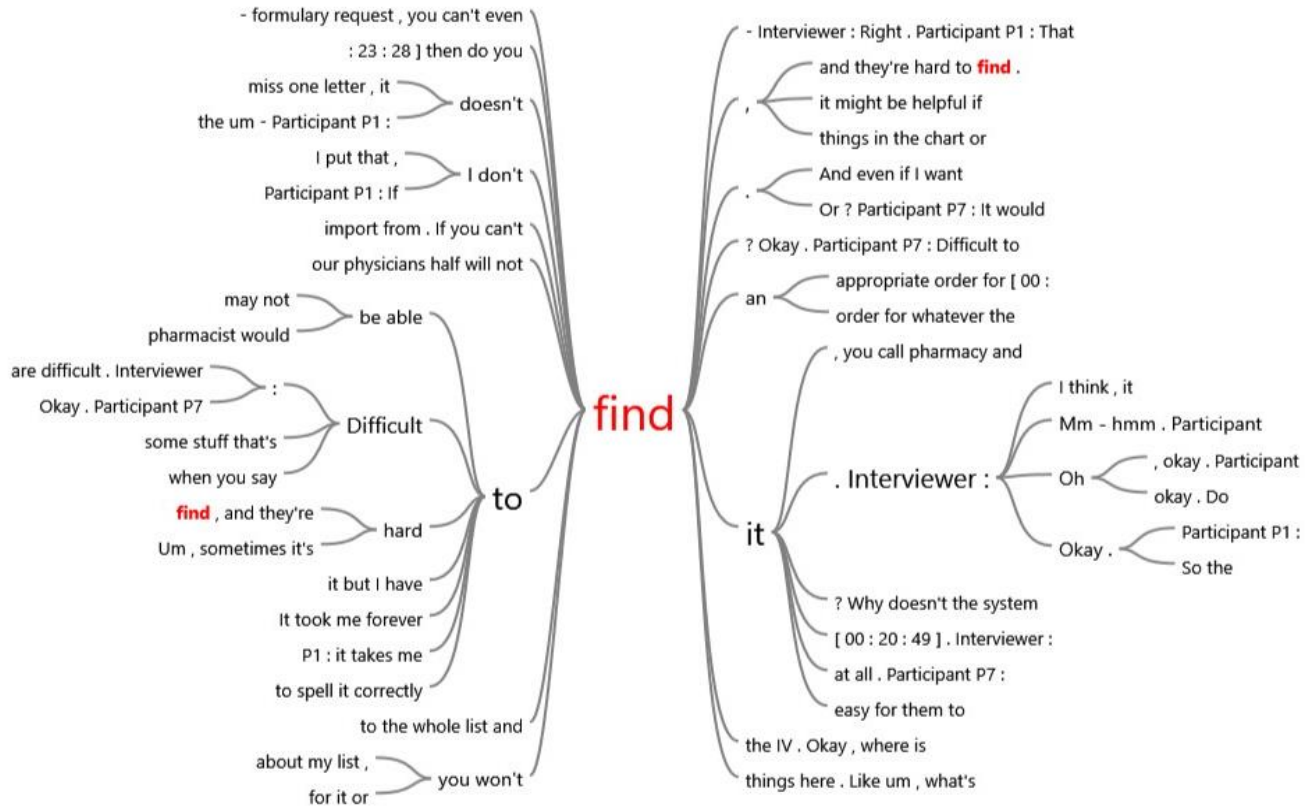


Figure 10. NVivo Word Tree of the Term "Find".

Patient Throughput Barriers

Seven of the participants find it difficult to manage patient throughput in the emergency department (ED) due to patient admissions and repetitive handoff documentation. Many hospitals experience hospital overcrowding when admitted patients are "boarded" and roomed in the ED (McKenna et al., 2019). When ED overcrowding occurs, there are many consequences such as a delay in care for those that are critically ill, a reduction in quality care, and an increase in medical errors (McKenna et al., 2019). In addition to overcrowding and admissions from the emergency room, efficient handoff communication between emergency physicians and internal medicine has been a major concern (Apker et al., 2014). Participant P2 shared her experience:

> "So, I'm gonna admit this patient…I use a dot phrase, .PT admit. Then I take this and I put it in the email and I sent it off to whoever. Um, and that's like the easy one. The one that takes a while is, um, the I-Pass handoff- Which we're supposed to be doing on everybody. But only time I do the I-Pass handoff is really for the hospitalists because- here it populates some information, but then you still have to put this in here and then I still got to do the email, so what I've done with acute issues, I just take my assessment and plan, cut and paste and put it there. Um, and then, you know, it adds whatever I want there. And then I copy this, cut this and send it in an email….
>
> The I-Pass and D-Pass handoff is the same thing. I mean, even if you do the D-Pass handoff, it doesn't add everything, you still have to put it in…So, you know, you're spending time. So, then what I do, is in this case I would, um, if the Pharm D's have done the med orders for me, then I'll just go in …. I'm reviewing it and I would sign off, place my admit orders and then I would sign that…. And then I share this note, because then I'll come back and do whatever I haven't done."

One of the processes for admitting a patient is completing the admission handoff. The participant shared her account of using an I-Pass or D-Pass Handoff template and the use of a dot phrase to shorten her documentation (i.e. .PT admit is abbreviated for Patient Admission). The I-Pass handoff is a mnemonic and handoff tool that uses a bundle of interventions that comprise of standardized education about the patient (Heilman, Flanigan, Nelson, Johnson, & Yarris, 2016).

The participant also shared that the counterpart of I-Pass is the D-Pass template which the physicians in the emergency center (EC) use. Although the I-Pass is sparingly used, the D-Pass is often added to their note and sent to the primary admitting service in an email form.

Participant P3 shared similar but unique views:

> "We have to put in the admission orders, which is not normal for an emergency department. I practiced in a real emergency room for four years before I came here as an attending. So, I mean I worked in a, in a regular hospital and you know, admission orders is not something that as an emergency trained physician I should be doing…I mean the American College of Emergency Physicians even says we shouldn't be doing that. Um, so sitting down doing admission orders, then instead of picking up a phone and talking directly to somebody, which we do sometimes, then you have to write an email. And so, we have to open Outlook, you know, open up a new email. We have to type up…. send that out. And um, and make sure that we send it to every appropriate, you know, attending. And um because again, it's, it's more than Epic. I mean as much as Epic does, we still have to go through Outlook, we still have to talk to- Talk to some physicians.
>
> …But here, let me, take you through the adult single (admission) order set.…I think that the negatives overshadow the positives with the EHR and I think it just frustrates me and…I feel like it slows down my day. I feel like it gets me upset during my shift. Like it's a big negative on my shift…I hate dealing with this EHR.
>
> We used Cerner at my other hospital. It's not perfect. It had its own problems, but it was the same for everybody and you just learn to live with it…Um, anyway, so this admit to inpatient tab is like the bane of my existence. You have to do a service and you have to do a unit, but now we're doing mainly EC, so that's just a waste of time. Then you have to do a diagnosis, then you have to do the admission date. Why? Why can't it just set it to today? It doesn't make sense. There's no reason for them not to be and it's just extra clicks and that extra time wasted. Length of stay, no reason for me to decide that. I have no idea. And that's anyone. Like it's ridiculous. Admitting provider, attending provider, there's no difference….
>
> It's like this…. Okay, let's say I start with my name, I have to type in my name again. Here, finally you can do the equal sign thing, which is a little bit of a time saver, but you can't do the equal sign for these two fields…More frustration, more clicks, more wasted time. And then proposed treatment plan, I don't know who that's important for, but like we're already sending in all this other information, like the I-Pass handoff and an email."

Participant P4 expressed the same sentiments about patient handoff and a different perspective about ED throughput and capacity:

> **“**So, if all providers could gauge their activity when we're trying to assess when to call in backup, that would be helpful. Like if you poll people around the room 'Hey, how many do you have? Do you have any more capacity to take anybody?' and if they're able to see quickly that now I've got 16 I really don't think I'll be able to pick up anymore. 'Oh, you've only got nine? maybe I might be able to pick up one or two'… If we could get a quick pulse and when we need to make a decision to call in back up, that would be great...One of our criteria for calling in backup… is the amount of patients per hour, per provider. You know, if you're saturated... you know, if you're overloaded and you're not going to have any capacity. We've got 20 waiting in the waiting room if we don't think we're going to be able to absorb those by the existing staff and then we call backup in.
>
> Uh, I mean, and I think we just get bogged down with too many patients…like, I know I need to admit you, but I need to go see these two people that just came in. And so, I'm going to hold on your disposition because you're safe and in a good spot- But I can't get to your admission orders right now. And so, I see this patient and that patient for instance, and get their workup going and then I'll go back- To do this disposition because it takes some time and you know…the documentation of the decisions, medical decisions made, but my capacity to do that is limited. I know it's going to take x and these patients are quasi sick too and I have already kind of addressed their sickness. Maybe they came in with hypertension or fever.
>
> So, I've kind of got them settled with fluids, antibiotics, they're going to be admitted, my decisions done, but I can't affect my electronic documentation...The electronic part of my decision- There's a delay because I've got to go address which is half that's what happens in it you know, there's just no way… I could hit the admit button, but I can't because I gotta go through all that (documentation)- I got to make sure the nurses reconcile the meds or reviewed the meds so that I can make a complete admission order. And then I have to you know, sit down and do the admission and we haven't even talked about writing the admission orders...
>
> So, well then you have, have to go outside of this to do the communication. That's part of the problem. Is that when I hit admit, it doesn't automatically send a note message to the admitting physician listed…Like you have an admission… why do we have to repeat what's already here? If they just got it, as soon as we signed these admission orders with the doctor, the admitting doctor's name would be great if they just got a notification on their Haiku (mobile) or whatever, oh, you have an admission. And we wouldn't have to, you know, like repeat what's in our notes. Like, they have an admission they need to open up and look at it. I mean… I’m doing the best I can.”

To gauge ED patient throughout and capacity, Participant P4 advocated for an at-a-glance view to see how many patients are currently assigned to providers, the number of patients seen per hour, and the total number of patients waiting to be seen. It was emphasized that ED throughput and capacity affects how often leadership calls for backup. In addition to capacity, the participant described what it felt like to be overwhelmed with treating patients in the ED, supporting those who need to be admitted, and the task of completing documentation. Participant P5 expressed:

> "I have to do the admission…That's really the only thing, I think that's what slows me the most. I have found that for most people doing the initial documentation of HPI, review of systems, history, or physical, it's pretty simple… I never had to actually admit anybody until I got here. So that is the biggest challenge. I mean we're supposed to see one patient an hour. I guarantee you- If we were not doing admissions, we could see more than two an hour. It's easy. But the fact that you have to come back and sit down and admit a patient, that takes time. You can't just breeze through an admission. So that's kind of a big deal…
>
> But the way I do the um D-Pass handoff is I will go to MDM, and then enter a new workup, and then use my dot-phrase .D template… and that's my email to-those folks, and then I'll fill in whatever needs to be filled in, then I will copy it, send it to them in an email, update this again, and that way they know that under my MDM you can see the email that I sent the primary, and it's already saved…"

All of the participants indicated that the 'MDM' part of their note is where they document their medical decision making. They indicated that the clinical impression is the patient's diagnosis (problem) and the MDM is where they basically address the problem. Participant P5 also noted that sometimes physicians do not fill out the clinical impression but there will be an MDM instead. When Participant P6 was asked about her experience, she shared:

> "It's terrible…. So, it doesn't necessarily sound like a system problem, um, or not organizational, but a workflow type problem. Do you want me to tell you the whole thing? It's because we're doing two jobs, we're being an emergency physician and we're being a hospitalist-... admitting the patient. So, if I'm a hospitalist, and I have done that job for two years at different points in my life, I

> always go over the meds one by one with the patient. I feel it's my responsibility. Even if the nurses do it, it's usually not quite as complicated as our patients. I, uh, always go over their past medical history, you know, their, significant history ...
>
> You know, I kinda talk to them- if I have more time, but here we're trying to, just send off some orders. You know, I'm not really gonna spend extra time... 'Cause I'm just the emergency-physician. So, if I went back and tried to do this with every patient, you know, it's already hard to see 12 patients in a twelve-hour period... it's one patient-... an hour. It's already hard. Which for an ER is really very slow...So I would probably take two hours per patient, you know."

Participant P7 shared a similar but different view about the patient admission process. He expressed:

> "Whether we are going to admit the patient using an EHR or using paper, it is the same. It just needs to be done. I mean it's tedious, you know in many other countries without the such focusing on documentation for insurance purposes there's no need for all of this. Okay, so like in the Far East or even Japan, their medical records are very brief. It's for the purpose of the physician making decisions. Okay, it's not for the purpose of the insurance.
>
> So, the throughput for the patients would be very fast. In the clinic they can see like ten minutes per patient. In the ER they would see many many more patients than we do. You know, but then in a way this is good for academic purposes because when you do retrospect chart review, you got all the details. You know like, there is good and bad."

Participant P8 shared:

> "This is a pain in the butt, you know, 'cause what I have to do now when the guy got admitted is send a note to the admitting team. Uh, the next thing…when I do my admission note, and when I send the admission order…there's stuff here that… I would like to be able to auto-populate. Like a smart link. And I don't like the D-Pass handoff because I don't think that it really makes it clear what's going on. When I use that, I cut it, I paste it, and I send it. Okay. Now, the reason that I like to do that is because if they don't get it, when you update my note, this falls in.... and it's really slowing me down. I used to see 16 patients a shift. That was my norm. Now a patient an hour is, uh, the most- is pretty much the most I can do. And I'm usually here an hour after my shift. So, it's, it's hard."

While the participants shared frustrations with writing admission orders, they were merely concerned with outside communication for patient handoff. They generally prefer for the primary team to be automatically notified when patients are admitted. According to each account, there is

a system limitation that does not include timely electronic notification for handoff. The participants spend a lot of time writing admission orders and completing handoff documentation (see Figure 11).

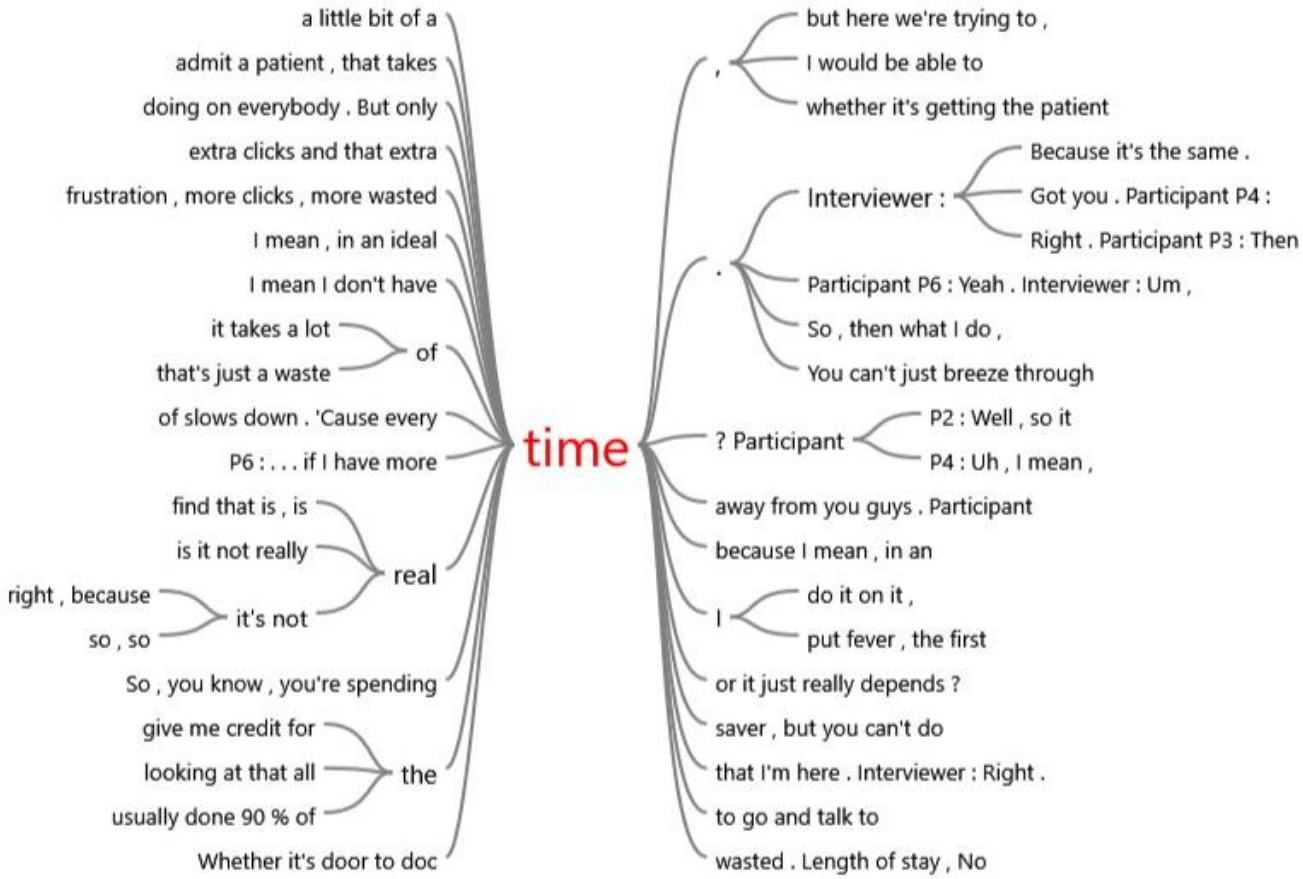


Figure 11. NVivo Word Tree of the Term "Time".

Poor System Performance

Six of the participants expressed frustration with application failure and a slow system response while they perform tasks in the system. The participants particularly find it disruptive when the system crashes during a 10-12-hour work shift or when the system lags as they attempt to write advanced imaging orders for a patient. As the participants reflected on their experiences using an EHR system, they were able to describe their biggest challenges. Participant P1 expressed:

> "Well the most issue is when you place radiology orders. That kind of takes time to process. Like x-ray or cat scan. It doesn't freeze, but it takes a long time to go through….and there is nothing you can do but wait for it. It takes like maybe 30 seconds….or it seems like 30 seconds, but that is a long time…So, this is what also kind of slows down, sometimes if you have your note shared and you want to come and open the HPI and review of system and add information to it. Sometimes it doesn't work. You see that bar going- But it doesn't often allow you to do an update. So, you will have to shut down Epic and re-open it to work. But nothing happened and basically you see as a bar going like this across….
>
> So, what happened? You have the bar going like this. But that does not open… until I close the system. Like, I can move to physical exam. And this moving is correct. I can move to MDM and it opens, but sometimes it does not. And the only way it will work, is by closing Epic and reopening."

Participant P2 noted:

> "So, one of the issues is, especially when I've been working a lot of shifts and it's like all of a sudden, the system will start slowing down. Or if I try to do an order, it just gets, starts circling and then I have to call 4info to get rebooted. Every time we do an upgrade, the system gets slower, at least I perceive it as getting slower. And then also the, um, the crashing of the system that doesn't allow me to continue to do my work or putting orders in. I have to log out of Epic… I will log out and then have to re log in, which takes time or when it freezes, I can't even do that and I have to wait for the help desk to answer then….
>
> Like I'll be either dictating a note or putting an order in and like, um, last night or the night before I was trying to put an order in and it just, then it just frozen and it just kept circling. It was an order to, um, what was I doing? I think I was ordering a medication. The main thing that I dislike was just the crashing of the system- Like if you're in for a long period of time- So like when I called on Saturday, they're like- Well yeah, I see that you've been on for nine hours….Well, I mean the system is on but again, I'm going in to see different people, you know-and stuff so they shouldn't be timing out because that kind of thing slows me."

Participants P1 and P2 shared a few details about the system lag when trying to submit different types of orders for a patient or trying to navigate between notes. They also alluded to the application failures that occurs after they are logged in for ten hours or more. This theme is evident as described by Barrett and Stephens (2016) who emphasized that EHR systems must meet the demands of a user's environment to allow them the flexibility to complete a task

quickly and seamlessly. Participant P3 expanded on system failure and the impact it has on writing clinical progress notes:

> "So, we have the ability of taking pictures of a wound and adding it to our note… That's wonderful but it crashes the system. Anytime you try to load a picture, you have to shrink the picture for it to fit. And there's a huge problem with Epic where it runs out of memory constant. Three times a night in a 12-hour shift. About every four hours, it runs out of memory. Yeah, and you can lose notes…and as it is right now, I think I have a note in my, um, In Basket and I have this guy… I've talked to support and they still haven't fixed it. It's a note that's not done, but it is done…It's a note that I can't delete because it was corrupted by the system. I don't even know if it's that. Like if you open a note instead of or orders or anything, when the window pops up, instead of seeing the orders, you'll see just a black screen in that window."

When the participant was further asked to reflect on his lived experiences with using an EHR system and his feelings about pain points, he noted:

> "It's frustrating. I mean the only way I can manage it is I just deal with it because if I don't there's going to be more patients waiting. I call 4info (helpdesk) on occasion mostly when like, um, you know, a chart is broken like that note that I can't get rid of... I mean that's mainly when I'll call them. Um, because I've talked to them now enough that I know that I have to like actually go to the windows thing and log off. Any other way to do it doesn't fix the problem. Just by closing Epic and reloading it, it doesn't help-
>
> When it runs out of memory or when I feel like it's being extra sluggish about to crash, or when I start seeing that black screen, I think that's the warning before it runs out of memory… So, I will restart at least two times a shift. And that's ridiculous.
>
> We work 12-hour shifts and uh, we work seven to five, sometimes too, but I'll often have to restart twice in the seven to five. And that's just not acceptable. Like it should be designed to run. And I've heard people say, "Oh, well they talked to Epic and this system wasn't designed to run 12 hours," and that is not true. There are many emergency room doctors that work 24, 72 hours."

In situations where application failure takes place, the physicians are interrupted from performing tasks and taking care of the patient. The work of Babbott et al. (2013) and Barrett and Stephens (2016) reinforced the need for providers to have a fully functioning EHR system with workplace practices that match. Participant P5 shared:

> "The one comment I have about this though, a lot of times when you go back to imaging, and you have a CT, it takes forever. I just feel like it stops, and of course it won't do it now, but I feel like it's only with CTs, it doesn't happen with X rays, and I don't, I don't know why, but with CTs I just feels like it takes a minute, and sometimes we just have to literally sit there, and wait for it to do its thing, before you sign it…. Well, I don't know if this is Epic related, institution or what… When I work nights, every single night that I work, I have to call 4info to reset my session 'cause it freezes at some point. Every single night, I mean, like I know these people, I know Debbie, and I know all of them- Like all these people they are like, "Hey, how have you been. I haven't heard from you in a week." Oh it's 'cause I was on vacation, you know….
>
> And a lot of times I know when it's coming, because I'll start getting little error messages here and there….or my screen will turn all white like over here, on this part. And I'm like, Oh okay. It's about to die, maybe I should call now that I have time versus in the next 20 minutes- Like I know. It gives me signs. And it's usually in the middle of the night. That's a pain because it usually happens when you're trying to do something important. And now you gotta, the whole thing has to be turned off. You have to call for 4info, they have to restart everything, you can lose data. I've lost, lost a couple of notes like that, that then I can't recover."

Participant P6 shared the same views:

> "The system freezes and of course at ten hours, eight or nine hours, it goes down. And it used to make me crazy 'cause I lose notes, but I figured out a way how to get them back. I go back- it'll be in my note and then I could copy it and put it in. But that is really hard, oh my God…And, so what it'll do, you'll be in the middle of a note… or you're trying to put an order, now that's the worst, when you're in the middle of your orders and it can't do any more, then you have to restart ... you know restart everything. And sometimes it, it'll even lose your other note ... I mean I try really hard to save them, but sometimes it loses, loses your notes."

Participant P8 emphasized the severity of losing notes, continuous system lags, and being burnt out when the system randomly shuts down:

> "About midway through, sometime usually about three or four times, in, uh, a shift, I have to close out everything, log out and come back in 'cause it starts slowing down. And if you get shut down and you have charts up, you lose those charts. And here we can have up to four charts up, which is nice. But when you have four charts up and you haven't saved the note or haven't shared the note- Especially if I'm moving to the end of the shift.
>
> And the other thing I'll do is around the six-hour mark, I'll shut down and come back in. Before it does anything wonky, I will just shut down and come back in

> and now I'll do it again at about the nine-hour mark. And that helps, but it doesn't always prevent that nasty shut down. And we did that a lot last night….
>
> Well, if you've been here a while and you pull up an order set ...for example, you'll get nothing but a white screen. I have no idea why that happens. Okay, and let's do a CT, CT brain. Okay. And I click on this and I get this pop up. Sometimes this pop up will be nothing but white. Okay. So, if you make it smaller, then you can see it, and sometimes you can't, so you just go fishing around until you know where, just- start typing in a, in a blank space… You know, and it's like, uh ... But you can see it taking it so you know that it's the right thing. You know, right underneath there is where that should be. And then you start fishing over here for a second. Okay.
>
> And there's a lag for advanced imaging... I don't have a problem with plain films- But when I'm ordering CTs and MRIs and the stuff that's not usual to the ER, it takes a minute. I don't know why, but CTs and MRIs, not so much with the dopplers I don't think, CTs and MRIs, it takes a minute to, to do…And it goes through those little things- to validate that, you know, the three checks, then it shows up…It says validating the sourcing or whatever they are….
>
> So, then you know, you're burnt out and then the system shuts you down and you just, and you just wanna curse. It's like, you're trying to do the best you can with patient care, but then you're staying late and then the system doesn't make it any better because you're trying to work on your efficiency as well."

The participants described one of their primary work processes to include writing clinical progress notes and placing orders in the system. While Barrett and Stephens (2016) detailed the importance of a useful EHR system that supports a user's primary work processes, the shared personal accounts of participants suggest an unusable system (see Figure 12).

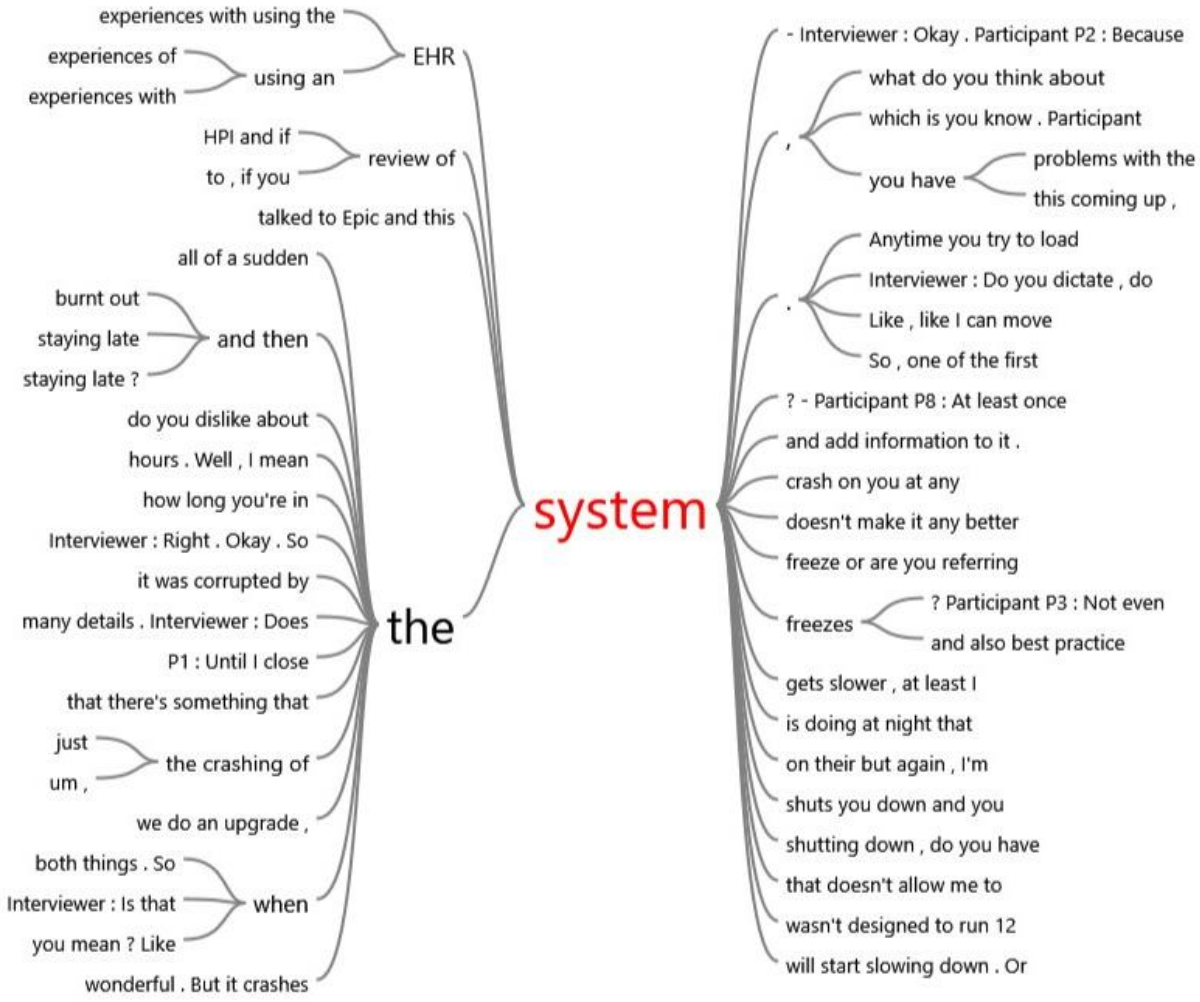


Figure 12. NVivo Word Tree of the Term “System”.

A later journal entry reflected on the emotional well-being of participant P8:

> “As I listened to the participant pour out her heart regarding her day-to-day experiences, I saw desperation in her face as she explained how much she desired to be more efficient but somehow struggled to find her way. She often compared herself to other providers and could not understand how they are able to be efficient with their patient care and clinical documentation. Most importantly, she believed that all of the documentation and mouse clicking serves a purpose for billing but does not adequately tell the story of the patient. She expressed how important it is to describe and explain what happened to the patient during each visit. Whether it's previous medical history, active problems, current medications, all documentation matters. Her ultimate goal is to find the balance between becoming more efficient and communicate the story of the patient.”

Patterns Across Cases

The researcher identified themes through an iterative coding method and the review of each transcript. The five identified themes were:

1. Historical Chart Review (T1)
2. Inadequate Note Documentation (T2)
3. Difficult Order Entry (T3)
4. Patient Throughput Barriers (T4)
5. Poor System Performance (T5)

The frequency of themes by each participant are summarized in the table below (see Table 7). The values in the table represent the total number of patterns identified from the imported data and conceptual links among themes using the NVivo software. According to Smith et al. (2009), if themes occur in at least a third or half of the interview data, they can be classified as recurrent themes.

Table 7

Summary of Recurrent Themes by Each Participant

	T1	T2	T3	T4	T5	Total
Participant P1	**0**	**8**	**8**	**0**	**4**	**20**
Participant P2	**1**	**15**	**0**	**3**	**5**	**24**
Participant P3	**12**	**7**	**1**	**3**	**5**	**28**
Participant P4	**8**	**6**	**0**	**7**	**0**	**21**
Participant P5	**8**	**7**	**4**	**4**	**5**	**28**
Participant P6	**6**	**7**	**2**	**4**	**4**	**23**
Participant P7	**0**	**2**	**3**	**1**	**0**	**6**
Participant P8	**0**	**6**	**0**	**8**	**9**	**23**
Total	**35**	**58**	**18**	**30**	**32**	

Summary

The researcher presented an overview of the data coding and analysis techniques to support the thematic findings in this study. From the interviews, five themes emerged: historical

chart review, inadequate note documentation, difficult order entry, patient throughput barriers, and poor system performance. The themes represent what emergency room physicians describe as the “pain points” of their user experiences with EHR systems and their perspectives about how they manage the difficulty of system tasks and demands. In the next chapter, the researcher will suggest conclusions and recommendations for future research on the way emergency room physicians perform routine clinical tasks in the system and the aspects of the system that do not meet the needs of physician users.

Chapter 5

Conclusions, Implications, Recommendations, and Summary

Introduction

The review of literature informed an important gap in the research examining the lived experiences of physicians who use an EHR system. The previous chapter provided details on emerging themes in this study based on iterative coding and data analysis from semi-structured interviews. This chapter presents information to address the validity of the findings, the main research question, and the strengths, weaknesses, and limitations of the study. Information is also provided to discuss the implications, recommendations for future EHR system design, and future research.

Conclusions

The research goal was to answer the research question: What are the "pain points" that physicians describe as their lived experiences with EHR system use? The identified findings are used to help answer the overarching grand tour research question and the three sub-questions:

1. How do physician users describe how they perform routine clinical tasks in the system?
2. How do physician users describe how they experience system task functions that are difficult to perform?
3. How do physician users describe aspects of the system that do not meet the needs of physician users?

The findings and conclusions for each question are described below as well as the themes

and their relationships. The responses shared from the participants in this study reveal that their experiences in using an EHR system vary in complexity.

Research Questions

How do physician users describe how they perform routine clinical tasks in the system? Participants expressed that they begin patient care with first assessing the acuity of the patient, followed by historical chart review. Within this theme, click burden, information overload, and the ability to find relevant patient information were common subordinate themes. Most of the participants reported negative feelings on the ability to locate clinical information about the patient, including historical progress notes, home medications, and lab results. They also stressed the burden of using a mouse to click through several screens and filter out data to locate relevant information. Many have expressed that they were overwhelmed with the amount of information found in chart review and the results activity. There is reportedly no easy way to trend lab data and customize the home medications in an easily viewable format. One participant noted that although home medications are not easily viewable, nursing does not always update the medication list appropriately.

Others have reported that note documentation is both difficult to find and hard to read. Although chart review filters are available, some participants are not privy to using them or chose not to use based on the unexpected result of filtering out needed information. For those that use filters, nursing notes are often filtered out and note authors are filtered in. Most participants noted that they always review the patient's information first before going into the exam room to see the patient. One participant shared that her goal is to always get the most succinct pointed cancer specific note and the note written by the primary care physician (PCP). If there are several telephone notes or nursing notes, then chart review becomes too "noisy" for her.

After the participants review historical chart information, they routinely start writing their progress note and enter orders for the patient. Prior to ordering lab orders, the participants try their best to ensure that the patient has not already had labs drawn. Afterwards, the patient is seen and examined, the progress note is saved, and any outstanding imaging and lab orders are reviewed. Last, the participants shared that they make the clinical decision to disposition the patient for discharge or admission.

How do physician users describe how they experience system task functions that are difficult to perform? The physicians described their most difficult experiences with transcribing progress notes, searching for clinical orders, and admitting a patient. The most reported concern was inadequate note documentation, particularly focusing on the limited ease of use with HPI and ROS Smart Form note templates. As described by Bush, Kuelbs, Ryu, Jiang, and Chiang (2017), Smartforms contain disease-specific templates with pre-defined statements and buttons to help a clinician facilitate decision-making when writing clinical notes. Although the physicians believed that point-click buttons on note templates are good for medical coding purposes, they are convinced that pre-defined templates do not give a great depiction of the patient's story.

Progress notes can begin with an unstructured or structured note template that consist of separate blocks of texts for different data elements (Bush, Kuelbs, Ryu, Jiang, & Chiang, 2017). For instance, a physician who interviews a patient with a certain diagnosis, may have a note that begins with a template to document the symptoms of their complaint (Bush et al., 2017). At that point, the pre-defined text can be automatically inserted into the physician's note. In addition to pre-defined text, the physicians felt strongly against the multiple number of clicks required for note documentation. Along with other task functions that are difficult to perform, physicians

believe that the multiple clicks are frustrating and reduces their productivity. The findings were consistent with Guo et al.'s (2017) study where physicians expressed frustration with click burden and the poor ease of use in EHR systems.

Many of the physicians prefer writing narrative text or dictation software to help with their level of thinking while transcribing notes. Other concerns stemmed from notes that are repeatedly copy and pasted into the A&P section of the note. Particularly during chart review, the physicians shared that it is difficult to sift through note documentation when they unaware if there is new documentation or if it is actually copied over from a previous hospitalization. It is reportedly common that physicians see the same notes repeatedly and get lost in translation. Consistent with Tsou et al.'s (2017) and Rathert et al.'s (2019) findings, text that is copied and pasted could cause internal inconsistencies and medical documentation errors.

Comments were shared by physicians who described their experiences with difficult order entry. The most common orders that proved difficulty were lab orders and medication orders. In most instances, the physicians felt that search terms should be spelled exactly correct or else they spend additional time searching for orders. In contrast, Mosaly et al.'s (2017) findings suggest that instead of physicians spending additional time searching for orders, they delegate the task to someone else (i.e. resident physicians or nurses). Many physicians expressed that they desired the system to be "smarter" in which it should predict the words of misspellings and suggest words based on synonyms. Although some use search terms that they are most familiar with, Mosaly et al. (2017) found that users may not be properly trained to effectively interact with the database and use appropriate keywords. In addition to concerns with lab orders, medication orders were also difficult to search and find. This included medications that have different forms such as oral dilaudid, IV dilaudid, or lollipop dilaudid. The shared experiences

are in line with Mosaly et al.'s findings which suggest there is sub-optimal functionality within EHR search databases.

Beyond transcribing notes and placing orders, the physicians shared that they admit patients to the hospital despite their role as an ER physician and not a hospitalist. They emphasized that the hospital is usually overcrowded and patients are boarded in the ER which often leads to patient throughput barriers. Although the physicians are constantly under pressure to see more patients, there are bottlenecks that impede their progress. Currently, the worry focused on physicians not being able to see more than one patient per hour. As Participant P4 and P5 summarized, ER physicians need to balance new patients that have just come in the door and cannot just breeze through an admission with other patients. For instance, the new patient must be seen and have their labs worked up, the quasi sick patients must be settled with fluids or antibiotics, and the admitted patients need medical decisions made. With the combination of these elements, physicians get bogged down with too many patients.

Coupled with writing admission orders, the physicians also have task functions that include patient handoff documentation. The D-Pass or I-Pass handoff tool is used as a method to handoff a patient's care to another provider. While some physicians copy and paste the documentation into an email, others prefer less duplication by only adding it to their progress note. The email is sent to a pager number which is connected to the primary admitting service. Subsequently, whoever is on-call for that service will read the email and become aware that they are receiving a patient. Alternatively, some physicians prefer to use their own customized template for handoff and add it to their assessment and plan. It appears that the physicians have no standardized way of communicating to the primary admitting service. According to the

physicians in the ER, the primary admitting service are not always in the system and indicate that they need a unique notification when patients are being admitted.

How do physician users describe aspects of the system that do not meet the needs of physician users? Over half of the physicians were eager to report the poor system performance that they experience on a daily basis. The physicians described how the system lags when they search for advanced imaging orders and how the system stops functioning after working a 10-12-hour shift. There was a high level of concern as physicians explained the amount of time it takes for them to place orders for computerized tomography (CT) and magnetic resonance imaging (MRI) exams. They noted this issue to be a pain point as it reportedly takes approximately 30 seconds to a minute before they are given the opportunity to sign the orders.

In addition to system lags when ordering advanced imaging orders, the physicians described their experiences when the system allegedly runs out of memory. As Participant P3 mentioned, there is a huge problem with the application where it runs out of memory and the computer crashes after being logged in for long periods of time. Several physicians noted that they lose their pended notes and the note eventually becomes corrupt and un-editable. Research suggests that if a system contained functionality to prevent errors, then it is possible that the physician would have a better chance of avoiding technology driven errors and mistakes when using the system (Kaipio et al., 2017). In fact, the physicians spend a good amount of time calling the help desk for assistance with shutting down the application and restarting their machine. Several of the physicians feel pressure as they try to manage patient care and complete tasks in the system, when the system is unusable. Based on the shared experiences among the physicians, the intensity of stress levels increase as physicians try their best to be efficient.

Strengths, Weaknesses, and Limitations

One of the strengths in this study are the eight participants who agreed to participate in the study and were eager to share their unique lived experiences of using an EHR system. Given the nature of patient care in the hospital, it is not always feasible for a physician to have free time to spare (Dobrzykowski & Tarafdar, 2016). The participants are also considered physician champions who have a vested interest in advocating for a better and useful EHR system. The researcher believes that the unique experiences of the emergency room physicians have been fully represented through the interview data that was collected, analyzed, and presented. Although the sample size was small, it could also be viewed as a strength that allowed the researcher to focus on the unique perspectives of lived experiences on a case-by-case basis (Smith et al., 2009). The researcher was given the opportunity to analyze the data and write about the particular phenomenon in detail.

The professional background of the researcher could be considered a weakness in this study. The researcher has worked with the study participants and knows them professionally. She knows the participants and has assisted with the implementation and support of the system over the past five years. The researcher took every precaution to bracket her experiences to fully understand the lived experiences of the participants. The researcher minimized this limitation by extensive bracketing and following a journaling protocol as described by Smith et al. (2009). The researcher had to overcome challenges such as professional bias and preconceived notions about the participants. For instance, the researcher knows why the system was built the way it is and who made the decisions to build it as such. Due to this, the researcher had preconceived notions that the participants would not feel comfortable sharing their unique experiences. The researcher overcame this challenge by remaining confident during each interview session and ensured the

comfort of the participants as they shared their experiences. The researcher also reminded the participants prior to the sessions that their experiences would not be shared with leadership and that the interview could be stopped at any time they wished.

The convenience sample of participants who primarily work in one department of the hospital could be considered a limitation of this study. There are several other departments in the hospital in which the users may use different tools and experience the EHR system differently than their ER counterparts. The organization used in this study also specializes in oncology care. Thus, the ER physicians who work in this hospital have a different use case for the EHR system than providers who work in a regular hospital. Although this could be considered a limitation, the limitation is minimal as the study focuses on practical day-to-day processes in patient care. The study was also limited to attending physicians and not those who are residents or fellows.

Validity

As aforementioned, Yardley (2000) indicated that there are four principles that researchers must adhere to in order to evaluate the quality of qualitative research: (1) sensitivity to context, (2) commitment and rigor, (3) transparency and coherence, and (4) impact and importance (as cited in Smith et al., 2009).

Sensitivity to Context

The researcher exhibited sensitivity to context by first recruiting a purposeful sample of participants who share a particular lived experience. It was especially important for the researcher to establish rapport with the participants and ensure that they were comfortable throughout the entire interview process. Any questions that appeared to be ambiguous to the participants were clarified and answered accordingly. The researcher also showed empathy

towards situations that were difficult for the participants to share and made sure to present interview data anonymously to protect each individual.

Commitment and Rigor

The researcher showed commitment and rigor by actively listening and engaging with the participants as they shared their in-depth accounts of their lived experiences. The data from each interview was thoroughly reviewed and analyzed through a systematic method. It was also just as important for the researcher to ensure that the data was sufficiently interpreted in the analysis stage. Thus, the participants were able to review a verbatim extract of their transcript to ensure that the interpretation was correct. The researcher only used final extracts that were agreed upon in the final version of the transcript.

Transparency and Coherence

All aspects of the research including participant selection and recruitment were carefully described throughout the study. The researcher also explained the data coding and analysis process and explained how emergent themes were derived. Throughout data analysis, the common themes were grouped and presented together logically. There were also no details spared as the researcher presented the findings through a first-person narrative. Supportive literature also helped the researcher frame the research findings.

Transparency and coherence were also demonstrated as the researcher included an additional question to the interview guide based on the reflection of the pilot interviews. The additional question: *"Describe your workflow when you log in to the EHR system at the beginning of your shift,"* allowed a proper flow of the interviews and allowed each participant to freely open up about their process and day-to-day experiences.

Impact and Importance

The researcher strived to present findings that were useful and interesting to the reader. Several studies attempted to use task-based scenarios and heuristic evaluations to assess how a physician user interacts with EHR systems and perform routine clinical tasks (Mosaly et al., 2017; Park et al. 2020; Park et al., 2012; Savoy, Patel, Flanagan, & Weiner, 2017). This study provides an opportunity for the reader to understand how a physician user describes their firsthand experience of "pain points" as they use EHR systems. The findings reveal consistencies with previous research that suggest physicians experience mental burden and burnout using EHR systems due to task complexity, task demand, and inefficiencies of system design (Patterson et al., 2017; Resiman, 2017). This study is exceptionally important since the emergency department has been negatively impacted by overcrowding and very few studies have had success in improving patient flow (Berger et al., 2016).

Implications

The findings from this study have multiple implications for information technology (IT) system designers, healthcare administrators, and physician end users. There is currently no known research that specifically examines the personal lived experiences of physicians who use EHR systems. Each interview allowed participants to share their rich accounts of their user experience and uniqueness as they expressed their thoughts as suggestive in an IPA study (Smith et al., 2009). The findings allow future research opportunities for designers to re-evaluate the amount of information displayed to physician users as they review historical chart information. There are also new possibilities for designers to find innovate ways to reduce click burden as physicians review chart information, transcribe progress notes, and perform other routine tasks in the system. The findings suggest that participants routinely struggle with poor system

performance and believe it has become the new normal. This feedback offers the potential for system designers to address what causes the system to become slow and perform less than optimal.

Beyond user interfaces that display too much information, click burden, and poor system performance, healthcare administrators can look closely at ED overcrowding and the impacts of patient throughput. Several participants have shared that there is an overwhelming concern for writing admission orders and patient handoff documentation. The participants continually alluded to their unorthodox role of being a hospitalist physician instead of an ER physician. Although organizations have implemented several interventions to increase the number of hospitalists in the ED and the number of beds, McKenna et al. (2019) suggested that administrators deploy additional interventions that are more effective. The findings are in line with McKenna et al.'s study in which participants appeared less concerned with bed capacity but more so with the actual ability to use the EHR system efficiently and treat non-acute and acute patients. It is reportedly difficult for clinicians to see several patients, make medical decisions, and keep up with their clinical documentation. According to Cullen, Dan, Rogers, and Fisk (2014), it is difficult for users to complete a work task that depends on some level of cognitive load and complete other tasks at the same time.

Recommendations

The findings of this study present prospective changes that are relevant for EHR usability and ongoing healthcare practices. Although the participants shared their lived experiences of using a system that has already gone through implementation, there is a vast amount of opportunity for improvement. As promoted by Feng and Wei (2019), a good user experience is necessary for both the company and the user. When a user's interaction with a product is

satisfying, their instrumental needs are fulfilled and a company considers it to be a key driver of sustainability (Feng & Wei, 2019). The findings particularly promote changes to the user interface where relevant patient information is stored and retrieved. The findings also provide direction for designers to review an enhanced EHR database look-up for common drug and lab names, identify changes to note templates, and determine how to increase system performance.

First, system designers should review these findings and identify the types of users who fit the profile in this study. Afterwards, the designers should invite the users to a brainstorming session to allow them an opportunity to identify systemic issues and workflow issues that hinder them from practicing patient care safely and efficiently. A follow-up session is also necessary to allow designers the opportunity to observe physicians in their day-to-day environment using an EHR system while treating patients. Kellog et al. (2017) emphasized that it is important for designers to focus on examining and changing current flaws in the system as well as think about the future development of EHR systems. Many of the participants were interested in sharing their lived experiences in hopes of having an impact on current and future EHR design.

Second, the researcher recommends that healthcare leaders and administrators examine patient admissions done by ER providers. It is clear from the findings that a large amount of responsibility falls on attending physicians who work in Emergency Medicine. It is difficult for these providers to manage patient throughput in the ER, be fully responsible for admitting patients to the floor, and to maintain their clinical documentation in the system. The researcher recommends that healthcare leaders particularly review the amount of staffing available to help with overflow in the ER. According to Abir et al. (2019), when there is an increase in ER volume, usually the amount of nursing, physician assistants, and resident staff increases. Unfortunately, there is not an increase in staffing for attending physicians.

In addition to patient admission, handoff documentation is another task that healthcare leaders and designers need to review. Based on the shared experiences from the participants, system designers should identify ways for admission documentation to easily be seen by other providers as soon as it is written. Although written handoff does not replace verbal communication, ER physicians prefer that their inpatient counterparts receive an alert as soon as a patient is admitted to their service. They also prefer a reduction of repetitive documentation that is required to be sent in an email. The findings reveal that patient handoff is being documented in several places. According to Apker et al. (2014), EHR systems should reduce the burden of repetitive information that is already available to both the sending and receiving physician in the chart. Both designers and administrators should work with Emergency Medicine and a primary service on the inpatient side to examine where the disconnect in communication lies.

Last, the researcher recommends that system designers work with the EHR vendor to determine the root cause of poor system performance. Based on the findings, ER physicians become frustrated when they have tirelessly worked 10-12 hours shifts and the system begins to either slow down or shut down completely. This burden causes them to lose unsaved progress notes and stay late to finish documentation. Designers should also look at what causes a delay in processing advanced imaging orders such as CT and X-Ray. As suggested by Priestman et al. (2018), the network infrastructure of an EHR system requires early attention and ongoing optimization. For an EHR system to be truly successful, investments should be made on technology hardware requirements and optimizing workflows (Priestman et al., 2018).

Future Research

This study provides future research opportunities for researchers to investigate the experiences of individuals who work in a different specialized area of the hospital, such as the intensive care unit (ICU). Although the ER is different from the ICU where critically ill patients are taken care of, researchers have an opportunity to focus on what other physicians describe as the pain points of their user experiences with EHR systems. Research should focus on the different tools these professionals use and their perspectives about how they manage the difficulty of system tasks and demands.

Additional research opportunities exist for EHR usability. Future researchers can review the set of specific tasks that the participants described and evaluate how these users can become more efficient. Most participants alluded to their level of efficiency based on how quickly they review the patient's story (i.e. historical chart information), assess and treat the patient, write a clinical progress note, place orders, stabilizable the patient, and disposition them to home or to be admitted. As indicated by Priestman et al. (2018), it is imperative that clinicians process a vast amount of information and remain accurate and efficient.

Future research opportunities also lie in the use of various mobile platforms. Several participants expressed that they use a mobile platform to begin their clinical note and review a patient's lab results. Although tablets and mobile devices have limited functionality, the participants expressed the desire to start documentation in one platform (desktop) and continue the note in a different platform (tablet). Based on the findings, there is limited functionality with EHR systems where a note is saved (pended) prior to continuing the note in a different platform. These findings differ with the research of Guo et al. (2017) where physicians were able to complete all documentation for a patient via handheld device. In particular, Guo et al. noted that

physicians could review the chart, dictate notes, submit for billing, and place orders from the palm of their hands. Thus, there are several opportunities to explore the usability of different EHR systems and how certain platforms are integrated.

Summary

This research study was aimed understanding what emergency room physicians describe as the "pain points" of their user experiences with EHR systems. Although researchers have examined EHR adaptation and user interface design with various types of stakeholders (Park et al., 2015; Taieb-Maimon et al., 2017), research on understanding the lived experiences of physicians who use the system is noticeably absent in the literature. Previous research literature examined the importance of EHR usability and the user experience, but did not address how physicians describe their lived experiences and how they perceive how they manage system tasks and demands. Park et al. (2015) specifically pointed out the need for research on how clinicians perform their day-to-day work processes and which part of the system prove to be the most challenging for physician users. This research study attempted to advance the work of Mazur et al. (2016) and Taieb-Maimon et al. (2017) by investigating not only what current problems exist in EHR system design, but also investigating how physician users manage the difficulty of system tasks and demands.

The overarching grand tour research question used to guide this study was: *What are the "pain points" that physicians describe as their lived experiences with EHR system use?* Three sub-questions questions were used to frame this study and help facilitate the main focus on the grand tour question:

1. How do physician users describe how they perform routine clinical tasks in the system?

2. How do physician users describe how they experience system task functions that are difficult to perform?
3. How do physician users describe aspects of the system that do not meet the needs of physician users?

Hospital environments are typically fast-paced and physicians' time is extremely valuable. Research indicates that physicians constantly face challenges with their time constraints because they have to quickly assess patients and review data to make sound clinical decisions (Sultanum, Brudno, Wigdor, & Chevalier, 2018). Due to these barriers, many studies have used simulated environments and survey data as reasonable methods in identifying system design limitations due to the availability of participants (Dobrzykowski & Tarafdar, 2016; Mazur et al., 2016; Mosaly et al., 2017). Nevertheless, usability issues remain a major concern for physicians (Kaipio et al., 2017). This research was conducted to better understand the research gap, which is to discover what physicians describe as real medical scenarios in the context of their user experiences with EHR systems.

The review of the literature revealed a need to better understand EHR usability concerns such as ease of use, navigation, order entry, and issues with task demand, task difficulty and performance for physician users. A thorough examination of ease use was explored along with the degree in which physician users value the ability to document information and share data with other clinicians. Navigation is also an important contributor of EHR usability because physicians often navigate through various screens to access patient information in a timely manner (Roman et al., 2017). In addition to navigating through the system, physicians perform other tasks such as entering orders to be carried out for their patients. The researcher shared

several UX research principles that pertain to the holistic view of the user-product interaction, the practical and pleasurable views of a user, and the context in which the user uses the system.

Qualitative methodologies used in EHR studies provide an in-depth explanation of how technology influences medical practice and the way physicians interact with technology in their environment (Park, Lee, & Chen, 2012; Pine & Chen 2020). Unlike other qualitative methodologies, IPA allows participants to share their own perspective of an experience, as well as give room for researchers to interpret that experience (Wagstaff et al., 2014). IPA closely follows the lead of philosopher Edmund Husserl who advised those working in phenomenological research to examine the everyday flow of a person's lived experience (Smith et al., 2009; Husserl, 1927).

Phenomenology can be described as a deep journey that explores how people experience life and the various aspects of their experience (Smith et al., 2009). A total of eight participants were recruited from the emergency department who were all attending physicians. Out of the eight participants, two were pilot participants. The researcher conducted the study using the IPA methodology (Smith et al., 2009) to discover what emergency room physicians describe as the "pain points" of their user experiences with EHR systems.

The lived experiences of emergency room physicians through semi-structured interviews revealed five major themes. Themes were derived through the analysis of coded interviews and the understanding of the researcher:

1. *Historical Chart Review* – As a necessary step in obtaining the 'story' of the patient, the participants find it difficult to review relevant historical information.
2. *Inadequate Note Documentation* – The majority of the participants described how displeased they were with the methods available for clinical note documentation and

how note documentation is inadequate and hard to follow.

3. *Difficult Order Entry* – Over half of the participants believe that clinical order entry requires a considerable amount of effort and time. Specifically, lab and medication orders were identified as hard to find and difficult to order.
4. *Patient Throughput Barriers*– Almost all of the participants find it difficult to manage patient throughput in the ED due to patient admissions and repetitive handoff documentation.
5. *Poor System Performance* – Over half of the participants expressed frustration with application failure and a slow response time while using the system. In particular, participants find it disruptive when the system crashes after a 10-12-hour work shift or when there is system lag while attempting to enter advanced imaging orders for a patient.

The findings in this study reveal that the participant's lived experiences in using an EHR system vary in complexity. The most represented theme was inadequate note documentation, followed by poor system performance, historical chart review, patient throughput barriers, and difficult order entry. The findings are generalizable to other healthcare institutions, clinicians, and system designers for the future development of EHR systems. The researcher incorporated several methods to limit any personal bias and any influencing factors during interviews and through subsequent follow-up interviews. The findings present a high level of validity based on the four principles as described by Yardley (2000): sensitivity to context, commitment and rigor, transparency and coherence, and impact and importance (as cited in Smith et al., 2009).

The findings from this study also have multiple implications for information technology (IT) system designers, healthcare administrators, and physician end users. The findings allow

future research opportunities for designers to re-evaluate the amount of information displayed to physician users, reduce click burden, and enhance routine tasks in the system. Additional findings offer the potential for system designers to identify what causes the system to become slow and perform less than optimal. Beyond user interfaces that display too much information, click burden, and poor system performance, healthcare administrators can look closely at ED overcrowding and the impacts of patient throughput. Future research opportunities include a closer look at EHR usability, the use of mobile platforms to document patient care, and examining the lived experiences of clinical professionals who work in other specialized units of the hospital.

Appendix A

Interview Guide

1. Describe your workflow when you log in to the EHR system at the beginning of your shift.
Prompts: How do you determine which patients you will assign to your treatment team?

2. Describe the ways in which the EHR system influences the way you manage patient care.
Prompts: What tasks do you perform? What features of the system do you use?
Why do you use those? Tell me about the clinical tasks you perform outside of the EHR system.
Prompts: Can you describe the amount of time it takes for you to complete those tasks?
What features of the system are congruent with the clinical workflows outside of the system?

3. Tell me about the features you like about the current EHR system you use.
Prompts: Describe why you like those features in the system.

4. Tell me about the features you dislike about the current EHR system you use.
Prompts: Describe why you dislike those features in the system. What features do you find the most cumbersome to use?

5. Reflecting on your experiences with using EHR systems, what do you think about pain points, problems that occur when you reach a standstill while attempting to complete a task?
Prompts: What is the largest challenge you are currently facing? How do you manage these difficulties?

6. Describe how using an EHR system impacts your daily reporting throughput metrics and performance.
Prompts: What is your process for quickly treating a patient and dispositioning them for discharge or admission? Are there any systemic workflow issues that you feel strongly about? What do you feel could be done differently?

7. Describe your first experience with EHR system.
Prompts: How did you feel? Where were you? What happened? Have you documented patient care on paper before? How was that experience compared to using an EHR now?

8. What additional information would you like to share about your experiences using an EHR system?

Appendix B

IRB Approvals

NOVA SOUTHEASTERN UNIVERSITY
Institutional Review Board

MEMORANDUM

To: **Elizabeth Arceneaux**

From: **Ling Wang, Ph.D.,**
Center Representative, Institutional Review Board

Date: **September 5, 2019**

Re: **IRB #: 2019-451; Title, "Identifying Physicians' User Experience (UX) Pain Points in Using Electronic Health Record (EHR) Systems."**

I have reviewed the above-referenced research protocol at the center level. Based on the information provided, I have determined that this study is exempt from further IRB review under **45 CFR 46.101(b) (Exempt 2: Interviews, surveys, focus groups, observations of public behavior, and other similar methodologies)**. You may proceed with your study as described to the IRB. As principal investigator, you must adhere to the following requirements:

1) CONSENT: If recruitment procedures include consent forms, they must be obtained in such a manner that they are clearly understood by the subjects and the process affords subjects the opportunity to ask questions, obtain detailed answers from those directly involved in the research, and have sufficient time to consider their participation after they have been provided this information. The subjects must be given a copy of the signed consent document, and a copy must be placed in a secure file separate from de-identified participant information. Record of informed consent must be retained for a minimum of three years from the conclusion of the study.

2) ADVERSE EVENTS/UNANTICIPATED PROBLEMS: The principal investigator is required to notify the IRB chair and me (954-262-5369 and Ling Wang, Ph.D., respectively) of any adverse reactions or unanticipated events that may develop as a result of this study. Reactions or events may include, but are not limited to, injury, depression as a result of participation in the study, life-threatening situation, death, or loss of confidentiality/anonymity of subject. Approval may be withdrawn if the problem is serious.

3) AMENDMENTS: Any changes in the study (e.g., procedures, number or types of subjects, consent forms, investigators, etc.) must be approved by the IRB prior to implementation. Please be advised that changes in a study may require further review depending on the nature of the change. Please contact me with any questions regarding amendments or changes to your study.

The NSU IRB is in compliance with the requirements for the protection of human subjects prescribed in Part 46 of Title 45 of the Code of Federal Regulations (45 CFR 46) revised June 18, 1991.

Cc: Laurie Dringus, Ph.D.
Ling Wang, Ph.D.

3301 College Avenue • Fort Lauderdale, Florida 33314-7796
(954) 262-0000 • 800-672-7223, ext. 5369 • Email: irb@nova.edu • Web site: www.nova.edu/irb

THE UNIVERSITY OF TEXAS
MD Anderson Cancer Center
Office of Protocol Research

Institutional Review Board (IRB)
Unit 1637
Phone 713-792-2933
Fax 713-794-4589

To: Susan Gaeta 11/12/2019
From: Qianna Royston
CC: Elizabeth J. Arceneaux, Kumar Alagappan, Susan Gaeta, Michelle D. Linares, OPR PRMSAAC
MDACC Protocol ID #: PA19-0546
Protocol Title: Identifying Physicians' User Experience (UX) Pain Points in Using Electronic Health Record (EHR) Systems.
Version: 05

Subject: Contingencies Met - Protocol PA19-0546

Official IRB Approval Date: 09/23/2019

On 11/07/2019 the Institutional Review Board 4 committee, chair, or designee granted approval to the above named and numbered protocol since the contingencies outlined by the IRB 4 on 09/23/2019 have been met.

It was noted that the protocol, informed consent documents (ICDs) and/or the Waivers of ICD and Authorization are satisfactory and in compliance with federal and institutional guidelines. No participants may be entered on this protocol until it has been officially activated by OPR.

In keeping with the requirements outlined in 45CFR46.109(e) and 21 CFR56.109(f), the IRB shall conduct continuing review of all protocols at intervals appropriate to the degree of risk, but not less than once per year.

You are responsible for promptly reporting to the IRB:

- any severe adverse events;
- any death while patient is on study;
- any unanticipated problems involving risks to subjects or others;
- any proposed changes in the research activity (changes may not be initiated without IRB review and approval, except where necessary to eliminate apparent immediate hazards to the subjects).

The protocol has been reviewed under the 2018 requirements - revised Common Rule.

a. Protocol does not meet any of the new and revised exemption categories. In keeping with the requirements outlined in 45CFR46.109(e) continuing review still applies.

The IRB approval expiration date is 11/07/2020.

To activate this study, please compose and send a "Request for Activation" memo in PDOL.

The existing Informed Consent and/or Waivers of Informed Consent and Authorization cannot be used until the protocol is Activated.

If a Material Transfer Agreement (MTA) is required, it must be obtained prior to Activation.

Note: If a grant is the basis of your protocol, the grant must be funded before research can begin.

In the event of any questions or concerns, please contact the sender of this message at (713) 792-2933.

Qianna Royston 11/12/2019 08:53:31 AM

This is a representation of an electronic record that was signed and dated electronically and this page is the manifestation of the electronic signature and date:

Qianna Royston
11/12/2019 08:52:29 AM
IRB 4 Chair Designee
FWA #: 00000363
OHRP IRB Registration Number: IRB 4 IRB00005015

Appendix C

Recruitment Flyer/email

Hello Dr. _____.

I am doctoral candidate at Nova Southeastern University working on a Ph.D. dissertation in the College of Computing and Engineering that focuses on the lived experiences of physicians who use an Electronic Health Record (EHR) system. I am also a Senior EHR analyst on the One Connect team who provides application support for the emergency center (EC). The goal of this project is to discover what emergency room (ER) physicians describe as the "pain points" of their user experiences with EHR systems, which may include many different experiences to be uncovered, and their perspectives about how they manage the difficulty of system tasks and demands.

Although previous research has examined EHR system adaptation and user interface design with various stakeholders, research is limited on the lived experiences of physicians who use the system. I am specifically interested in interviewing attending physicians who have used an EHR system for at least one year and those who have expressed a strong interest in promoting and implementing change to an electronic system that could benefit physicians and their patients. Because your leadership has recognized you as a physician champion, I am interested in learning more about your lived experiences and perspectives of the system that are viewed as pain points. Pain points can be defined as problems that occur while you attempt to navigate and perform a system function.

Each interview will take place in your office or a conference room on-site and will be audio recorded. Your participation in this study will not be reported back to department leadership in any way. The interview is expected to be 45 minutes to 60 minutes. In addition, you will be asked to meet for a 10-minute post-interview session that will occur within 45 days of the initial interview. The post interview will allow you to review the accuracy of the interview transcription.

If you are willing to participate in this project, please email me at ejarceneaux@mdanderson.org or ea782@mynsu.nova.edu. Upon your acceptance, we will schedule the interview to be held at the location of your choice as indicated above.

Should you have any questions, please contact me at 713-563-9572 or send an email to either of the email addresses listed above. Thank you for your time.

Best wishes,

Elizabeth J. Arceneaux, MS

Appendix D

Participant's Consent

THE UNIVERSITY OF TEXAS
MD Anderson Cancer Center

Informed Consent

INFORMED CONSENT/AUTHORIZATION FOR PARTICIPATION IN RESEARCH

Identifying Physicians' User Experience (UX) Pain Points in Using Electronic Health Record (EHR) Systems.
PA19-0546

Study Chair: Dr. Susan Gaeta

Nova Southeastern University
College: College of Engineering and Computing
Principal Investigator/Study Collaborator:
Dr. Susan Gaeta, Elizabeth Arceneaux, BBA, MS
Faculty Advisor/Dissertation Chair: Laurie Dringus, BS, MS, PhD

_____ _____
Participant's Name Study ID

This is an informed consent and authorization form for a research study. It includes a summary about the study. A more detailed description of procedures and risks is provided after the summary.

STUDY SUMMARY

The goal of this research study is to learn more about what emergency room physicians describe as the "pain points" of their user experiences with electronic health record (EHR) systems, which may include many different experiences to be uncovered, and their perspectives about how they manage system tasks and meet clinical demands.

This study is investigational.

The information learned from this study may help guide healthcare and information technology professionals to make sound decisions that could impact the future of EHR system design. There are no benefits for you in this study.

Your participation is completely voluntary. Before choosing to take part in this study, you should discuss with the study team any concerns you may have, including time commitment.

You can read a list of potential risks below in the Possible Risks section of this consent.

Your participation in this study should last about 70 minutes total, spread out over 2 sessions over up to 45 days.

There are no costs to you for being in this research study.

You may choose not to take part in this study.

Your participation in this study will not be reported back to department leadership in any way.

1. STUDY DETAILS

There will be 8 attending physicians who will take part in this study.

If you agree to take part in this study, you will be interviewed in 1 session that should last about 60 minutes. In the interview, you will be asked to:

- Share a detailed account of your user experience with EHR systems.
- Demonstrate your day-to-day workflows in the EHR (OneConnect) shadow environment on your work computer. The EHR shadow environment is a copy of the production environment that each participant can access without having any impacts to real patient data.

You will meet with the researcher for an additional 10 minutes within 45 days of the interview to review the interview material. In this post-interview session, you will review and ensure the accuracy and reliability of the transcription of your interview.

2. POSSIBLE RISKS

You should discuss the risks of **interviews** with the study chair. The known risks are listed in this form, but they will vary from person to person. Some questions may make you feel upset or uncomfortable. You may refuse to answer any question. If you have concerns after completing the interview, you are encouraged to contact the study chair.

Information about you in this research study will be handled in a confidential manner, within the limits of the law and will be limited to people who have a need to review this information. To protect the privacy of all participants, the names of each participant will be replaced as pseudonyms (e.g. Participant 1, Participant 2, Participant 3, etc.).

This data will be available to the researcher, the Institutional Review Board (IRB), and other representatives of this institution, and any regulatory and granting agencies (if applicable). If the results of the study are published in a scientific journal or book, you will not be identified. All confidential data will be kept securely on a private network drive available to the study staff. All data will be kept for 36 months from the end of the study and will be handled according to current MD Anderson institutional policy.

If you choose to stop being in the study before it is over, any information about you that was collected **before** the date you leave the study will be kept in the research records for 36 months from the end of the study and may be used as a part of the research.

This research study involves audio recording. The interview will be transcribed by a transcription service, who will have access to the identifiable data (your voice used during the interview). This recording will be available to the researcher, the Institutional Review Board (IRB) and other representatives of this institution. The recording will be kept, stored, and handled according to current MD Anderson institutional policy as stated in the section above. Because what is in the recording could be used to find out that it is you, it is not possible to be sure that the recording will always be kept confidential. The researcher will try to keep anyone not working on the research from listening to or viewing the recording.

This study may involve unpredictable risks to the participants.

3. COSTS AND COMPENSATION

If you suffer injury as a direct result of taking part in this study, MD Anderson health providers will provide medical care. However, this medical care will be billed to your insurance provider or you in the ordinary manner. You will not be reimbursed for expenses or compensated financially by MD Anderson or Nova Southeastern University for this injury. You may also contact the Chair of MD Anderson's IRB at 713-792-6477 with questions about study-related injuries. By signing this consent form, you are not giving up any of your legal rights.

There are no plans to compensate you for any patents or discoveries that may result from your participation in this research.

You will be given a compensation for being in this research study. This compensation will include a $50 gas card for a 70-minute interview session. If you do not complete the study, compensation will be prorated to a 35-minute interview session and you will be given a $25 gas card for partial participation. The compensation will be provided within 45 days of the interview session.

Additional Information

4. You may ask the study chair (Dr. Susan Gaeta or Elizabeth Arceneaux, at 281-908-2208) any questions you have about this study. You may also contact the Chair of MD Anderson's Institutional Review Board (IRB - a committee that reviews research studies) at 713-792-6477 with any questions that have to do with this study or your rights as a study participant.

5. You may choose not to take part in this study without any penalty or loss of benefits to which you are otherwise entitled. You may also withdraw from participation in this study at any time without any penalty or loss of benefits.

6. This study or your participation in it may be changed or stopped at any time by the study chair, Nova Southeastern University, or the IRB of MD Anderson.

7. MD Anderson may benefit from your participation and/or what is learned in this study.

8. This study is sponsored and/or supported by: Nova Southeastern University.

Future Research

Data

Your personal information is being collected as part of this study. These data may be used by researchers at MD Anderson and Nova Southeastern University and/or shared with other researchers and/or institutions for use in future research.

Before being used or shared for future research, every effort will be made to remove your identifying information from any data. If all identifying information is removed, you will not be asked for additional permission before future research is performed.

In some cases, all of your identifying information may not be removed before your data are used for future research. If future research is performed at MD Anderson, the researchers must get approval from the Institutional Review Board (IRB) of MD Anderson before your data can be used. At that time, the IRB will decide whether or not further permission from you is required. The IRB is a committee of doctors, researchers, and community members that is responsible for protecting study participants and making sure all research is safe and ethical.

If this research is not performed at MD Anderson, MD Anderson will not have oversight of any data.

Authorization for Use and Disclosure of Information

A. During the course of this study, MD Anderson may be collecting and using your information. For legal, ethical, research, and safety-related reasons, the research team may share your information with:
   - The Office for Human Research Protections (OHRP)
   - The IRB (IRB - a committee that reviews research studies) and officials of MD Anderson

- Nova Southeastern University, who is a sponsor or supporter of this study, and/or any future sponsors/supporters of the study
- Study monitors and auditors who verify the accuracy of the information
- Individuals who put all the study information together in report form

B. Signing this consent is optional but you cannot take part in this study if you do not agree and sign.

C. MD Anderson will keep your information confidential when possible.

CONSENT/AUTHORIZATION

I understand the information in this consent form. I have had a chance to read the consent form for this study, or have had it read to me. I have had a chance to think about it, ask questions, and talk about it with others as needed. I give the study chair permission to enroll me on this study. By signing this consent form, I am not giving up any of my legal rights. I will be given a signed copy of this consent document.

SIGNATURE OF PARTICIPANT _____ DATE _____

LEGALLY AUTHORIZED REPRESENTATIVE (LAR)

The following signature line should only be filled out when the participant does not have the capacity to legally consent to take part in the study and/or sign this document on his or her own behalf.

SIGNATURE OF LAR _____ DATE _____

RELATIONSHIP TO PARTICIPANT _____

WITNESS TO CONSENT

I was present during the explanation of the research to be performed under Protocol **PA19-0546**.

SIGNATURE OF WITNESS TO THE VERBAL CONSENT PRESENTATION (OTHER THAN PHYSICIAN OR STUDY CHAIR) _____ DATE _____

A witness signature is only required for vulnerable adult participants. If witnessing the assent of a pediatric participant, leave this line blank and sign on the witness to assent page instead.

PERSON OBTAINING CONSENT

I have discussed this research study with the participant and/or his or her authorized representative, using language that is understandable and appropriate. I believe that I have fully informed this participant of the nature of this study and its possible benefits and risks and that the participant understood this explanation.

PERSON OBTAINING CONSENT _____ DATE _____

TRANSLATOR

I have translated the above informed consent as written (without additions or subtractions) into_____and assisted the people
(Name of Language)
obtaining and providing consent by translating all questions and responses during the consent process for this participant.

_____ _____

NAME OF TRANSLATOR SIGNATURE OF TRANSLATOR DATE

☐ Please check here if the translator was a member of the research team. (If checked, a witness, other than the translator, must sign the witness line below.)

SIGNATURE OF WITNESS TO THE VERBAL TRANSLATION (OTHER THAN TRANSLATOR, PARENT/GUARDIAN, OR STUDY CHAIR) DATE

Appendix E

Transcript Review Letter

Hello Dr _____,

Thank you for participating in the study to discover what emergency room (ER) physicians describe as the "pain points" of their user experiences with EHR systems, which may include many different experiences to be uncovered, and their perspectives about how they manage the difficulty of system tasks and demands.

Attached to this message is a transcript from the recorded interview, which was transcribed by a professional transcriptionist. Please review and advise if any revisions are needed, or if there are any further thoughts that you have had since our interview. I ask that feedback is provided by _____. As previously indicated, the transcript from the recorded interview will not be disseminated to anyone other than the participant for each interview. Revisions and additions will be included on the revised transcript.

If you have any questions, please do not hesitate to contact me at (713) 563-9572 or at ejarceneaux@mdanderson.org or ea782@nova.edu.

Again, thank you for participating in the study.

Sincerely,
Elizabeth J. Arceneaux, MS
Ea782@nova.edu
(716) 860-0746

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