YOU WANT ME TO DOCUMENT WHAT: A QUALITATIVE DESCRIPTIVE STUDY OF ED NURSES' PERCEIVED ROLE IN THE USE OF ELECTRONIC HEALTHCARE RECORDS IN A LEARNING HEALTHCARE SYSTEM

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Chair: Karen Wambach

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Abstract

Objective: Nurses are challenged with collecting and using information in the form of electronic healthcare records (EHR) data. Learning healthcare systems (LHS) are reliant on nurses collecting accurate patient information in EHRs, yet nurses are challenged with the process of documenting while focusing on patient care. This split focus can impact converting information into meaningful knowledge later. No research describing nurses' perceived role in a LHS exists.

Method: This qualitative study was conducted to obtain insight in nurses' perceived role in collecting and using data as part of a LHS. The research questions explored were: 1) What are nurses' perceptions of what it takes to collect information representing the patient's health in the EHR? 2) What are nurses' perceptions of their role in capturing and recording information in the form of EHR data? 3) What challenges do nurses face in EHR usability when trying to capture information in the form of data? 4) How do nurses use data to influence their practice? A qualitative descriptive design was used. Seven emergency department nurses from two midwestern hospitals were interviewed using semi-structured interview questions.

Results: Using inductive data analysis four themes were identified: 1) The impact hospital's electronic healthcare systems have on human factors. 2) Hospitals' leadership influences collected patient information and the nursing documentation process. 3) Nurses are concerned about the impact of electronic healthcare record documentation on patient safety and quality of care. 4) Nurses use the electronic healthcare record documentation process to assist in nursing decision-making as they care for patients.

Conclusion: Findings revealed nurses perceive their roles as a complex interaction with patients and EHRs. They are continuously challenged with meeting internal and external demands. There is a need to provide enhanced education on the strengths and capabilities of the EHR systems.

Leadership's development of ways to help support nurses in their daily activities is necessary. They valued quality metric reporting as a means of patient safety and quality improvement. Lastly, nurses should be provided with education on the importance of their role in the entire system when it comes to collecting and using EHR data.

Keywords: learning healthcare system, data, electronic healthcare records, information, nursing, documentation

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Dedication

For Scott Hewins, my friend, companion, pull me off the cliff edge while refilling my writing juice partner. You are my dream. I love you babe.

Table of Contents

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List of Tables

Chapter 1: Background

The phenomenon of interest explored in this study was understanding nurses' perceived role in the use of electronic healthcare records in a learning healthcare system. Chapter 1 contains the background information supporting the reasons this information was significant. This section covers an explanation of what a learning health care system (LHS) is and its importance to healthcare systems. Philosophical foundations supporting the four research questions studied is presented. Terms specific to this study are defined for clearer understanding. Lastly research assumptions are presented.

Problem and Significance

The concept of a LHS was born out of the need to address the delay in putting research into practice. The primary focus of a LHS is to reengineer the dissemination of knowledge derived from clinical research to make it more readily available to healthcare delivery models and direct care providers (Institute of Medicine, 2007). This initial definition has evolved beyond the scope of just research to include expanding the learning from all collected clinical data to be used in multiple ways (Friedman et al., 2016). In 2011, the Institute of Medicine (IoM, 2011a) challenged the healthcare industry to obtain a goal where 90% of all healthcare systems will have clinical decisions supported by accurate, timely and up-to-date clinical information by the year 2020.

Information derived from accurate and timely data is required for wise decision-making (Institute of Medicine, 2007). Yet, the biggest challenge with using EHR information to support a LHS is related to insufficient development, collection, standardization and analytical methodologies in using EHR data (Sacristan & Dilla, 2015). The advent and expanded reliance on bedside computers have caused a technological explosion transforming the way information is obtained (Ancker et al., 2014). It is estimated that healthcare data volume doubles every two years because new technological avenues allow for more and more data to be collected (Sacristan & Dilla, 2015).

Critical internal and external decisions are made every day in healthcare based on patient level data (Buntin, Burke, Hoaglin, & Blumenthal, 2011). It is imperative that complete and accurate patient level data are available for the comprehensive functioning of a LHS which are reliant on multiple uses of the same data elements (Hayward-Rowse, & Whittle, 2006). Utilization of the information gleaned from electronic healthcare records (EHR) is reliant on semantically defined, understood and accurately captured data based on the information presented to the healthcare provider.

Raman et al. (2018) define electronic healthcare records as a “digital longitudinal repository of electronic health information about an individual patient” (p. 13) giving healthcare personnel the information necessary for healthcare. EHR data allow direct care providers the patient level information necessary to deliver timely care. Information gathered through EHRs also gives rise to the opportunity for real-world clinical decision making as the data collected help answer questions about hospitals, systems, and demographic health. The focus of this study is direct patient level information captured in EHRs.

Hospital nurses delivering direct patient care are instrumental in transforming patients’ encounter information into data captured in hospital EHRs. They are the primary holders of the key responsibility of interpreting and entering the patient’s condition and event data into the EHR. Using the nursing process, they must convert what they are hearing and seeing from the patient and the care delivered into predetermined data fields within the EHR. They may decide that the reflection of the patient condition is better represented using natural language instead of entering pre-designated labels into discrete data fields; in such cases, data may be typed as narrative notes (Kaggal et al., 2016).

There are multiple potential problems with information being captured appropriately and accurately owing to the data burden requirements thrusted upon these nurses. Since nurses collect and enter data while simultaneously delivering patient care, their workflow may be challenged. Sharpe and McDermott (2009) believe that accuracy and productivity decreases when multiple tasks are required by the same person at the same time. These nurses must thoroughly understand the semantic definition assigned to individual EHR data fields which can be a challenge depending on how much exposure they have had to the specific term and its defined intended use in the EHR design (Takashima, Bakker, van Hell, Janzen, & McQueen, 2017). There is little known about the impact that nurses’ data interpretation has on the entire healthcare system. Lastly, natural language used in narrative notes is not semantically defined and therefore not universally understood with the same meaning and context as represented by unified medical language that discrete fields may represent (Agrawal et al., 2013).

Nurses’ role in the information representation of the LHS can directly influence decision-making at all levels of healthcare based on the information they collect as data elements. As nurses face challenges with their LHS information gathering role, downhill fallout when trying to use this informative data for nonclinical purposes will ensue (Feder, 2017; Goode, Crego, Cary, Thornlow, & Merwin, 2016). Therefore, it is important to better understand and define nurses’ perception of their role in collecting, interpreting and transforming information represented by data into wise decision-making to support true LHS. Using a descriptive qualitative methodology, the focus of this study was to gain a better understanding of what nurses perceive as their role in the information represented by data collection and use process as part of a LHS.

Philosophical Foundation

The philosophical foundation of constructivism was used in this study to capture the collective meanings and understanding from multiple realities of nurses’ perceived definitions and experiences of information as part of a LHS. Perceptions are a perceived truth. Patton (2015) describes the basic social psychological theorem as what is perceived as being real is real in its consequences. If the thing is not recognized as real or true, then it will not function as truth to the community. Truth is a matter of shared meaning and consensus among people. Culture influences truth and perception. The philosophy of qualitative inquiry is based on constructivism which relies on the fundamental questions of what are the perceived truths, explanations, beliefs and worldview of the phenomena of concern (Patton, 2015).

Exploration and identification of this specialized community’s perceived truth, beliefs and worldview on their role in a LHS as it relates to information and data gathered through the EHR was important. Therefore, a qualitative design was the best research method to use for this inquiry.

Qualitative inquiry models have three design elements: naturalistic inquiry, design flexibility and purposeful sampling (Patton, 2015). We used naturalistic inquiry to gather and evaluate data based on real-world situations as they naturally unfolded.

Purposeful sampling was used to identify information-rich and illuminative cases aimed to gain insight for the phenomenon of interest. This methodology was useful because nurses’ perception of their role in a LHS must be purposeful and meaningful to gain the best insight from the information they collect. Therefore, study information was gathered in a natural operational environment with a flexible enough design to adapt to different circumstances as they arose during the data collection and analysis process.

The nursing process is based on a holistic approach to care where multiple theoretical frameworks are used to support the paradigm nurses use to deliver care no matter what position they hold in the healthcare industry (McEwen & Wills, 2007). This holistic approach to nursing care delivery models influences healthcare informatics and LHS models (Ronquillo, Currie & Paddy, 2016). Although qualitative inquiry typically uses atheoretical frameworks, a mixed set of concepts from data-information-knowledge-wisdom framework, complexity science, complex adaptive systems, big data, and LHS models were used to inform this study's design. When used together, these theoretical concepts allowed for a more comprehensive scaffolding to support the interpretation of this study's findings.

The study of informatics, which deals with collection and transformation of data into decision-making, is reliant on Ackoff's (1989) hierarchy of data-information-knowledge-wisdom (DIKW) and will be discussed in detail in chapter two. Operationalizing the DIKW model must include defining principles of LHS that rely on information derived from data collected at the bedside during the patient encounter. This information is at the core of decision-making.

The LHS model also addresses culture, patient anchored design and processes, engaged patients and public, decision-making, best-practice-care every time, transparent outcomes, cost evaluation, ongoing knowledge development, digital technology, reliable and secure health information, data utility, and leadership (Institute of Medicine, 2007). This study was focused on evaluating connections between many of the components from nurses' perceived role.

The healthcare industry is one large complex adaptive system split into smaller individualized complex adaptive systems. The interconnectivity of these systems can have substantial, unintended, far-reaching downhill and uphill effects on each other. Healthcare systems are always in a state of change in complex system-wide relationships. One small change in one place may give rise to bigger changes in another. Reusable data is one component which has the power to represent multiple different system components at different levels. Therefore, other theories supporting development of informatics and data use in a LHS must include impact evaluation through better understanding of complexity science, complex adaptive systems, and big data (Abbott, Foster, de Fatinma, & Dykes, 2014; Ellis & Herbert, 2011; Hast, DiGioia, Thompson, & Wolf, 2013; Koerner, 2009; Lanham et al. 2013). Chapter two provides a detailed discussion of the impact these interrelated concepts have on LHS.

Purpose

The purpose of this study was to gain insight into what nurses perceive as their role in the development and use of information and new knowledge in a LHS specific to collecting and using information in the form data collected through electronic healthcare records (EHR). A qualitative descriptive research design fits with this study because little is known about direct patient care nurses' perception of their role in the LHS, especially when it is linked to the information collected in EHRs.

Research Questions

The purpose of this study was to gain insight into what nurses perceive as their role in the development and use of information and new knowledge in a LHS specific to collecting and using electronic healthcare records (EHR) data. The study's goal was to explore these four research questions:

1. What are nurses' perceptions of what it takes to collect information representing the patient's health in the EHR?
2. What are nurses' perceptions of their role in capturing and recording information in the form of EHR data?

3. What challenges do nurses face in EHR usability when trying to capture information in the form of data?
4. How do nurses use data to influence their practice?

Significance of the Study

The knowledge and insight gained from this study will impact healthcare delivery systems as they become more complex. Healthcare systems are being held accountable for providing improved quality results at every level in an environment where reimbursements are challenged (Martin, Neumann, Mountford, Bisognano, & Nolan, 2009). More knowledge will be gained on nurses' needs while they are collecting and documenting information as they deliver their care.

LHS must understand the culture and phenomena of perceived roles. Since data is at the core of decision-making throughout healthcare systems, this study will help provide more insight into nurses' perceived roles in their use of information in a learning healthcare system. Understanding their role will allow leaders to develop targeted tools and resources to assist nurses in effective and efficient use of data to gain the information they need for better decision-making. This will ultimately lead to more accurate information systems with a downhill effect of better decision making.

Definition of Terms

"Big data" as described by Westra et al. (2017) refers to the volume, velocity, variety veracity, and value of data representing the information collected by the provider.

"Data" is a character or characters which have no meaning when presented alone (Nelson & Staggers, 2014).

"Database" is a data repository where information is electronically collected and stored for future extraction and use (Lee et al., 2015).

"Electronic Health Record" is defined as the individual patient's digital longitudinal repository of electronic health information (Raman et al., 2018).

"Information" is obtained when data has been put into context to have meaning. A core component to healthcare information is patient level data which is collected in EHRs. Patient level data is assembled, analyzed, and interpreted to create the information (Friedman et al., 2010).

"Knowledge" is derived from the information represented by the data (Kaggal et al., 2016).

"Nurse" is a licensed registered nurse providing direct nursing care at the patient's bedside.

"Patient level data" is defined as the individual patient's information collected as data in the EHR record at the time of the patient's hospital event. Subsequently the collected information is directly reviewed by the healthcare staff at the time of the encounter.

"Volume" of data is the magnitude, depth, and breadth of data (Westra et al., 2017).

"Velocity" refers to how quickly data are generated, analyzed, and subsequently translated into research and practice (Westra et al., 2017).

"Variety" is the availability and use of multiple data sources in structured heterogenetic types of collection such as in EHRs combined with index data, genomics and/or social media (Westra et al., 2017).

"Veracity" describes the characteristics of quality of the data (Westra et al., 2017).

"Value" is the ability of obtain insights and repurpose the data for multiple uses (Westra et al., 2017).

“Wisdom” uses knowledge to manage or solve problems including knowing when and how to manage patient needs (Ronquillo et al., 2016).

Assumptions

1. Nurses providing direct patient care will be willing to share their experiences about collecting information in the form of EHR data while providing care.
2. Nurses providing direct patient care will be able to recall experiences with collecting data while delivering care.
3. Nurses providing direct patient care will be able to recall experiences of using data to make decisions.

Summary

In summary, chapter 1 contained a discussion of the phenomenon of interest, which is a lack of understanding of nurses’ perception of their role in a learning healthcare system where the information they collect in electronic healthcare records are used for multiple industry wide decision-making enterprises. This phenomenon of interest led to this study’s development and completion. The significance of this problem, study aim with specific research questions evaluated, philosophical tenets supporting this study, purpose of the study, definition of key terms, and assumptions were discussed to give thorough support to the qualitative inquiry which directed this study’s design.

Chapter 2: Literature Review

This literature review includes content supporting the need to better understand nurses' role in learning healthcare systems (LHS) where they collect the patient's experience and represent it as data in electronic healthcare records (EHR). This review includes a discussion of how the development of EHRs have impacted the transformation of data into decision-making and the key roles which data management and informatics influence and support improved quality care. An overview of the different theories and models supporting the use of data in LHS is also presented. Lastly, information on how human factors impact LHS is presented.

Learning Healthcare Systems

Learning healthcare systems (LHS) can be defined as healthcare systems which have a supporting infrastructure and culture that provides information for understanding and knowledge generation from previous evidence (Kaggal et al., 2016). In 2011 the Institute of Medicine (IoM) identified LHS as systems which support providers in generating new knowledge and subsequently apply that knowledge into clinical practices through technological infrastructures which capture and report accurate data. This includes aligning science, informatics, incentives, and culture in a cyclical process where continuous improvement and innovation are embedded in the delivery system while the new knowledge generated becomes a by-product of the healthcare delivery experience (Learning Healthcare Project, n.d.). Therefore, the goal of LHS conceptual development is to drive participatory biomedical learning and discovery as a natural outgrowth of the patient health experience (Friedman et al. 2010; Institute of Medicine, 2011).

The LHS model operates by using information gained through patient level data as a core component of all decision-making. The model demonstrates that data collection leads to data assembly which is then analyzed and interpreted to create the information needed for decision-making. From this point, action can be taken based on the decision-making processes. This transformation process is conceptually represented in the data-information-knowledge-wisdom (DIKW) model. Feedback is gained from the action as change is created and implemented. New data are then collected and the cycle begins again until the goal is achieved (Friedman et al., 2010).

A mature LHS will account for multiple independent yet simultaneously operating variables within the system such as culture, available resources, knowledge, human factors, present structure, and future needs. Learning healthcare systems are in constant evaluation and improvement stages where data drives system change and the change then drives different data (Friedman et al., 2010). A LHS is always moving and always learning. It is imperative that the healthcare industry learns from timely, accurate and semantically defined biological and clinical data.

Data elements captured in EHR’s lead to real time information and sequential analytics which allows for rapid development of new knowledge (Kaggal et al., 2016). Since EHRs have the power to provide real time data, there now exists a more rapid way for improving healthcare experiences (Buntin et al., 2011; Friedman, et al., 2010; Institute of Medicine, 2007). As knowledge develops from the ability to create and interpret real time analytics, providers are rapidly learning how to assimilate the knowledge into wise decision-making and ultimately their practice. There is now momentum for earlier development of new knowledge not just based on research but also by using process data obtained from EHRs.

Multiple challenges exist with the use of data due to limitations in the way data are collected, stored and retrieved (Wang & Krishnan, 2014). Human factor limitations also have a role in the use of EHR data (Wickens, Lee, Liu, & Gordon Becker, 2004). Therefore, a LHS’s analytical implementation must keep pace with the ability to accurately collect and store data.

The collection of hospital data relies on nurses' ability to understand how their role in this process is integrated into their patient care.

Data-Information-Knowledge-Wisdom Model's Impact on Learning Healthcare Systems

The DIKW model demonstrates the connectivity between the individual concepts of the data lifecycle which includes transformation of data into actionable decision-making. Gee et al. (2011) believe this transformational interconnectivity is critical as the healthcare industry develops a collective wisdom between providers, patients, and health. There are two distinct concepts in the data to knowledge continuum. This section speaks to concepts which need to be considered to be able to operationalize the DIKW model in a LHS.

Data and Information

In the simplest definition, data by itself is limited to a character which has no meaning when presented alone (Nelson & Staggers, 2014). Only when it is given meaning does it become information. Yet, healthcare decisions are made every day which rely on semantically defined, accurately collected and reported patient level data (Jeffs, Nincic, White, Hayes & Lo, 2015).

The technological explosion has positioned the use of computers in healthcare as a mainstay. Governmental regulations require patient level data to be collected in EHRs (United States Department of Health and Human Services, n.d.). Data curation, preservation and retrieval require systematic processes to be able to manage this EHR data (Yu Chen Kung & Campbell, 2016). Databases are an example of a tool supporting those processes. Lee et al. (2015) described databases as data repositories where information is electronically collected and stored for future extraction and use. The parameters of individual databases are dependent upon the defined needs and contemporary resources of the organization collecting and using the data. EHRs are a compilation of multiple databases designed to represent the patient's experience.

Only when data elements have been semantically defined and put into context, can they be transformed into usable information with the same interpretative meaning for internal and external users such as the clinician, researcher, administrator or public advocacy professional (Ancker et al, 2014; Nelson & Staggers, 2014). The challenge with managing healthcare data is the same data point may be used in multiple contexts or with differing meanings. Information formulated from data is used to make informed decisions in all internal and external vested areas of the healthcare system (Baro, Degoul, Beuscart, & Chazard, 2015). Internal use of captured data may include immediately referencing ongoing care, identifying reimbursements, mitigating litigation, supporting risk management programs, developing protocols and policies, supporting executive decision-making, and determining resource allocation (Ancker et al., 2014; Heintzman et al., 2014; Kaggal et al., 2016). Whereas, external healthcare data use expands to include addressing the data needs of those who develop public policy, make scientific discoveries, and evaluate epidemiology statistics (Heisey-Grover, Wall, Helwig, & Wright, 2015; Urech et al., 2015; Weiskopf, Hripcsak, Swaminathan, & Weng, 2013; Weiskopf & Weng, 2013).

Another challenge with managing data is the lack of universal understanding of the same datum or lack of ability to capture the full context of the event so the datum can be accurately translated to represent the patient condition (Yu Chen Kung & Campbell, 2016). An example would be logging the exact time of a ST elevation myocardial infarction (STEMI) system activation. Should the time collected and reported in the EHR be the time the paramedics radioed the emergency department doctor to let them know they were transporting a patient with a STEMI or the time the operator paged the cardiac catherization lab personnel or when the lab personnel arrived and took the patient to the intervention lab? Nurses collecting and recording this information may not know the effects of inaccurately reported times which they are responsible for entering in the semantically defined field. Inaccurate information skews quality improvement efforts and government reporting.

Another example of the challenge with managing data is the accuracy needed when the nurse is logging a patient's blood pressure. When relevant, nurses may grapple with how and where to document the location the blood pressure was taken (e.g. wrist, right arm, left leg), position of the patient at the time of treatment (e.g. lying flat, sitting, standing), or even if the blood pressure results were from an invasive line or external location. Confusion to the nurse trying to accurately reflect the information may occur if the EHR does not have appropriately defined discrete data fields.

Structured electronic data collection occurs as discrete fields where settings and input structures are in place requiring defined responses (e.g. alpha fields, numeric fields, date/time and drop-down options, etc.) or as unstructured narrative text where there is limited structure for what is put in the field. Both means of capturing data have strengths and limitations. Limitations will make the data less meaningful and potentially cause errors in interpretation which will have a negative impact on the entire LHS.

Due to the vast number of defining characteristics of the human condition, defining and coding patient level data in an EHR is difficult (Nelson & Staggers, 2014). Interpretation of the information derived from a specific data element's meaning can vary broadly based on the area of the country or world that providers live, have studied in or even granularly may vary based on the hospital unit's specialty. Therefore, processes for defining and capturing data must be carefully addressed in an organization's data management plan.

Developing standardized terminology to define nursing concepts has been the focus of many programs such as SNOMED CT (United States National Library of Medicine, 2017).

Standardized terminology and coding are at times used interchangeably. The goal is for consistent meaning to be given to specific datum leading to effective management of the data for future retrieval and use. Standardized terminology with well understood ontological meaning allows for the mapping of systematized data nomenclature to occur (Nandigam & Topaz, 2016).

Semantic interoperability allows for the exchange of data by requiring unambiguous definitions of the specific data elements captured in computer systems. These definitions allow for computer systems to exchange data with shared meaning by having the ability for computer logic, inferencing, knowledge discovery, and data association to occur between systems using some form of a mapping program. Data mapping allows for multiple EHR systems to communicate so the data representing the patient condition can be transferred from one organization to another.

Classifying the patient's experience using an assigned code representing the standardized terminology allows computer programmers or data abstractors to extract information from a database for analytics to be performed. This allows the end users of the data to gain insight on the questions they are trying to answer (Kaggal et al., 2016). Coding procedures are frequently evaluated and updated (Sanders et al., 2012). Multiple philosophies exist on the best way to capture the human condition through electronic coding by assigning numbers to specific human conditions or processes. Philosophies on how to code elements are dependent on the scope of the information's use by the organization defining the codes.

Coding systems may include SNOMED, ICD-9/10, diagnostic related groups, clinical document architecture, LOINC, health level seven, core clinical documentation, current procedure terminology, national drug code, etc. Nurses are challenged with understanding these data management concepts with little or no experience on the systems complex interconnectivity.

However, literature is not present demonstrating nurses' level of understanding in defining and coding requirements for the information in the form of data they are charged with capturing.

Lanham, Leykum, and McDaniel (2011) found that standardized homogeneous EHR use between nurses may be more reliant on verbal communication between the staff rather than information retrieved from the EHR. While every nurse does not need to know the detail of the coding to deliver effective and efficient care, they do need to have a basic understanding of what happens to the data they collect, including coding, and the power it holds which they can tap into to deliver better patient care.

The expanded use of technology in healthcare has transformed the availability of multiple data elements commonly referred to as big data (Wang & Krishnan, 2014). The theory of big data uses a multitude of defining factors which are inherent with issues challenging the management of collecting and transforming data into decision-making. The exponential growth of healthcare data has engaged healthcare leaders in further development and use of big data theories as these leaders develop their data management systems.

Advances in EHR technology have allowed the healthcare industry to connect variables which were not available before (Nash, 2014). Effective and efficient use of EHR data is now an expected part of the patient experience (Ralston, Coleman, Reid, Handley, & Larson, 2010). Big data can assist leaders and providers with improving patient care through data-driven decision-making.

The most comprehensive description of big data addresses the data's volume, velocity, variety, veracity and value. Volume refers to magnitude or amount of the usable data present. Velocity refers to the speed data are generated, analyzed and used. Veracity refers to the conformity of data which would include accuracy. Variety is the availability and use of multiple data sources in structural heterogeneity data types. The value of big data is the ability to obtain insight for wisdom development and repurpose that data for multiple uses (Westra et al. 2016). Big data requires capturing, storage, formatting, extraction, curation, integration, analysis and visualization (Westra et al, 2016; Wang & Krishnan, 2014). However, the variance in the velocity, variety, veracity and value including how the semantics of data elements supporting big data are defined and captured has caused challenges and at times chaos (Baro et al., 2015). The variance of data elements' semantics makes it difficult for those entering the information into EHRs to use analytical functions for report development so they can rapidly drive the care they deliver (Fernandez-Breis et al., 2013).

Significance, variation and velocity in data collection are big data properties which must be factored in all data and knowledge management programs. Other properties creating challenges with the use of big data include workflow aspects for the staff, computational methods used in analytics, creation of meaningful information, data sharing, and the human element (Baro et al., 2015). This proposed study is focused on further defining the human element property.

Development of EHR systems has had a focus on front-end collection and documentation of the patient's experience rather than a mixed model to include extracting information to support Learning Health Systems. Spetz and Kean (2009) measured implementation of health IT systems. They identified that key pitfalls with implementation could have been prevented with better leadership support, realistic scheduling and addressing staff skepticism with EHRs relative to workflow. Morrison, Jones, Blackwell, and Vuylsteka (2008) demonstrated that EHRs are primarily used as a means for staff communication concerning the patient's status. What was not addressed was the ability to further harness the power of the data collected to embrace principles which make secondary use data so powerful.

Besides recognition of EHRs as communication tools, they are also designed as clinical decision support tools and physician order entry with feedback on lab results (Georgiou & Westbrook, 2009; Georgiou et al., 2007; Trivedi et al., 2009). Christensen and Grimsmo (2008) included in their discussion that the instant availability of patient records was important but there may be diminished patient information available due to the transfer of administrative work.

Healthcare informatics is challenged with defining ways to streamline, support, and create innovative ways to maximize capturing the depth and breadth of the patient condition to leverage the data in a LHS. Meaningful use as described by the United States Department of Health and Human Services has been a driving force behind bringing together EHR data semantics (United States Department of Health and Human Services, n.d.). Rapid development and adoption of EHRs has also allowed data to be collected in a way that allows for longitudinal and real time knowledge formation (Kaggal et al., 2016). The ability to have ongoing use of EHR information is critical to supporting the needs of LHS.

The volume of influencers involved in the development and ongoing use of big data grows every day. All stakeholders have unique needs which influence the depth and breadth of the data definitions they need collected and reported to meet their objectives. Each entity has their own motivation for collecting and using the data which may correlate or conflict with the other stakeholders. This is causing significant issues with the validity and reliability of the data retrieved from EHR (Heintzman et al., 2014; Weiskopf et al., 2013; Weiskopf & Weng, 2013).

Another issue with the use of big data was reported by Weiskopf et al. (2013) where they demonstrated EHRs have missing data elements which affect downhill reporting and analytics.

The caregiver’s workflow changes and added responsibility for understanding the semantics of data during the data collection process while simultaneously delivering care has been overlooked in the management of big data. This is causing an issue with validity and reliability for multiple uses of EHR data. This neglect can cause a ripple effect resulting in wrong conclusions from inaccurate dataset (Hayrinen, Saranto, & Nykanen, 2008; Rea et al., 2012; Urech et al., 2015).

To feel connected to the goals of the organization, nurses need to feel a sense of ownership. Furne, Ross and Rink (2001) believe that if disconnects exist between data and the nurses’ sense of ownership, leadership will not be able to develop the resources needed to enforce a sense of responsibility. Nurses must be involved in the process of transforming EHR data into usable decision-making from multiple vectors as part of a LHS. Yet, there is no literature on nurses’ perception of their role in the LHS’s data continuum.

For LHS to improve quality of care delivery, new tools and services need to be created for data discovery, integration, analysis, completeness, and visualization (Bar-Lev, 2015; Baro et al., 2015; Walker et al., 2014). A better understanding of influencers which negatively impact the data continuum will promote a rise in the quality of user performance leading to a more robust LHS. An evaluation of the gaps of a LHS must begin with nurses’ perception of their role on the data continuum.

Big data must be accurate and semantically defined to be useful in an ongoing system of decision making. Accuracy in what is being collected by nurses depends on individual nurse’s experience with EHRs and data transformation. More importantly, their motivation for collecting the information must be evaluated. Svinicki and McKeachie (2014) believe that understanding the user’s motivation allows for development of enhanced resources, tools and educational opportunities.

Methodological, technologic and legal factors are limitations for using big data in clinical research and care delivery models. Methodological barriers include the low quality of data such as incomplete and lack of data standardization. Codified data includes systems where the collected information is given a semantic code which has a standardized definition. Analyses conducted on databases are often used for administrative and billing purposes. This is evident with the use of ICD codes. The challenge with this type of coding is they are defined for reimbursement purposes and not to completely define the patient's condition and care.

Challenges also exist with managing constantly changing data with varying definitions which are housed in different repositories. Different databases with different quality and completeness lead to biased fact finding and false discoveries (Wang & Krishnan, 2014). Infrastructures must exist to gather the depth and breadth of information in EHR, yet EHR will be vendor specific and only developed to the level the consumer can afford. Governmental regulations had to be developed to improve interoperability between data vendors allowing patient level data to follow the patient (United States Department of Health and Human Services, 2014).

Knowledge

Knowledge is recognized as an increasingly valuable multidisciplinary asset to healthcare organizations (Wang & Wang, 2016) and is a core component for effective LHS. As data is transformed into and information into knowledge, principles of knowledge management must be addressed. Knowledge management focuses on ensuring members of the healthcare community have the right level of organizational knowledge provided through assets and artifacts, in the right place, at the right time to subsequently make wise decisions about the delivery of care (Dwivedi, Bali, & Naguib, 2010). This is especially important for organizations wanting to adhere to the LHS model as defined by the IoM (2007). The knowledge supporting LHS must include the entire spectrum of activities with managing data and converting subsequent knowledge into wise decision-making. This transformational process includes identification, codification, and ultimate dissemination of information (Wang & Wang, 2016).

Knowledge management is not the same as data or information management. Knowledge management systems (KMS) rely on the experiences of the human element to transform the data and information into knowledge from which action can be taken (Wang & Wang, 2016). Sustainable KMS require the creation and assimilation of new concepts, ideas and knowledge, identifying and defining exactly what is being described. Formation of a coding system that will capture a specific idea or concept in a way that is easily retrievable and can be disseminated is a critical element to a KMS (Nash, 2014). Efficiently capturing necessary data at the right level along with the experience and expertise of workers involved must be achieved. This includes integration of organizational artifacts such as documents, policies, and procedures (Sacristan & Dilla, 2015).

Wisdom

The data explosion representing the patient condition brought about with the expanded use of EHRs has caused challenges with the ability to mine and subsequently use the data to form new knowledge as is required for effective LHS. Therefore, it is important to consider the classical work from Kish (1959) and McGrath (1981) in defining how to transform data into wise decision-making.

Kish (1959) identified three dimensions of research data (generalizability, precision of measure, existentialism/usability) as being relevant. These dimensions are still applicable and relevant in the way the healthcare industry uses data. Identification of the intended data use impacts the generalizability of the data will be to represent the patient condition. This includes understanding the needs of the different users of that same data element. Defining how precise the intended measure needs to be to represent the level of intended information is important to understand. Lastly, the intended use of the data being captured includes how educated the end user of the data must be about the data in order to have the necessary skills to use the data. In the data management design, strengthening one dimension will weaken the other two dimensions thus possibly limiting the use of specific data elements based on how they are semantically defined, captured and coded.

McGrath (1981) promoted including statistical significance versus substantive importance definitions of the data to wisdom transformation. As an example, eye color is easy to semantically define and capture in discrete fields of an EHR. Therefore, there is the ability to perform statistical analysis because data are well defined (eye color) but there would be no substantive importance to use eye color data in a cancer regression analysis. A balance with all these factors must be achieved when transforming data decision-making.

A shortcoming of the DIKW model is that it does little to define how to manage the linkage between the elements to maximize the human element's performance when interacting with the data. This is an important consideration and the basis of this study.

Complexity Science and Complex Adaptive System's Impact on Learning Healthcare Systems

Evaluation of all the influencers playing a role in transformation of data to decision-making must be performed to support more efficient and effective LHS. This includes understanding the interconnectedness of all influencers which are best represented through the lens of complexity science theory. Koerner (2009) stated that all interactions with the world begins with the way that person views the world. Holistic and interconnected views are the foundational concepts of complexity science.

Discussing complexity science theory requires a core understanding of complex adaptive systems (CAS). Complex adaptive systems help make sense of human responses to problem solving (Ellis & Herbert, 2011). They are unpredictable and ever changing (Hast et al., 2013). The epitome of CAS are hospitals as their dynamics are ever changing based on the influencers interacting with them (Hast et al., 2013). Hospitals are chaotic environments and are affected by all the influencers which interact with their system. Abbott, Foster, de Fatima Marin and Dykes (2014) also believe that as CAS, it is commonplace for hospitals to have variations in the norm and non-linear responses. They also believed that health information technology is strongly influenced by the complex context where the implementation occurs. This thought again leads back to identifying nurses' role in data management of a LHS.

Data helps the healthcare industry transcend the concrete realm into an abstract one where pictures of change can be developed and created using the interconnectedness complexity science represents (Koerner, 2009; Lanham et al., 2013). Managing hospitals as CAS means becoming even more aware of the variances brought about with the need to manage big data. Complex adaptive systems must be supported by reliable and valid data. Therefore, understanding the process of data capture from nurses' perspective is important to understanding how to better manage this complex adaptive system.

Nurses are a key component to understanding how the data to decision-making transformation takes place in CAS. Jeffs et al., (2015) believe leadership has the responsibility of demonstrating how to use clinical quality data to nurses. This may be partially true. Again, using complexity science theory as a basis for understanding the human elements' impact on systems, nurses have the primary role of inputting the data into EHRs and what they enter may be able to directly affect the outcome and downhill use of the data. To mitigate any interconnected issue which may result from nurses' lack of understanding, these nurses need to have ownership in the data management process so must possess a certain amount of knowledge of the full spectrum of the data. Without the full spectrum of understanding, sustainable changes will be ineffective and quality will be compromised (Essen & Lindblad, 2013).

High value knowledge derived from big data must come from quality patient level data to have a sustainable LHS (Sacristan & Dilla, 2015). Understanding nurses' perceived role in data management will allow for targeted tools to be created to better meet their needs.

Informatics' Consideration in Learning Healthcare Systems

With the technology explosion, new inventive ways of delivering care while capturing information in the form of data supporting care delivery has the potential to improve quality, control cost, and obtain greater engagement of patients in their health (Buntin et al., 2011). In response to safety issues from misinterpretation of EHR data, the Institute of Medicine (IoM) and Office of the National Coordinator for Health Information Technology (ONC) brought together healthcare leaders for developing the Safety and Assurance Factors for EHR Resilience (SAFER) Guides (Institute of Medicine, 2011a; Office of the National Coordinator of Health Information Technology, 2012). The SAFER guide addressed information technology (IT) dimensions for: 1) high priority practices, 2) contingency planning, 3) organizational responsibility, 4) systems configuration, 5) system interfaces, 6) patient identification, 7) computerized provider order entry with decision support, 8) test results, reporting, and follow-up, and 9) clinician communication. SAFER Guide developers also focused on computerized provider order entry with decision support, test results, reporting and clinician communication as a focus for nurses. However, their recommendations did not address how nurses could use other important data they collect in EHRs.

Natural language processing can take place with free text in the EHR but is subject to interpretation and completion (Kaggal et al. 2016). It is also very difficult and expensive to electronically extract from databases for the purposes of extrapolating the data to put the information gathered from the data into required registries for third party use. It is much easier for data stored in discrete fields to be extrapolated and universally used.

While this is an issue with EHR development, little is known about how nurses perceive their role in collecting and interpreting information gained from EHR data. With a better understanding of how they perceive their strengths and limitations of understanding how data are used for multiple levels of decision-making, additional resources can be developed to support their efforts.

Four dimensions of improvement in healthcare informatics for LHS include promoting technical advances and innovation, knowledge generation and use, engaging patients and the public and fostering stewardship and governance of healthcare delivery systems (Institute of Medicine, 2007). The IoM Committee on Patient Safety and Health Information Technology (2011) further recommended enhancement of meaningful use by continual development of semantic interoperability and exchange and consistent identification of patients across their entire health continuum.

Dissatisfaction with EHRs is a barrier to achieving the data management potential capable with the enhanced technology (Buntin et al., 2011). The Institute of Medicine’s report calls for improved EHR systems to improve human-computer interactions (Institute of Medicine Committee, 2011).

Cognition in a Learning Healthcare Systems

Learning healthcare systems require the human element to be able to convert information into data which is then transformed into decision-making and back into data again. This takes cognition. Although human factors evaluation is multi-faceted (Wickens et al., 2004), the scope of this human factors literature review is only focusing on cognition because that supports this study.

The human brain is a pattern recognition machine. It is reliant upon past experiences to continuously look for information where it thinks it can find it (Wickens et al., 2004). Data received through any human sensory system must be transformed into something the brain can recognize, process, and act upon. If the individual has never had the experience for pattern recognition to take place, then learning must happen which will slow down reaction time. Wickens et al., (2004) breaks cognition up into perceptual encoding, central processing, and responding to the event where distinct processes of cognition take place. These are known as bottom-up or top-down cognition and are based on memory.

Perceptual filtering and pattern recognition can be defined as salience, effort, expectancy or value. Salience filtering is a bottom-up process where what is experienced has attentional capture and signals important events. Expectancy and value work together and is a knowledge driven cognitive process where meaning is based on past experiences which allows for the perception of knowing where to scan for information. This is a top-down process. Lastly, effort can be described as to how much attention is desired to put into trying to find the information sought.

Working memory is important to understand in that it is transient and limited only having the ability to holding a small amount of information at any given time. Limitation in the working memory must be factored in the design of any system. One of the challenges nurses face when entering data is remembering all the data interoperability semantics for what they enter without the education, experience or support on the purpose for the data, yet that is the exact data which is used to attempt to improve healthcare delivery systems (Wang, Li, Zhang, Suzuki, & Araki, 2013). Their working memory and pattern recognition is going to be limited which may cause inaccuracies in the data they capture.

Long term memory is based on repeated past experiences. These experiences have been repeated enough that the signals for memory have transitioned to the long-term memory portion of the brain (Wickens et al., 2004). Wisdom needed for decision-making is produced through this area.

A consideration for reliance on long-term memory is that information erosion can occur if that memory is not exposed and used frequently enough (Wickens et al., 2004). Biological conditions such as age, changes in mental capacity due to medications and disease processes, such as Alzheimer's, can expedite this erosion process causing the human element to lose the ability to link their operational world to memories.

Nurses, like all healthcare professionals, are trained to expect the unexpected. This has become more complex as EHRs have developed (Office of the National Coordinator of Health Information Technology, 2012). This constant change can interfere with the cognitive processes which again threatens data integrity. If nurses have a clear understanding of their role in the LHS they are more likely not to have threats to their cognitive ability when transforming data into decision-making for all users of the data. Understanding their role is necessary to make a LHS work efficiently and effectively for the patient's health and wellbeing.

Summary and Gaps in Literature

This review of literature discussed the conceptual underpinning of the data-information-knowledge-wisdom model which supports learning healthcare systems. Discussion of how concepts from complexity science, complex adaptive systems and big data influence the nature of the DIKW model was presented. The influence these models have on the entire healthcare system was discussed. The perception of the impact on the nurse caring for the patient at the bedside while collecting information in the form of data in an EHR is not well understood or reflected in the literature, further supporting the need for this qualitative inquiry.

Chapter 3: Methods

In this chapter the purpose of the study, the research questions and the methodology of the study design are reviewed. The design, sample, and setting are presented along with the description of the data collection procedures. Data analysis, trustworthiness principles followed, and evidence of rigor are also be presented. Ethical considerations for human participants conclude the chapter.

Purpose and Research Questions

To recap, the purpose of this study was to gain insight into what nurses perceive as their role in the development and use of new knowledge in a LHS specific to collecting and using information in the form of data collected through electronic healthcare records (EHR). This study's goal was to explore answers to these four research questions:

1. What are nurses' perceptions of what it takes to collect information representing the patient's health in the EHR?
2. What are nurses' perceptions of their role in capturing and recording information in the form of EHR data?
3. What are the challenges nurses have with EHR usability when trying to capture information in the form of data?
4. How do nurses use data to influence their practice?

Research Design

This study's qualitative descriptive design allowed me to explore nurses' perception of their role in information collection and use as part of a learning healthcare system (LHS). I explored the challenges nurses have with EHRs usability, data reporting, converting information into data and then back into useful information. I used an applied research approach where understanding the nature of the use of data was the key factor (Patton, 2015).

Specifically, I applied Sandelowski's (2000; 2009) qualitative descriptive methodology including purposeful sampling, semi-structured open-ended question, simultaneous data collection and analysis, data immersion and an inductive process for codifying and reporting the organized data in a descriptive manner. This method was appropriate to build new knowledge for a phenomenon which has little supporting information (Patton, 2015).

Sample

Patton (2015) stated that qualitative inquiry focuses on the relatively small samples to obtain purposeful meaning. Information-rich cases were purposively selected to maximize depth and breadth of information to describe the phenomena of interest. Since little is known about nurses' perception of their role in the LHS, the target sample was those who provide direct patient care and perform duties which included information collecting and reporting in EHRs.

The purposeful sample included licensed nurses from two emergency departments (ED) who enter patient level data in EHR during delivery of direct patient care. Rationale for sampling ED nurses was they are in a unique care delivery position because their time with a patient is limited before the patient is admitted or discharged. Due to the nature of emergency nursing, these nurses possess a wide breadth of understanding of the care needed for multiple patient issues which had to rapidly be reflected in EHR. This methodology allowed for a greater opportunity for more focused use of different types of information collected and used.

Inpatient nurses were not chosen for this study because they have a different focus than their emergency counterparts, i.e. inpatient nurses have more time to become better acquainted with the patient's condition and to interact with the information collected in the EHR. Conversely, special procedural areas are very focused on the patient's condition specific to the procedure and thus a more defined focus of information gathering, which was too narrow of a scope for this study.

Targeted sampling criteria included the nurse had to be a licensed registered nurse with over one-year experience, currently practiced in the ED delivering direct patient care, entered patient level data in hospital's EHR system, spoke English and was willing to share experiences with EHR systems and quality data. Due to advanced education on how to use information obtained from data, individuals with advanced practice nursing degree, management experience or data abstraction experience were excluded from the study. New graduate nurses with less than one-year experience were also excluded because the first year of assimilation into practice would be their primary focus.

To determine sample size, qualitative research relies on data saturation rather than power as is required for quantitative research (Patton, 2015). Marshall and Rossman (2016) state that data saturation is achieved when repeated patterns emerge and little more can be gained from further data collection. There is no literature supporting a given sample size for this topic. Therefore, sample size estimate was based on logical reasoning. This study's sample size factored in potential differing views from novice to expert nurses in practice and experiences. Data saturation was achieved with a sample of seven.

Setting

Participants were recruited from two midwestern hospitals located in two different urban areas. Facility types included one university-based and one community-based hospital. The university's main campus ED was used for recruitment. It has 42 ED beds with a total of 890 licensed admitting beds.

Initially, only the university setting was planned for recruitment. Due to slow enrollment, the study's setting was expanded to include a community-based hospital. The community hospital is licensed for 420 admitting beds with 38 ED beds.

Recruitment and Informed Consent

The university-based hospital's recruitment process began July, 2019 after receiving permission from the ED department director. Per the hospital's policy on outside study recruitment, a PowerPoint™ slide presentation explaining the details of the study was provided to the director (see Appendix A). He presented the recruitment information at the ED's department meeting and forwarded an email drafted by the researcher to eligible staff (see Appendix B).

Gaining permission to recruit from the community-based hospital required a presentation to their research committee, their IRB approval, recruiting a physician sponsor from their ED and KUMC's IRB amendment approval. Once they gave permission to begin, recruitment efforts included a presentation by me at the ED's monthly department wide meeting by me and the recruitment email sent by the director to eligible nurses. Both facilities posted approved recruitment pamphlets throughout their departments (see Appendix C).

Interested nurses contacted me directly by email to schedule a meeting. I evaluated the participant's eligibility by reviewing the inclusion and exclusion criteria with them. All nurses stating interest were eligible. They were then given the option to be interviewed in person or by phone. All participants preferred to participate by phone.

After scheduling the interview, the participants were emailed the informed consent document for review prior to the interview (see Appendix D). Information in the informed consent was verbally reviewed and all questions were resolved at the beginning of each interview. All participants gave their verbal consent to participate. Participation in the interview also constituted informed consent.

Data Collection

Qualitative research requires the researcher to be the primary instrument for data collection and analysis (Patton, 2015). As the instrument, it is important for the researcher to build a relationship with the participant so open and honest communication can freely occur when asking them to share their experiences. To develop and foster this relationship, the interview occurred in a relaxed setting most comfortable and convenient to the participant. I also had credibility with the nurses as I informed them that I have been involved in the specialty of emergency nursing for over 25 years. This made me able to relate to their experiences allowing for an even more relaxed interview session.

As the instrument, it was important to understand that while building the rapport with the participants, I had the potential to influence their responses. Mindful care and attention were taken to minimize the response influence I may have had by conveying their attitudes and views were valuable, useful and the target for exploration of this study (Marshall & Rossman, 2016).

The interview began with introductions, reviewing the purpose of the study, and subsequently obtaining information consent. To control for confidentiality and protect the participant’s identity, once informed consent was received, participants were assigned a participant ID number of RN 1, 2, 3, etc., which was documented on the Interview Tracking Log (see Appendix E). Information collected on this tracking log included the participant’s initials, assigned ID number, date consent was received, timing of the interview, and any process comments. This process secured the participant’s confidentiality while effectively managing issues during the data analysis and reporting. This log was kept on a secure password protected laptop and ultimately downloaded to the university's secured P-share drive when it became available. Only the researchers had access to this data.

The interview process used a semi-structured interview guide with questions about basic demographic information and core open-ended questions (see Appendix F). The focus was to capture what the participants deemed important in their perception of their role in a learning healthcare system.

Data Protection

The study was approved by University of Kansa Medical Center (KUMC) Institutional Review Board (IRB) under flexible review. Furthermore, when the second hospital was added KUMC IRB also approved the amendments. All documents pertaining to the study were electronically secured on the KUMC secured shared-drive storage site. Only three people had access to this study's secured shared-drive, the researcher, the principle investigator/faculty mentor and the minor faculty advisor.

Interviews were recorded using two recorders. After the interview, the recordings were uploaded to the KUMC's secured shared-drive. The recordings on the handheld devices were then deleted. Transcriptions were performed by the researcher. These transcriptions were also kept on the secured shared-drive.

Data Analysis

Qualitative content analysis aims to obtain a broad description of a phenomenon in a condensed format (Elo & Kyngas, 2007). Lack of knowledge about a phenomenon is a core tenant for using content analysis (Patton, 2015). Inductive content analysis searches for themes and trends to interpret an understanding of latent content (Sandelowski, 2000). Emerging patterns through the inductive process may lead to new theory development.

In alignment with the tenants of content analysis, this study’s findings were in alignment with identifying latent content of nurses’ perceptions of their role in LHS as it pertains to their interaction with EHRs. Therefore, an inductive content analysis methodology was appropriate for this phenomenon of interest as little is known about nurses’ perceived roles in LHS.

Simultaneously collecting and analyzing the data is an important characteristic of this type of qualitative research (Patton, 2015). Data analysis, being an iterative process, was ongoing after completion of the first interview until all data were thoroughly analyzed. Analyzing the data as the interviews progressed was useful as modifications and minor changes were needed during the individual interviews. Data immersion was required as each interview occurred. Although the interview guide was used to drive all the participants’ conversations, each interview varied slightly from successive ones based on progression of knowledge attained during this iterative process.

Since inductive analysis is an iterative ongoing process to generate new concepts, explanations, and results from data, a coding process was defined (Patton, 2015). The data were read and re-read until conceptual classification of patterns emerged. The coding process occurred using a data reduction method. The first level was identified as the unit derived from the individual transcriptions in their entirety. The second level was condensing the units into units of meaning where the unit was reduced into separate individual thoughts. A synopsis of each meaning unit was reduced into a formulated meaning. Reduction was the next step where the formulated meaning was reduced to a phrase that described what the nurse was communicating. This reduction was further defined into concepts and ultimately the different concepts were categorized into themes.

The data were placed on a tracking grid with restatement and condensed quotes supporting the patterns. Repeated regularities in the patterns were demonstrated and classifications identified on the grid. As Patton (2015) suggested, I looked for overlapping bridging data, extending the data to go deeper into meaning or new categories that fit the meaning unit better to further condense the meaning's existence.

This detailed process promoted the right level of engagement with the data to vet out themes (Marshall & Rossman, 2016). Coding and categorizing data while developing themes included triangulation of the findings with the principal investigator/faculty mentor, the minor advisor and supporting literature.

Trustworthiness and Methodological Rigor

Qualitative research requires inquiry truthfulness, applicability, consistency and neutrality to obtain a trustworthy design (Lincoln & Guba, 1985). Lincoln and Guba (1985) also stated that to establish trustworthiness in data analysis credibility, dependability, confirmability, transferability, and authenticity criteria must be present. This study incorporated internal consistency by using participant engagement with an investigator familiar with the needs of the ED setting, triangulation of data with peer and current literature, and participant member checking to verify their intended meaning (Lincoln & Guba, 1985).

As recommended by Patton (2015), multiple procedures were included in this qualitative research design to support trustworthiness and rigor. Using purposeful sampling strategy, inductive reasoning analysis, triangulation of data outcomes with secondary data reviewers, and use of current literature.

Triangulation of findings is important to establish trustworthiness and methodological rigor (Barbour, 2001). As the codification process took place, the researcher triangulated findings with the principal investigator/faculty mentor, minor advisor and supporting literature using an iterative process until consensus was achieved.

During the data analysis process, audit trail detailing the analysis supported the development of the concepts, explanations, results, and themes. This emphasized the important focus of establishing data saturation and design rigor.

Ethical Considerations

Flexible IRB review took place at the university setting and approved. This was appropriate because this study was minimal risk; i.e. the interviews were focused on a benign topic which provided little threat to participants and there was no federal funding for this study. The community-based hospital's IRB approved the conduct of the study under an exempt from review category due to minimal research risk.

Participant privacy, confidentiality, and right to participate were supported throughout the study process. All email communications were sent through the KUMC email system. Digital information was stored on a secured shared-drive where only the researcher, principal investigator/faculty mentor and minor advisor had access to the study's files. All pocket recordings were then deleted once the upload was completed. Transcriptions were personally completed by me and the documents stored on the secured shared-drive. All analysis tracking spreadsheets were also stored on the secured shared-drive.

To maintain confidentiality, participants were coded with a unique number and outcomes were reported in an aggregate format. The hospitals the nurses worked at were not linked to their identification. This methodology supported maintenance of anonymity and dignity through the analysis and reporting phases. This confidentiality strategy mitigated potential participant risk.

Study Time Frame

Data were collected from September to December of 2019. Analysis was ongoing during data collection and completed in March, 2020. Findings were reported to the dissertation committee via dissertation defense on April, 24, 2020. Dissemination of the findings are planned through publications and presentations at professional meetings.

Summary

Details of this study's qualitative research methods including the purpose of the design, sample, setting, IRB application, participant recruitment, and scheduling were discussed. A semi-structured interview process was used to obtain the data. An inductive content analysis process was used for the data evaluation. Ethical considerations protecting the participants and the study's rigor and trustworthiness were addressed as they are key to a strong qualitative research design. It was also important to recognize and discuss potential limitations to the study. Lastly, the study's timeline was presented.

Chapter 4: Findings

The purpose of this study was to gain insight into what nurses perceive as their role in the development and use of new knowledge in a Learning Healthcare System (LHS) specific to collecting and using data from electronic healthcare records (EHR). To paraphrase the study's research questions, it was designed to further understand nurses' perceptions of collecting information representing the patient's experience in an EHR, what they feel their role is in capturing and recording information in EHRs, the challenges they face with EHR usability and how resulting data influences their practice.

A description of the sample is initially provided. Discussion of the findings begin with a description of the nurses' understanding of their interpretation of the meaning of data and a learning healthcare system. Inductive content analysis resulted in four distinct yet interrelated themes:

- The impact hospital's electronic healthcare systems have on human factors.
- Hospitals' leadership influences collected patient information and the nursing documentation process.
- Nurses are concerned about the impact of electronic healthcare record documentation on patient safety and quality of care.
- Nurses use the electronic healthcare record documentation process to assist in nursing decision-making as they care for patients.

The remainder of the findings section discusses these themes and further delineation of the data categories associated with them. A summary of findings concludes this section.

Sample

Seven emergency department (ED) nurses participated in the study. Three were from the community-based hospital and four from the university-based hospital. Details of the nurses' demographic data are presented in Table 1. There was a broad range of participant ages and years in practice as a RN. All the participants had been entering data into EHRs since the beginning of their practice except for the most seasoned nurse who started entering data as soon as EHRs were developed and rolled out to her unit. This individual had experienced the transition from solely paper charting to the full integration of EHR systems.

Table 1

Nurses' Demographics

Participant ID	Age	Gender	Level of Nursing Education	Years as as RN	Years Entering Data as an RN
RN 1	34	Female	Bachelors	10	10
RN 2	45	Female	Bachelors	3	3
RN 3	25	Female	Bachelors	3.5	3.5
RN 4	53	Female	Masters	30	15
RN 5	32	Male	Bachelors	5.5	5.5
RN 6	35	Female	Diploma	7	7
RN 7	38	Male	Diploma	4.5	4.5

Nurses' Interpretation of Data and Learning Healthcare System Findings

What the Term Data Means to the Nurse

To facilitate baseline understanding of nurses' perceptions of the EHR it was important to get a definition of the term data since that is the core of what is collected in an EHR. Nurses described data on a continuum from raw numbers to a representation of what nurses do. They viewed the collection of data in terms of a broad range of context-based "charted" information. One nurse (RN 5) said data "…by itself is meaningless unless in the right context".

Collectively, it was evident that data could include everything from singular pieces such as patient's age, focused information like medications, to all history, assessment, diagnosis and treatment information about patients. They further described that data needed to include the reporting side, such as the information they receive on time critical diagnosis (TCD) metrics for their patients diagnosed with a stroke, ST-elevation myocardial infarction (STEMI), trauma, or sepsis.

What Learning Healthcare System Means to the Nurse

It was also important to get a baseline understanding of what nurses thought the phrase learning healthcare system (LHS) means since the information they capture in the EHR is used for multiple different purposes such as informing patient care, quality monitoring, operational activities, hospital or unit budget and finance and public health initiatives. When each nurse was asked what a LHS meant to them, all seven nurses initially said they were unfamiliar with that term or concept. They were then challenged to make a supposition of what it sounded like it should mean. Their responses varied: "…always open to learning new things" (RN 1); "…using the information that we have to improve what we we're doing" (RN 2); "…sounds like a marketing ploy to sell something" (RN 5); "required computer training for everything we do…" (RN 6); and "…learns from nurses' feedback to improve" (RN 7). The closest to Kaggal et al.'s (2016) definition of LHS came from RN 3 who described it as being a representation of a system where all professions continuously learn something new to advance their knowledge base and help the nurse help patients.

Thematic Findings

Consistent with the qualitative descriptive design (Patton, 2015), inductive content analysis was used for data analysis. The seven interviews, i.e. the units of analysis, were reduced into a total of 989 units of meaning. These units of meaning were further reduced and analyzed for likeness and ultimately grouped into four themes. Some concepts defining these units of meaning were not mutually exclusive to one theme (see Table 2).

Table 2

Non-mutually Exclusive Descriptive Concepts Supporting Themes

Themes	Descriptive Concepts
The impact hospital's electronic healthcare systems have on human factors.	Adaptability Cognition Empowerment Expectations Feelings Frustration Interruptions Learning and training Motivation Stress Working memory
Hospital's leadership influences collected patient information and the nursing documentation process.	Accountability Compliance Expectations Influence Business needs Cultural support
Nurses are concerned about the impact of electronic healthcare records documentation on patient safety and quality of care.	Accuracy Accountability Communication Compliance Feedback Quality indicators Resource allocation
Nurses use the electronic healthcare record documentation process to assist in nursing decision-making as they care for patients.	Access to patient information Cognition Communication Education/learning Finding balance Interruptions Litigation Reference tools Resources Working memory

The Impact Hospital's Electronic Healthcare Systems Have on Human Factors

Studying human factors includes evaluating how human brains and bodies interact with organizational systems. The findings produced information on how nursing interactions with information and EHRs processes while performing their patient care duties. The seven concepts supporting this theme included cognition, adaptability, interruptions, learning/training, working memory, and feelings.

Cognition. Cognition requires information processing which includes bottom-up or top-down processing (Wickens et al., 2004). Most nursing functions are performed from a top-down information processing, referring to what the nurse anticipates and expects to happen. The nurses presented several issues with information processing, including what and where to document data while simultaneously caring for the patient. Examples of challenges included, determining location and functionality of needed equipment, finding the correct place in the chart to capture the patient's experience, and deciding when and where to chart while delivering care.

Furthermore, they also described external and personal internal pressures impacting the way they performed their charting. External expectations came from administration, patients, rapid changes to the documentation systems, and perceptions of what other staff members need for the continuum of care.

RN 7 best represented it by describing how to document in a way that the continuum of care can be followed by other nurses caring for patients:

> when I was a floor nurse…what did I need to see…from previous charting. What, what did I value? Honestly, I didn't value - oh did you have like an unsuccessful IV start. That didn't bother me. Did you give like a blanket downstairs? Did you give them a snack downstairs? That's not really that big of an issue. But what I do need to know is like that focused assessment. Like that thing that brought them in. How were their lung's sounds? …I think there's a hierarchy…

The biggest internal pressure noted by all seven nurses was the feeling of the need to mitigate any potential future legal situations by making sure they documented everything so they could remember the details of that patient's episode in the future if they got called into court. RN 2 described her documentation process as such:

> …when I do an assessment, if it's something, I almost always put a note in anyways like within my assessment, to try to make it…detailed as far as why that patient's here or whatever, you just hear a lot from nurses it's like it's got to be thorough enough and specific enough that if you got taken to court could you, would you be able to remember this patient…I need to make sure to protect my ass.

When discussing if the nurses were familiar with organizational documentation policies, RN 3 reverted to discussing the power of EHRs in defensive charting:

> …interactions with the patient that could be a possible issue later with like things with the patient where you always want to protect yourself. The EHR's also a great way for staff to protect themselves against…patients and things that can come back later as far as…legal ramifications if they want to sue. If you have a patient come in and is adamant about suing, EHRs' great for nurses and doctors to kind of cover themselves and be like, this is what happened. This is what time this happened…and I do like that it gives you that timeline to be able to accurately present if you ever were involved in something where you needed to go to court.

However, as RN 5 put it when discussing the idea of documenting enough to remember the details of the patient's experience years down the road, "…that's just not feasible…". He further expressed challenges with finding balance between documenting enough and taking care of the patient. This concept will be discussed in detail under the reasoning for care theme.

Adaptability. Internal and external pressures force nurses to be adaptable to changes in the EHR system as RN 4 discussed, "…I just kind of laugh anymore. I mean, honestly, they're always going to be updating things…I think sometimes the things are helpful. Sometimes, I know they just won't and I'll have to find a workaround".

Nurses must also adapt their documentation based on patient and family interactions and work environment. Discerning factors included the ability to adapt based on patient's perceptions of them documenting in the room; individual caseload acuity levels; overall departmental acuity level; location of care, i.e. triage, behavioral, trauma rooms, critical care rooms, main care areas, transports; and volume of patients in the waiting room. Adaptability to current situations was best described by RN 2 when discussing the need to make judgements on when and how to document by saying:

> …honestly, a lot of it depends on the day, depends on the patient. If I have an ICU patient, then I try to keep up with that charting just because I think that's really important. You know, they're there for more than like a strep test or something…It's all important but you know, a little more critical, a little more higher acuity.

RN 6 further described the need for nurses to be adaptable by saying "…the expectation is always that we learn something new and change and we have to adapt well to it…otherwise it makes our job really hard if you're not adapting well".

Interruptions. Interruptions in nursing has been a long-standing issue that has been linked to errors and patient safety. The emotional toll that interruptions had was best described by RN 3: "…sometimes I'll get half a note done, I'll have to come back and finish it. The amount of times I get interrupted charting notes is ridiculous…to be honest, that's probably my most frustrating part." She further described the impact interruptions had on charting accuracy:

> …when I do get interrupted, I feel coming back to it, I may not remember everything that

> I started charting. I may have started charting with one intent and end it with a this is their history and this is what I can remember from what they told me.

Patient and information flow through the registration, triage, and main care systems also cause documentation interruptions. The logistics of the documentation process will be discussed further in the reasoning of care section.

Learning and Training. The nurses described three different ways of learning how to use and stay current with changes to EHRs. Primary learning took place in a formal classroom setting where content experts work directly with staff on how to use the system. This only happened when they first started in the ED or when an initial adjunctive electronic system is rolled out. One exception was RN 7 who was forced to do on the job training. Initial ED training in a classroom did not take place since he had previously worked on another unit prior to transferring to the ED. He described it as “a frustrating time” because he knew what was needed to be done but couldn’t get to the point in the system where documentation was to take place. This forced him to interrupt patient care to find someone who could help instruct him on how to complete the patient’s documentation.

The most common way these nurses learned how to use upgrades and changes to the EHRs was through the emails by staff outside of the ED. At times these programming changes happened once a month or more. The nurses would have to try to remember the changes while caring for patients.

Lastly these nurses described learning the most from each other. RN 4 described a story that involved learning secondhand from a student:

> …sometimes it’s really just asking some people around you how you get somewhere. We actually had a…student that was following one of the nurses that showed us how to

> retrieve information that you had actually deleted. She shot out an email to a bunch of us ‘hey look what my student taught me’.

Working Memory. Working memory, more commonly known as short term memory is felt to be a challenge by these nurses. They described short term memory as being an issue especially when charting had to be delayed. As discussed in the adaptability and interruption sections, internal and external factors cause delays in charting. RN 1 described it as “…I feel like if I walk out the door someone’s going to ask me something or have me go somewhere else and then I won’t get to chart it forever…as well as forgetting what happened”.

The nurses described their concern with their memory as how it impacted the accuracy in their delayed charting. While discussing challenges with documentation and caseload, RN 3 felt accuracy was “skewed” when documentation was delayed. When exploring accuracy in charting with RN 5, this nurse stated “…real-time documentation is going to be as accurate as it gets”.

Nurses discussed the need to create some form of a memory aide especially during TCD cases when electronic charting would be delayed because the direct focus was delivery emergency care. These aides could be jotting notes and times on whatever they had available. They also described times where they would have to back-chart a piece of information. They would have to estimate the information to be charted by using references from when something else happened such when they performed a procedure or administered a medication. The process of having to look back at other documentation to accurately back-chart increased their work load. RN 7 felt this was a problem especially if what was put in the system wasn’t accurate to begin with.

Feelings. A plethora of different feelings about documenting while delivering direct patient care was shared. Although charting was described as tedious, they understood that charting in the EHR was necessary. Frustration was the most frequent feeling described. Causes of frustration included: time away from patients to chart; the amount of required charting; audits; trying to simultaneously chart while delivering patient care; the number of changes with the system; and lack of training. The concept of stress was never overtly discussed but a latent connection could be made when they spoke of some of their defeated feelings such as being frustrated by not being able to do it all.

There was also a recurrent feeling that quality reports which came from the information entered in the EHR was a good thing. Results from those quality reports gave a sense of pride when seeing that TCD metrics were performed within the established goals or a process improvement was working. When talking about reviewing TCD quality reports, RN 3 said, "…I became a nurse because I wanted to help people and do good things for people. It gives me that full embodied feeling of 'okay this is why I became a nurse that I can make a difference in patient's life".

Hospital's Leadership Influences Collected Patient Information and the Nursing Documentation Process

Leadership refers to those individuals in the hierarchy of employment who oversee clinical and operational performance. They were described by the nurses as having a significant impact on the required charting. When asked what they felt their supervisor's view on the importance of EHR use, all nurses needed clarity on which supervisor. This led to discussions about how the different levels of leadership impacted their documentation and care processes.

They described their supervisors as being charge nurses, managers, and directors. All were felt to have a different influence on workflow in relation to what information is collected and reported.

Directors were thought to be interested in items such as what is needed to meet regulatory and business needs. This included oversight of macrosystems to meet accreditation standards, as reflected by RN 1, and billing, as RN 5 discussed.

It was felt that managers were interested in performance metrics and operational flow such as ED volume and throughput. Performance oversight included quality, nursing accountability, and compliance reporting. RN 1 stated:

> I think the manager of the ER really likes to look at the data and the information to track and trend. To see even if it has anything to do with like our patient how many patients you saw this month, or how quick they're getting back or discharged. Umm, I think she really likes to look at that.

RN 4 felt "…they look at it based on numbers of patient that we see as far as ER volumes". The thought was that charge nurses weren't as interested in the data as they were in the functioning of the unit. RN 1 felt that the charge nurse thinks like her and that the documentation is less helpful than managing the patient's and their care. Charge nurses were also described by RN 7 as having their own documentation needs.

Each level of leadership asks something different to be captured and reported by the nurse's documentation. The nurses described the prioritization of documentation based on what they know leadership looks at first. RN 7 represented it best when he said:

> I feel like I'm more apt to always chart what is followed and then do my best to get the other stuff that is expected…again, there are some things that are viewed as very important, that we will get feedback from if it's not taken care of…

Leadership was thought to be very supportive of the staff when it comes to documenting. It was believed that the EHR could be used to hold staff accountable, but it is not used as a punitive tool to watch over the nurses unless there was a habitual problem to address. RN 2 described it as:

> …they don’t use it as punitive. I mean, if it became something with if a particular nurse was doing something repeatedly…and they’d been asked to change that behavior, then it would become punitive. But, for the most part in situations like that, you know, they use it to learn from it to improve a system.

Nurses are Concerned about the Impact of Electronic Healthcare Records Documentation on Patient Safety and Quality of Care

Patient safety, clinical quality, and compliance feedback reporting were discussed by all the nurses. Concepts derived from these discussions included potential patient safety issues from missing or erroneous documentation and quality and compliance feedback reporting obtained from the information nurses enter.

Safety. Patient safety concerns seemed to be the biggest issue these nurses had with EHR documentation. They described accuracy in documentation as being their number one patient safety concern in charting. Documentation inaccuracies seemed to be rooted in delayed charting and interruptions. Personal documentation preferences and issues with EHR designs were also described as causes for inaccuracies.

Most nurses preferred documenting at the bedside, especially during the initial assessment. “It’s convenient”, described RN 6. This convenience helped mitigate accuracy issues from delayed charting. However, this nurse went on to describe times when she needed to leave the room to chart:

> I feel like most of the time I am able to document in the room. Sometimes children are harder to document in the room…or if is a like a patient code and the patient is deceased

> and their family members at the bedside that are with the patient following that then I do not chart in the room…to give the family time with their loved one that's just passed away.

RN 7 had a different perspective when discussing if he preferred to document at the bedside or delay his charting for a later time:

> …usually it's just the stuff that I could do very quickly charting an IV, or charting orthostatics, or…like putting on cardiac monitor or something like that. That…I'll do it in a room. But for the most part, it's usually I try to get everything done on everybody that I have and then I'll just chart solid for probably 10 or 15 minutes if I have that time.

He did agree that this process probably leads to less accurate information, "I do feel…sometimes it's incomplete". This nurse, as did others, made it very clear throughout the interview that patient care always took precedence over charting, "EHR documentation is important...I will always choose patient care over EHR documentation".

Inaccuracies in the form of missing documentation can directly cause danger to patients as described by RN 2:

> …we had a nurse at shift change. We had given the patient morphine and then that next nurse came on and it was never entered in that they give them morphine and gave them another dose of morphine. That gal's respirations were like 2 a minute.

This nurse also described a time when a temperature was not taken on a patient before they were transferred to the intensive care unit:

> ...a new one that they're talking about that we needed something and it had to do with the temp and it was a patient who ended up going up to the ICU and having to make it up there with nobody ever getting a temp on this patient…and when they got upstairs, they

> were…like 86 degrees…and so somehow that got overlooked….Given the fact that you don’t have infinite time. usually that means something else may not be getting documented in lieu of that.

Capturing accurate information in the patient chart is also reliant on the patient. Potential downhill safety issues can happen if the patient cannot remember their history or gives the nurse inaccurate information about their medication as RN 5 described in this patient exchange, “…Do you have any health problems? No. What meds you taking? Well see this little white pill for my blood pressure and I take one for my cholesterol”.

The design of EHRs make it a challenge for nurses to reflect the patient’s condition. Discrete fields and character limit settings in some sections were described as two features that did not meet the needs of the documenting nurse. “When I was trained, I was taught ‘you’re painting the story for everybody who doesn’t know this patient what they look like,” said RN 3. RN 4 further described her challenges with charting, “I chart a lot of notes because there’s so many discrete things that are overwhelming and you can’t always find them. There’s just so many and they don’t always fit what I want to say”.

When discussing discrete fields with RN 1, she said, “I usually choose to do it narrative just cause that way I don’t have to bother searching for it”. All nurses said they will take the time to use the narrative section of the chart which doesn’t have character limits to give a thorough description of the patient’s condition so they can better paint that picture.

Quality. Quality monitoring and feedback was described by the nurses as the quality reports and staff compliance tracking presented to them. Results from monitoring aggregate quality indicators were presented in group settings. Staff compliance monitoring and feedback were individualized.

Quality metrics included TCD measures which all nurses discussed and felt were very important and closely monitored by leadership. Reporting included the times it takes for certain functions to be performed on patients presenting with stroke, STEMI, trauma or sepsis. RN 4 described some of these metrics:

> For the ER a lot of that has to do with some of the time sensitive stuff…orders…that get loaded for stroke and trauma and STEMI. Things like that. Getting an EKG done and ordered for anybody that comes in with XYZ symptoms.

RN 3 elaborated on the importance of the TCD metrics, "…those are things that directly if you don't do something right now that patient could die".

These reports were presented in an aggregate format at department wide meetings. RN 7 indicated when there is something that needs to be worked on the information will also be presented during staff huddles:

> …so, when we do huddle where we…do talk about…places where we're struggling…as a group. We'll see how well we're doing on our…for example getting patients…that come in with stroke symptoms, or that come in with MI symptoms, how quickly we are getting them to intervention…that's closely followed.

Although it was voiced that tracking TCD metrics were important for quality of care, it was also thought by some that there were other motivating factors for the need to track these metrics. RN 1 discussed accreditations being a motivator for the organization to track TCD metrics:

> …overall, they're really good at tracking sepsis…they do a lot with…STEMI or like chest pain…it's because of our accreditation. Things like that too, so that's kind of their driving factor, in strokes, in traumas like yeah, they're more of the hot things to track, but

> I think it has to do with the accreditation as well.…

RN 3 felt the same about organizational impact when established TCD benchmarks were not met:

> …how are we doing with our EKG times when we get patients that come in and they have chest pain and we have to get that EKG done and read by an attending physician in 10 minutes? Um, otherwise we are out of the window. We don't meet our standard as in there are, I'm not sure what the ramifications are but we get ramifications from Joint Commission for not…meeting our times.

Besides seeing the information in the quarterly department meetings and during huddles, some of the quality indicators are also presented on charts in the breakroom. RN 3, "We have a chart in our breakroom that monthly tracks our performances how quickly the patient was flagged for what's called SERS criteria or sepsis criteria. How quickly they flagged for that and then how quickly they got their antibiotic administered".

This information is also used to influence staff's practice. Top performers are recognized. This type of recognition motivates a competitive nature among staff as RN 1 described:

> …for example, our educators umm, will pull statistics from like our patients with sepsis and recognize the nurses that, umm, delivered like our protocols for sepsis the quickest. Umm, like who was quickest with their fluid bolus and antibiotics being administered and blood cultures. Umm, so that is kind of one way we use the data…I'm also kind a competitive…I really feel like it motivates most people to be like Oh Yeah, Okay, I'm working on this.

Dedicated quality coordinators specific to the meeting the analysis needs of the ED are reportedly present at both facilities. Their responsibilities were described as performing chart audits and reporting TCD and non-TCD indicator findings to leadership for dissemination. Non-TCD indicators were described by RNs 3, 4, 5, and 7 as information such as documenting safety checks in alignment with protocols, pain medication follow-up, documented assessments and vital signs at the appropriate times, medication barcode scanning rates, in-puts and out-puts of non-critical patients, and comfort measures such as warm blankets, food, and drinks. RN 3 specifically said, "They use it for chart audits to make sure nursing staff is doing what they're suppose to be doing".

Furthermore, RN 2 discussed the metrics along with an 80% threshold compliance rate is reviewed individually during personal huddles. Due to the need to protect patient safety with medication administration, RN 4 discussed that a 98% threshold is used for medication scanning.

Information provided by the quality analysis coordinator is valued by the staff as demonstrated by RN 6 when she stated:

> …I do feel like the information they are able to collect from the electronic records does provide, um, sometimes negative but sometimes positive feedback to allow us to improve our charting system. And, also, to help us improve the care for our patients based on the data that they collect.

Nurses Use the Electronic Healthcare Record Documentation Process to Assist in Nursing Decision-Making as They Care for Patients

Reasoning for care refers to the elements of the top-down processing required for the nurses to perform when working with the patients while trying to document in the EHR. This theme includes prioritizing/balance, information access, and communication.

Prioritizing/Balance. These nurses made it very clear that taking care of the patient always came first. RN 7 said it best when describing prioritizing documentation of non-critical patient information:

> …the inputs and outputs in the ER on a non-critical patient. Sometimes those do get sacrificed for the sake of patient care….I get why administration is asking that of us but they're going to have to understand that if we have to choose, we will choose the patients over charting appropriate, charting everything…There's just so many different nursing tasks that you can chart on that aren't very big.

This nurse further described that although he would not sacrifice patient care for the sake of charting, he feels charting is important enough to sacrifice personal care, "…I definitely have taken shorter lunches…held my bladder…I won't sacrifice patient care for many things, for anything, but, um, sometimes a little selfcare…gets sacrificed for EHR documentation".

Prioritization of documentation changes with patient influx as described by RN 3, "If I get three patients at once I'm meeting all those patients, getting all those stories, then coming out and charting. I'm not delaying patient care". Although she prefers charting at the bedside, where she documents can change:

> … if I get 2 patients at once, or 3 patients at once, or 2 from triage and one from EMS. Then I just have to look at all 3 of my patients and prioritize their levels and decide who needs to be charted on more quickly.

Finding balance was a concern for the nurses, especially RN 2. She grappled with enough patient face-to-face time being present with the patient against the required documentation:

> …it is difficult in the ER to kinda keep up with both at the same time. We do have computers now in every, all of our rooms, so it's a little easier to kinda do a lot of my charting when I'm in there talking to the patient. But then you also kinda loose the face-to-face interaction with them because you're on the computer charting.

At one point in her career, she was instructed to spend less face-to-face time in the patient's room and move on. Then later go back in the chart to finish "…it's like…that balancing of time trying to manage my time versus being…present with my patient". She described feeling that getting to know the patients a little bit is important to her and the one thing she enjoys about the practice.

Information Access. Immediate access to patient information in EHRs was identified as important. The nurses described how they would look through the patient's chart prior to entering the room to be able to prioritize the needs of that patient and plan their patient interactions as is described by RN 2:

> …I will look back at the history and that way I have an idea of what I might be getting into with my patient…with patients that have a psych history, I kinda like to go through there, just to kinda see again…what I'm to to kinda expect, or to see what they've used in the past to, you know, to help the patient.

RN 5 described his interactions after reading the patient's chart, "All the information you read in the chart changes your interaction in some ways. It's just to what degree".

A pop-up flag system containing information about specific issues the patient may have is available in the EHR to alert nurses as they prepare to deliver patient care as described by RN 5, "if you have a pop-up in the EHR before you go in the patient's room 'hey, patient's deaf, you'll need a translator. That changes your interaction". He further described a scenario where the pop-up flag system protects nurses, "If patients exhibit behaviors, and violence, stuff like that, that's something that people should be aware". RN 3 even described how the flag system supports potential sepsis patients, "…how quickly the patient was flagged for what's called SERS criteria or sepsis criteria. How quickly they flagged for that and then how quickly they got their antibiotic administered".

The immediate accessibility of the needed information provided by EHRs could make a difference in the patient's continuity of care. RN 4 described what its like to have rapid access to patient's history:

> …the biggest thing I noticed when we first started using EHRs was that you could have a patient who had been in the hospital yesterday, had been discharged yesterday and they're now coming back because they have a complication or a new problem. I can get back in and see everything that was done during that hospitalization. Ten to fifteen years ago, that didn't happen. You spent hours waiting for medical records to find their chart and bring it up. It usually didn't even have the discharge teaching or the discharge done yet.

Electronic information from affiliated hospitals also provides for a more seamless care delivery experience. RN 2 described using this information, "It's just there and makes it easy for everybody to access…a little more seamless use of it to help care for that patient".

Accessibility to all patients' information within the unit also fosters better care by creating a sense of teamwork. Information can be seen by multiple providers at the same time. If a nurse is in with one patient but something is needed by another patient on their caseload, a surrogate nurse can step in and catch up by referencing the patient's EHR.

There are embedded links within the EHR system that nurses value. They described these links as being frequently accessed. Drug reference information was the most commonly discussed. RN 2 uses the drug reference as a means of making sure what she is giving the patient is compatible. She also stated that she uses the information to expand her own knowledge or to answer patient's questions:

> I always look at stuff in the…drug reference and stuff. I'm always double checking to make sure we've got compatibility with meds. Or just like, I've not heard of this med before what is this treating you know. So, I'll look it up. Or if the patient wants what's this treating, or whatever, I almost always just go ahead and pull up…even if it's like a simple, you know, like Zofran or something I'll describe it but then I'll pull up…that way it's like oh it's official.

Communication. The EHR is felt to be an excellent communication asset when the tool is maximized. Using the EHR as a communication tool improves patient care and ED throughput. RN 3 said, "…it's honestly the best communication tool we have".

The communication functions embedded within the ED's EHR extends beyond just demonstrating what the nurse has actively entered for other caregivers to follow such as assessment, treatments, and vital signs. According to RN 4, it also has the ability to flag completed tasks like when radiology results are posted and labs have been sent or are resulted.

The functionality of ED's EHR also has the potential for staff to make notes for other staff members. An example was provided by RN 3 when she discussed nurse and physician communication workflows:

> We're always moving at a very very quick rate. Being able to have that ability to communicate without having to physically go find somebody or physically have a conversation, I'm all about face to face or over the phone interaction. I think that's great. I think that's an unrealistic expectation in regard to the care we're expected to give…sometimes, I've got to get ahold of 3 or 4 doctors at one time for all my different patients. That's 4 individual people I have to either find within my department or page and wait for a page back.

Spending a lot of time in triage, RN 4 described how important it is to have the communication functions. It allowed her to help direct patient placement and find staff support to meet the needs of the patients:

> I think it improves the flow of being able to see where things are at in real time…It's how you see how busy triage is. It's how you see how many labs…somebody has ordered. Um, yeah, I mean you can virtually see how any nurse is doing. This nurse has these rooms and she can tell that she's got 3 patients placed in there right now and they're all sick. So, you know, if I'm in triage, that means that I am calling the flow coordinator or the charge nurse, or somebody that I know is floating so they can help them. Hey, I've had to put…2 people in here or this person is really sick and I need somebody else in there. Um, you can look and see you know wow, you know the reason my patient in PLS is not going anywhere is because they have two patients back there already. Oh, there's a trauma. I didn't even know there was one.

Miscommunication is a safety and quality patient care issue as stated by RN 7, "miscommunication impacts the quality of care". RN 3 added that she felt, "the biggest set-back in patient care is the lack or the miscommunication, or just purely the lack of communication".

Summary of Findings

The study findings provide an overview of the distinct yet interrelated concepts these nurses made as they shared their experiences with documenting in an EHR while trying to deliver patient care. The four themes (abbreviated) that emerged from the data are, human factors, leadership, safety and quality, and reasoning of care. The study findings provided information on the impact the nurse had on the EHR system and conversely how the system impacted the nurse's ability to deliver patient care. There was also discussion of what the term data means to these nurses along with what they felt that being a part of a learning healthcare system meant. It was felt that overall, the EHR was a positive tool, but trying to care for patients while documenting could cause issues with quality and safety. The drawback of using EHR was the challenge of trying to find the right balance of the amount of information to collect without impeding direct patient care.

Chapter 5: Summary, Discussion, Implications, Conclusion and Recommendations

To recap, the purpose of this study was to gain insight into what nurses perceive as their role in the development and use of information and new knowledge in a learning healthcare system (LHS), specific to collecting and using information in the form of electronic healthcare records (EHR) data. The study's methodology was guided by four research questions:

1. What are nurses' perceptions of what it takes to collect information representing the patient's health in the EHR?
2. What are nurses' perceptions of their role in capturing and recording information in the form of EHR data?
3. What challenges do nurses face in EHR usability when trying to capture information in the form of data?
4. How do nurses use data to influence their practice?

Inductive data analysis was used to gain an understanding of nurses' perception of their role in a LHS specific to the use of EHR. A summary along with the discussion of findings as it relates to the research questions is presented. Implications of the newly gained knowledge and recommendations on how that knowledge can be used to further practice and research is also presented. Conclusions describing the study complete this chapter.

Summary of Findings

Four themes emerged from this study's data:

- The impact hospital's electronic healthcare systems have on human factors.
- Hospitals' leadership influences collected patient information and the nursing documentation process.
- Nurses are concerned about the impact of electronic healthcare record documentation on patient safety and quality of care.

- Nurses use the electronic healthcare record documentation process to assist in nursing decision-making as they care for patients.

Distinct yet interrelated concepts were identified supporting these themes as the nurses shared their experiences with being a part of a LHS using EHR data.

Overall, the nurses felt the EHR was a positive tool. However, they grappled with trying find balance in caring for patients while documenting. Leadership influenced what and how they collected information but they never let documenting in the EHR get in the way of caring for the patient. The data they provided described the importance of finding the right amount of interaction with the EHR as a tool without impeding direct patient care.

Summary of Themes Relative to Research Questions

Research question one asked 'What are nurses' perceptions of what it takes to collect information representing the patient's health in the EHR?' To best answer this question both internal feelings and external documentation processes needs to be considered. Therefore, the themes '*The impact hospital's electronic healthcare system has on human factors*' and '*Nurses use the electronic healthcare record documentation process to assist in nursing decision-making as they care for patients*' help answer this question.

Nurses described how difficult it was to find balance between documenting and delivering direct patient care especially during events where time critical diagnosis (TCD) were involved or higher volumes and acuity levels within the department. They grappled with the demands on their time to perform charting when all they want to do is take good care of their patients. They also voiced frustration with the way the entire healthcare system makes them feel, meaning they do not feel they can do everything required or expected of them. There were constant interruptions affecting their workflow, the feeling of a need to perform defensive charting, and recognizing the requirement to continuously be adaptable.

Capturing the most information in the chart to paint the best picture was felt to be important. However, they struggled with EHR operational issues such as deciding when to use narrative notes versus predetermined discrete fields. They also discussed the importance of having an EHR in the patient room which simplified the documentation process but at the cost of eye-to-eye contact with patients.

Research question two asked ‘What are nurses’ perceptions of their role in capturing and recording information in the form of EHR data?’ The theme ‘*Nurses use the electronic healthcare record documentation process to assist in nursing decision-making as they care for patients*’ describes how they use the EHR to process patient information. They recognized that what they enter during their interaction with the patient may have a potential impact on patient care later. It was important for them to note that what they put in the chart is seen by others and may impact future decision making. The use of flag warnings or things like a patient being deaf were important to capture.

The ‘*Nurses are concerned about the impact of electronic healthcare record documentation on patient safety and quality of care*’ also helps answer this question. The nurses felt that accuracy of what was entered in an EHR has the power to influence patient quality and safety. There was a sense of information ownership they collected in the EHR.

Research question three was ‘What challenges do nurses face in EHR usability when trying to capture information in the form of data?” Again, ‘*Nurses use the electronic healthcare record documentation process to assist in nursing decision-making as they care for patients*’ supports this question. The process of documenting in the EHR is wrought with challenges. They described how the use of the right descriptive discrete fields was too difficult to find and did not represent the patients' condition well enough. They also described how finding time to document and frequent interruptions made documenting a challenge. The unit's overall acuity and throughput also impacted the EHR's usability.

Human factors as described in '*The impact hospital's electronic healthcare system has on human factors*' theme also played a role in the system's usability. Interruptions and patient flow frequently caused the nurses to have to back-chart. That required them to create memory aides which added steps to their workflow. Frequent EHR system changes along with lack of education and training were also described as issues with EHR usability

Research question four, 'How do nurse use data to influence their practice' looked at the interaction between data and nursing practice. '*Hospital's leadership influences collected patient information and the nursing documentation process*' best supports this research question. The nurses felt that leadership had a big influence on what they were required to capture in an EHR. The information the nurses provided helped upper level leadership meet initiatives such as accreditations and operational functioning. It also helped with staying focused on reportable TCD metrics. From a lower level leadership position, accountability metrics were collected and reported back to the nurses. This feedback influenced their performance as they tried to improve.

They also used the data in EHRs for direct care decision making as described in the concepts supporting the theme '*Nurses use the electronic healthcare record documentation process to assist in nursing decision-making as they care for patients*'. The EHR allows the nurse immediate access to patient information which drove their care decisions. Accessible references in the EHR systems also helped the nurses decide the best course of action for patient care.

Discussion

This study’s findings advanced the evidence of what nurses perceive as their role in the development and use of information and new knowledge in a LHS by collecting and using EHR data. The findings provided an overview of the complexities and challenges nurses face in being a part of a LHS, including documenting in an EHR while delivering patient care. Although they understood the importance of information collected in EHRs, nurses were continuously stressed with finding balance between providing direct patient care and documenting patient information, capturing required information as defined by their leadership, and performing mitigation strategies in documentation to protect themselves from potential legal actions. Meeting the demands of both internal and external pressures influence their documentation decision-making. They also considered the impact their documentation decisions had on the patient during the current visit and potential future ramifications.

The participants in the study were diverse in their age, level of nursing education and years of practice. Yet all had experienced documenting in an EHR for either the longevity of EHRs in their facility or as part of their entire practice experience. Their collective knowledge demonstrated they all faced the same challenges with system usability, expectations, and finding balance between documentation and direct patient care.

Quality reports such as those with TCD metrics were considered valuable. These reports allowed staff to measure team and self-performance. They added that all the quality reports they received provided motivation to improve care.

Patient safety is a big concern. Nurses recognized the accuracy of information provided in the EHR could directly impact patient safety. However, they also described how difficult it was to make sure the information was accurate with all the other pressures on their time. This is in alignment with Sharpe and McDermott (2009) who believed that accuracy and productivity decreased when multiple tasks were required by the same person at the same time. Delayed charting seemed to make the biggest impact on accuracy. Processes, emergency department patient flow, and acuity all had an impact on whether they had to delay charting. Furthermore, nurse preference for when and where to chart impacted their practice.

There was a perception that there are multiple uses for the information collected in EHRs beyond direct care of the patient, including leadership initiatives, accreditations, billings, and process reporting. However, none of the nurses stated that the information collected in the EHR was used outside the hospital. This implies a lack of understanding that the information they are responsible for collecting is used for research, public health or even legislative support. This demonstrates a lack of understanding that what they collect in the EHR is used beyond a specific patient, which Friedman et al. (2016) discussed as a need in a LHS.

Findings from this study also demonstrated that nurses identified with multiple meanings for the term data. Data and information were frequently used interchangeably. The nurses felt data could be a single point to be made, used to define what nurses do or a patient's condition. Although the data-information-knowledge-wisdom model appears to be linear, the nurses' representations were complex, similar to what Ronquillo, Currie, and Rodney (2016) demonstrated in their model.

Learning healthcare system was an unfamiliar term to these nurses. Potential meanings were extrapolated from the context of the phrase but nurses never overtly made the connection that the EHR data they entered was the main source of LHS information as described by Kaggal, et al. (2016). They did understand and report that the data they entered was used to follow quality metrics, compliance and improvements in newly implemented processes.

The study’s findings demonstrated the complexities involved in nurses delivering direct patient care while entering data into the EHR. They described the complex nature of accurately telling the patient’s story in an electronic format while giving care. This supports the idea that nurses operate in complex adaptive systems as they interact with each other, EHR data and patients simultaneously (Hast, DiGioia, Thompson, & Wolf, 2013; Koerner, 2009; Lanham et al. 2013). The findings indicate the data could be used to document patient care, protect oneself from litigation, show nurse accountability, and operationally in billing and accreditation purposes.

The interconnectedness of this complex system has substantial and unintended effects as demonstrated by the frustration they felt with frequent changes to EHR systems they attempt to keep up with. The nurses described times when changes were made to the EHR which had an unintended affect that could have impacted the patient nurse interaction.

EHRs offer the power to communicate in ways that are not simply homogenous patient information in discrete fields as described by Lanham, Leykum, and McDaniel (2011). The nurses were able to extrapolate multiple meanings from information presented such as communication between departments, unit flow, and patient placement and acuity. They could also communicate through the system when something arose that the nurse had to inform another caregiver about, like conversational speech. This ability to communicate in multiple ways in a complex system is important to understand.

Strengths of the Study

This is the first study to explore nurses’ perception of their role in the development and use of information and new knowledge in a LHS specific to EHR data. The qualitative approach was a strength because it provided an avenue for nurses to voice their thoughts and feelings about entering patient information into an EHR while they provided care . They were able to describe the benefits and challenges with being a part of a LHS using the patient data they entered. This study's findings provided a rich description of their perceived experiences, the phenomena of interest.

Another strength of the study was doing data collection over the phone, where the nurses felt most comfortable and was convenient to them. That allowed for a more relaxed interview. Being a veteran of emergency nursing, I was also able to relate to their emergency nursing experiences giving me credibility as they shared their experiences. Member checking took place throughout the interviews along with probing questions to further understand their meaning.

Limitations of the Study

Sampling bias must be evaluated as a limitation. This study was limited to two emergency department settings at two midwestern hospitals. Furthermore, it only explored emergency nurses' perceptions, excluding all other health care professionals such as physicians who enter information into EHRs while caring for patients. As such, the ability to generalize the outcomes to other practice areas of nursing, other types of providers or even the entire learning healthcare system is limited.

Implications for Practice and Research

This is the first study evaluating what nurses perceive as their role in the development and use of information and new knowledge in a LHS, specific to collecting and using EHR data. Nurses face many challenges in caring for their patients while documenting that care and the patient's condition in EHRs. The data they enter is used in multiple areas of the healthcare industry. It is critical for nurses to understand their role and the impact the patient level information they are responsible for collecting has on the entire LHS. It is also imperative that leaders in the healthcare systems understand the impact and toll it has on the nurse to carry the burden of accurately documenting many pieces of information while delivering care to the patient. A bilateral level of understanding could lead to better resources being provided to support nurses. Potential downhill impact could be better information captured in EHRs from which to make better decisions.

Nursing informaticians are necessary on the front line of systems development. These individuals are equipped with tools to assess the impact human factors have on an EHR systems and how those systems affect the human factors interacting with it. They have the ability to translate communication between clinical and information technology specialist. Having this skillset present during development and throughout use is a valuable asset because an informatician creates bridges between the healthcare system's needs, IT requirements and how the EHR should function to support multiple end users.

It is also important for nurses to understand the full scope of a LHS. Nurses in a LHS will learn from the information collected and make changes to improve patient care, including conducting research with the information gathered. The fact that none of the nurses mentioned that the information they collected could be used for research was concerning, especially when they discussed issues with accuracy of data collection. Again, downhill impact from data inaccuracies can cause the entire system to make incorrect suppositions on micro and macro system levels. This may include issues far-reaching outside of their organization such as with public health reporting, national level research and legislative resourcing. Ultimately this can become both a patient safety, population safety and healthcare resource issue.

The study findings lead to several suggestions for education and practice. These include:

1. Enhance education to include the strengths and capabilities of EHR systems. Multiple times the nurses referenced their desire for more education on the use and functionality of the EHR especially with the frequent system changes.
2. The development of a best practice guide to help support nurses' working memory would be beneficial. Working memory was discussed as a tool nurses must use to make sure documentation was not missed. Creating this guide may help in the development of electronic tools that can streamline the documentation process.
3. The skillset informaticians possess is needed throughout EHR development and enhancements. They have the ability to provide guidance to address the needs of the human factor. This will smooth the transition from development use.
4. Leadership must find ways to help support nurses in their daily activities. It was stated there are things that are not important to collect such as when the patient is given a warm blanket. Leadership is responsible for driving the balance of necessary information to meet organizational and care needs without asking for them to document more.
5. The support of the quality metric reporting is valuable and should continue. It was agreed upon that those reports and those conversations with leadership directly motivates nurses to improve. They enjoy seeing that they have made a difference in a situation where the patient's life was positively impacted.
6. Lastly, nurses should be provided with education on the importance of their role on the entire system when it comes to collecting and using EHR data. Nurses can maximize their LHS with a basic understanding of what happens to the collected

information and the power that it holds. This should begin with teaching them while they are in nursing school and reinforcing knowledge throughout their career. Changing the culture to foster a sense of ownership in their LHS is important in harnessing the power of the data. Improving the understanding that the EHR is a tool designed to improve healthcare will positively impact patient outcomes and the overall healthcare industry.

Conclusion

The findings of this study provided a rich understanding of nurses' perceived role in the development and use of information and new knowledge in a LHS specific to collecting and using EHR data. It revealed the intricacies and complex nature of their interactions with patients and EHR data while providing care. Bedside nurses are challenged with internal and external influences that simultaneously affect their interactions with the patients and the EHRs. Therefore, they need a better understanding of the downhill impact their documentation may have on the healthcare system. Nurses need more education about what being a part of a LHS means. Along with that, technical streamlining and support will help improve their workflow. Information stored in EHRs has immense potential for impacting professional practice and ultimately patient care.

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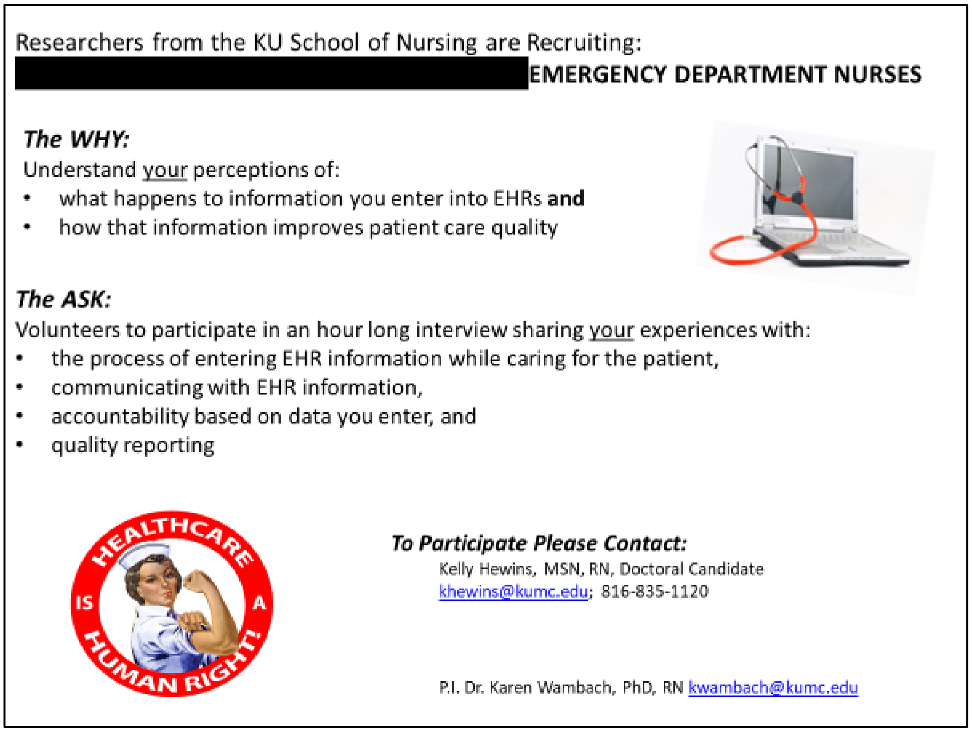
Appendix A

PowerPoint™ Slide Invitation to Participate in a Study on Nurses' Perceived Role in the Use of Information in a Learning Healthcare System for University-based Hospital



Researchers from the KU School of Nursing are Recruiting:
[redacted] **EMERGENCY DEPARTMENT NURSES**

The WHY:
Understand your perceptions of:

- what happens to information you enter into EHRs **and**
- how that information improves patient care quality

The ASK:
Volunteers to participate in an hour long interview sharing your experiences with:

- the process of entering EHR information while caring for the patient,
- communicating with EHR information,
- accountability based on data you enter, and
- quality reporting

To Participate Please Contact:
Kelly Hewins, MSN, RN, Doctoral Candidate
khewins@kumc.edu; 816-835-1120

P.I. Dr. Karen Wambach, PhD, RN kwambach@kumc.edu

Appendix B

Letter of Invitation to Participate in a Study on N*urses' Perceived Role in the Use of Information in a Learning Healthcare System*

Dear Colleague

We are seeking participants for a study exploring nurses' perception of what happens to the information entered into electronic healthcare records (EHR) and how that information improves the quality of patient care. This study is being conducted by a University of Kansas School of Nursing graduate student.

You are eligible to participate if you:

1. are licensed registered nurse;
2. have at least 1 year experience as a registered nurse;
3. deliver direct care to emergency department patients;
4. enter patient level data in your hospital's EHR system;
5. speak English;
6. have no data abstraction experience;
7. have no management experience; and
8. are willing to share your experiences using EHRs and the information obtained from the collected data.

There will be no direct benefit to you for your participation. However, your participation is likely to help us find ways to improve electronic health records and data reporting. This may lead to improved systems for you to do your work while enhancing clinical quality.

There are no anticipated risks for participating in this study. If you feel uncomfortable at any time you may stop participating.

If you agree to participate, I will schedule an interview with you that will last approximately one hour. The interview will be conducted in English and will be audio taped for detailed analysis. The main interview will be coordinated and arranged in a setting that is most comfortable to you between October 2019 and January 2020. Your information will remain confidential. You will only be identified with the use of identification number. All data that are collected for this study will be presented and published as aggregated data. Private information will be stored in locked files, or on a password protected electronic file.

If you are interested or would like to refer eligible licensed RNs, please contact me directly either by phone or email for more information. A copy of the *Research Consent Form* will be emailed to you prior to the interview and then reviewed as we begin the interview. Thank you for your time and consideration.

Sincerely,

Kelly Hewins, RN, MSN, CPHQ, Doctoral Candidate

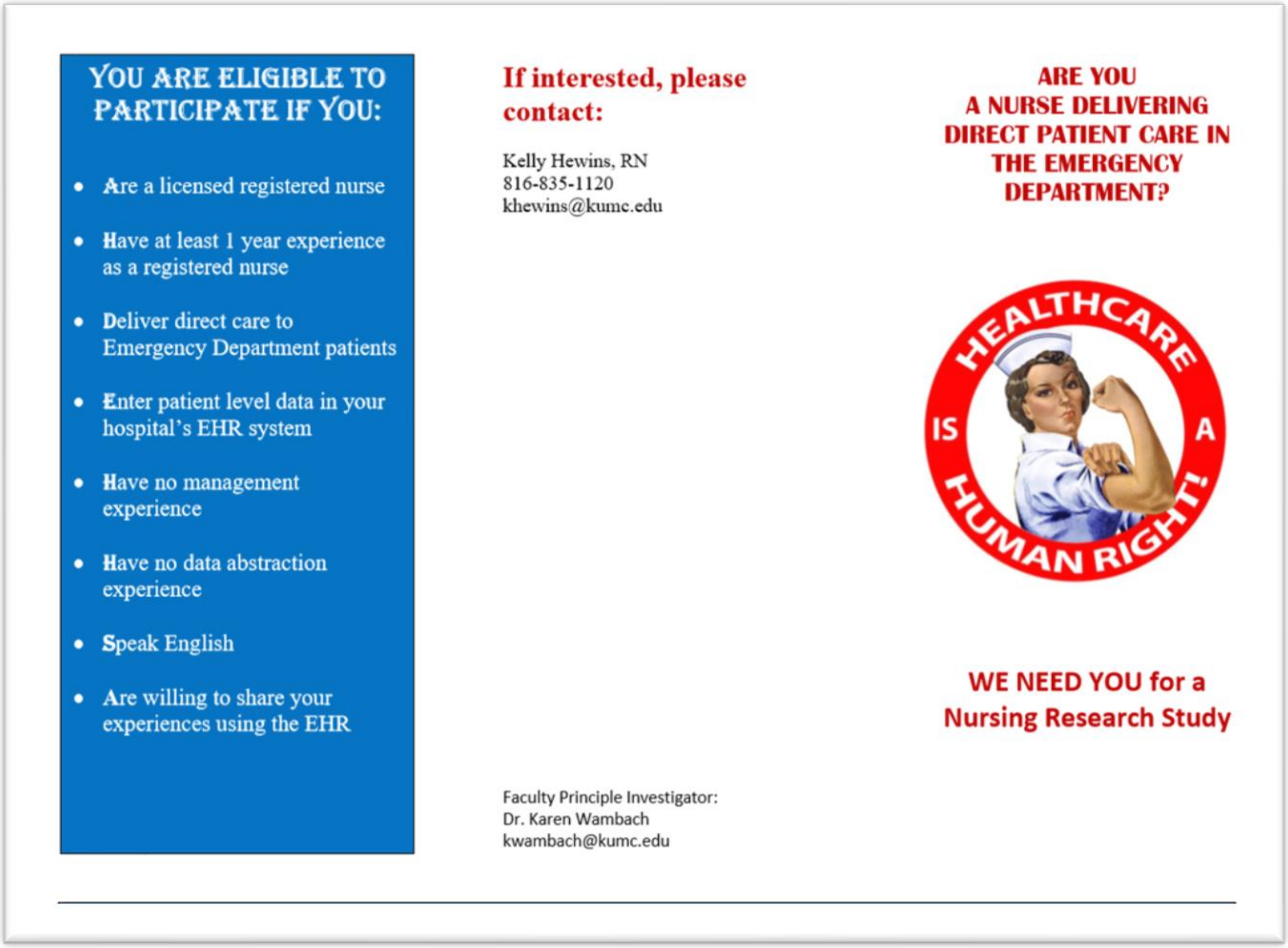
khewins@kumc.edu

816-835-1120

University of Kansas, School of Nursing

Appendix C

Promotional Pamphlet - Trifold, Front-Back



YOU ARE ELIGIBLE TO PARTICIPATE IF YOU:

- Are a licensed registered nurse
- Have at least 1 year experience as a registered nurse
- Deliver direct care to Emergency Department patients
- Enter patient level data in your hospital's EHR system
- Have no management experience
- Have no data abstraction experience
- Speak English
- Are willing to share your experiences using the EHR

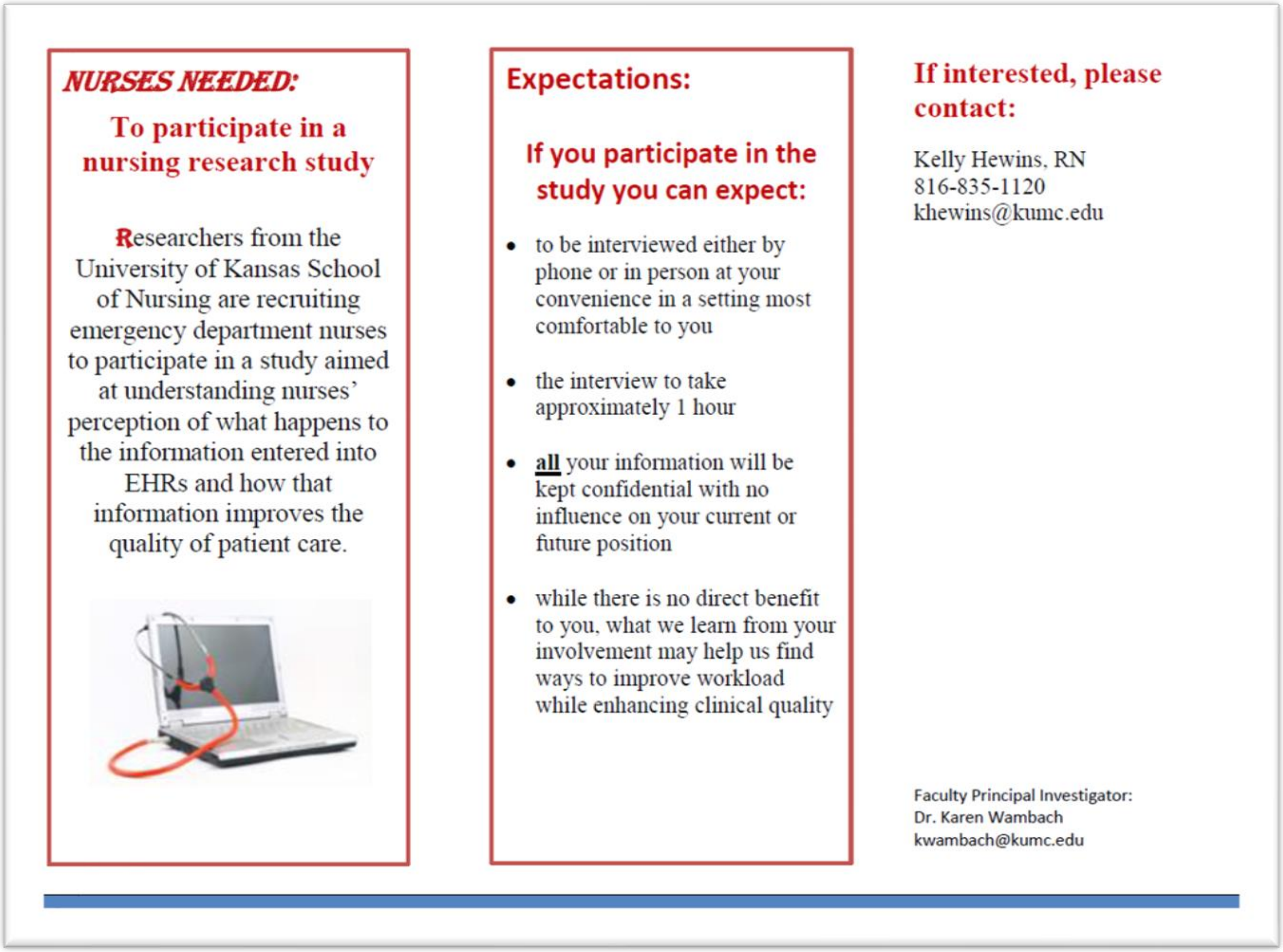
If interested, please contact:

Kelly Hewins, RN
816-835-1120
khewins@kumc.edu

Faculty Principle Investigator:
Dr. Karen Wambach
kwambach@kumc.edu

ARE YOU A NURSE DELIVERING DIRECT PATIENT CARE IN THE EMERGENCY DEPARTMENT?

WE NEED YOU for a Nursing Research Study



NURSES NEEDED:

To participate in a nursing research study

Researchers from the University of Kansas School of Nursing are recruiting emergency department nurses to participate in a study aimed at understanding nurses' perception of what happens to the information entered into EHRs and how that information improves the quality of patient care.

Expectations:

If you participate in the study you can expect:

- to be interviewed either by phone or in person at your convenience in a setting most comfortable to you
- the interview to take approximately 1 hour
- **all** your information will be kept confidential with no influence on your current or future position
- while there is no direct benefit to you, what we learn from your involvement may help us find ways to improve workload while enhancing clinical quality

If interested, please contact:

Kelly Hewins, RN
816-835-1120
khewins@kumc.edu

Faculty Principal Investigator:
Dr. Karen Wambach
kwambach@kumc.edu

Appendix D

Informed Consent

RESEARCH CONSENT

TITLE: A Qualitative Descriptive Study of Nurses' Perceived Role in the Use of Information in a Learning Healthcare System

Dr. Karen Wambach, PhD, RN and Kelly Hewins, MSN, RN

kwambach@kumc.edu khewins@kumc.edu

You are being asked to participate in a research study being done by the University of Kansas School of Nursing by Kelly Hewins and Dr. Karen Wambach because you are a registered nurse who enters information into electronic healthcare records (EHR) while delivering patient care.

Research studies may or may not benefit the people who participate. Your participation is optional. Research is voluntary, and you may change your mind about participating at any time. There will be no penalty to you if you decide not to participate, or if you start the study and decide to stop early. Not participating will also have no effect on current or future employment.

This consent form explains what you will do if you are in the study. It also describes the possible risks and benefits. Please read the form carefully and ask as many questions as you need to, before deciding about this research.

Why is this study being done?

The purpose of this study is to explore hospital nurses' perceptions of their role on the use of electronic health record data as part of a learning healthcare system. This includes an understanding of the challenges nurses face in using the data and information obtained from what is entered into the EHR.

What am I being asked to do?

If you are eligible and decide to participate in this study, your participation will last approximately one hour with the possibility of an additional 30 minutes for follow-up questions later if needed to clarify your survey content. Your participation will involve:

- An interview with the doctoral candidate asking:
    - a short series of demographic questions such as your age, gender, education level, license, and years in healthcare; and
    - open-ended questions about your use of
        - the information in electronic healthcare records;
        - the computer systems where patient records are captured and stored; and
        - quality reports.
- Your identity will be confidential. A number code will be the only identity marker for your transcribed interview comments. Only the researchers will know the meaning.
- The interview will be conducted and an auditoryl recording will be obtained by the doctoral candidate.
- The interview will be transcribed by the doctoral candidate.
- All recordings and transcriptions will be destroyed after analysis of the data is completed.
- Your involvement in the data collection portion of this study will take place between October 2019 and January 2020.

Are there any risks in participating?

You may feel uncomfortable discussing your experiences. If at any point you are not comfortable you may skip a question or stop participating all together. You are free to give only the information you choose.

Are there any benefits in joining this study?

You will not directly benefit from participating in this research study. Researchers hope that the information obtained in this study will help in the understanding and improving the experiences nurses have with using information from electronic health records to improve healthcare.

How will confidentiality and privacy be protected?

There is a small risk of loss of confidentiality when personal information is used for research. Your information will only be used by study team members and approved researchers. When we write up our results or make presentations, we will not use any names.

We will keep your study information indefinitely. The study information will be kept separately from your name and other personal identifiers. Study information will be shared with members of the research team. It might also be seen by people who monitor research if there was an audit. We will do our best to protect the confidentiality of your information.

If you want to cancel your permission to use your survey information, please write to Dr. Karen Wambach. The mailing address is Dr. Karen Wambach, University of Kansas Medical Center, 3901 Rainbow Boulevard, Mail Stop 4043, Kansas City, KS 66160. If you cancel permission to use your survey information, we will not gather any new information about you; however, we may use and share information that was gathered before we received your cancellation.

The researcher will protect your information, as required by law. Absolute confidentiality cannot be guaranteed because persons outside the study team may need to look at your study records. The researchers may publish the results of the study. If they do, they will only discuss group results. Your name will not be used in any publication or presentation about the study.

CONSENT

Please talk to the research team if you have any questions about joining the study. If you have questions about the rights of research participants, you may contact the KUMC Institutional Review Board at (913) 588-1240 or humansubjects@kumc.edu.

If you agree to join, please sign and date below. You will receive a signed copy of this form.

Printed name: ___________________________

Signature: ___________________________________ Date _________

Appendix E

Interview Tracking Log

Interviewer						
Initials	**ID #**	**Consent Date**	**Interview**			
			Date	**Start Time**	**End Time**	**Notable Encounter Issues**
	RN 1					
	RN 2					
	RN 3					
	Etc.					

Appendix F

Semi-structured Interview Guide

The key to a good interview is to make participants feel relaxed and comfortable. This will allow them to open-up. Therefore, it is important to create a connection with them without leading or guiding them on the information you are trying to collect. Let them know there is no right or wrong answers and the information they provide is going to help drive the development of support for their work. Assure them their identities will be kept confidential as only the research team will know who they are. We only ask that they be honest and open with their thoughts. Spend your time encouraging them to talk about their experiences in the way they see best fits the questions asked as they are the experts. Use the format below to guide your interview.

Introductions

- Introduce myself and tell the participant enough about my background in healthcare to make a connection with them but not too much so as to intimidate them.
- Ask them to tell me about themselves.
- Explain that we will be spending 30-60 minutes talking about their experiences with EHRs. Make them feel they are the expert and I am interested in hearing as many details they can share about their experiences.
- Let them know how much I appreciate their time and candidness in sharing. Their time is precious and I will respect time limits.

Demographic Information

- Age:
- Gender:

  - Male
  - Female
- What is your highest level of nursing education achieved?
  - Associate degree
  - Bachelor degree
  - Masters degree
  - Doctorate
  - Other (please specify): ______________________
- How many years have you been a registered nurse? _____________
- How many years of experience have you had with entering patient level data in electronic health records? _____________________
- List the licenses and/or certifications you hold: ___________________________________
- What is your current position title? ____
- Specify your type of employment
  - Full-time
  - Part-time
  - Per diem

Main Research Guide Discussion Points

Evaluating the point of care provider's perspectives on EHR

- Describe your feelings about documenting in electronic health records while simultaneously providing patient care.
  - Expand on feelings of strengths and challenges as needed
- When do you perform your documentation?

    - Why do you choose to document this way?
  - What kind of training have you had with your current electronic health record?
    - Expand as needed on in-service or data collection classes.
  - Added question: Are you familiar with any policy for EHR documentation.

Evaluating the culture of data use in provider's organization.

- How would you describe the importance or culture placed on electronic patient data within your organization?
- How would you describe the importance or culture placed on electronic patient data within your unit?
  - More specifically if needed: is there a difference in the way your organization versus your unit feels about patient level data?
- How do you feel your supervisor views the importance of electronic health record use?

Evaluating the point-of-care provider's interactions with data and quality reporting related to clinical care.

- Specific to your practice, how does documenting in an electronic health record impact the clinical care you give?
- What does the term "data" mean to you?
- What does the phrase "learning healthcare system" mean to you?
- What do you think happens to the information you have entered into the electronic health records?
- In your role as a bedside nurse, do you perceive yourself as performing data entry functions? If so, explain.
- Describe any quality reports you review.

- Is there anything else you would like to share about your use of electronic health records, quality reports or quality clinical data?

Closing

- Recap the main points
- Thank them for sharing their experience. Validate that you learned a lot from them because of this interaction.