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A Comparison of the Features and Functions Available in Electronic Health Records

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A COMPARISON OF THE FEATURES AND FUNCTIONS AVAILABLE IN ELECTRONIC HEALTH RECORDS

by

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ABSTRACT

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The Institute of Medicine (IOM) (2007) estimates that medical errors transpire at a rate of 1.5 million per year. The IOM (2000), approximates 7,000 deaths per year are related to preventable medication errors, which are the leading cause of medical errors. Adverse drug events (ADE) occur due to medication errors, which are 100% preventable. Annually, approximately $21 billion dollars are spent to care for patients' who experience ADE due to medication errors (IOM, 2007).

This doctoral project evaluates the current features and available functions for pediatric medication administration within the electronic health record (EHR). This comparison explored the EHR functionalities across all pediatric services and compared those tools to the features utilized in pediatric anesthesia. The electronic charting systems evaluated include: neonatal intensive care unit (NICU), emergency department (ED), post anesthesia care unit (PACU), operating room (OR), nursery, pre-operative, general pediatric floor and anesthesia departments. The EHR evaluation determined the department with the greatest differences in the EHR and medication administration record (MAR) is the anesthesia environment. The pediatric weight-based medication dosage was available for all other departments; therefore the same feature should be accessible to anesthesia providers.

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DEDICATION

I would like to express sincere thanks to my children, Haley and Grayson, my family, and Scott for supporting me throughout this long process. My children, family, and Scott have provided unwavering love, support and patience, as I have completed this doctoral capstone project. Without this support system, this new segment of our lives would not be possible.

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LIST OF ABBREVIATIONS

ADE	Adverse Drug Events
AHRQ	Agency for Healthcare Research and Quality
AANA	American Association of Nurse Anesthestists
CRNA	Certified Registered Nurse Anethestist
ED	Emergency Department
EHR	Electronic Health Record
HITECH	Health Information Technology for Economic and Clinical Health
IOM	Institute of Medicine
IRB	Institute Review Board
MAR	Medication Administration Record
NICU	Neonatal Intensive Care Unit
OR	Operating Room
PACU	Post Anesthesia Care Unit
POCA	Pediatric Perioperative Cardiac Arrest
QI	Quality Improvement
SALG	Safe Anesthesia Liaison Group
SPA	Society for Pediatric Anesthesia
USM	The University of Southern Mississippi
WUS	Wake Up Safe

CHAPTER I - INTRODUCTION

The American Reinvestment and Recovery Act along with the Health Information Technology for Economic and Clinical Health Act, were created in 2009 to increase patient safety and to streamline patient care through electronic health records (EHRs) (Charles, Gabriel, & Furukawa, 2014). The Office of the National Coordinator for Health Information Technology (ONC) created the meaningful use incentive program to accelerate the implementation of EHRs throughout all healthcare facilities.

The inception of meaningful use with certified EHR software was established to advance the efficiency, quality, and safety of patient care through the use of technology and also to decrease health discrepancies within the patient record (Charles et al., 2014). The use of EHRs through meaningful use is expected to improve patient outcomes, increase efficiency and maintain health information safety (Charles et al., 2014). Meaningful use sets specific goals for healthcare professionals in order for them to be eligible for reimbursement.

The EHR is a charting instrument that compiles patient data into a central location that can be accessed by all medical professionals on the care team. Having a patient's care charted in one location maximizes the efficiency of service delivery and enhances patient safety and quality of care. Other benefits of EHRs include: assimilating and identifying critical patient information, facilitating departmental and inter-facility access, providing built-in allergy safeguards to automatically warn against the use of medications that would result in adverse events, and prompting the safe prescription of medications and dosages (Charles et al., 2014). However, some nurses state dissatisfaction with the EHR, citing its cumbersome electronic methods (e.g., various flowsheets to document

between), design flaws (e.g., information does not cross between flowsheets, leading to documenting the same information twice), and lack of features within some departments (e.g., the massive transfusion protocol in the emergency department (ED) and medication calculations in the anesthesia charting environment) (Lavin, Harper, & Barr, 2015).

The effective use of health information technology by pediatric providers can help improve their ability to deliver high quality of care and improve patient outcomes. The use of health information technology is underused for quality improvement (QI), despite its ability to improve care (IOM, 2007). The main purpose of this capstone project is to improve the accuracy and consistency of electronic charting for pediatric patients through a QI initiative.

Quality indicators were created by the Agency for Healthcare Research and Quality (AHRQ) to provide United States healthcare facilities with the ability to identify practice areas for improvement. This project is focused on the patient safety QI. This project compared all pediatric medication and patient assessment charting processes within a local hospital's computerized charting system. The comparison evaluated these processes based on the efficiency and consistency throughout every department that provides care to pediatric patients. Through this evaluation, medical professionals can select systems to include in different pediatric settings that may decrease adverse drug events, hospital length of stay, and additional costs to the facility.

Significance of the Problem

The National Priorities Partnership [NPP] (2010), reported an estimated four million patients had experienced medication errors. This accounted for approximately $16.4 billion annually. Of those medication errors, thirty-seven percent were due to

incorrect dosages. Preventing medication errors is an ongoing process and the use of new technology can help to ensure proper adherence to hospital policies and procedures and also calculate correct medication dosages (Anderson, 2010). Furthermore, the Institute for Safe Medication Practices [ISMP] (2013) reported 210,648 medication errors and 45,421 deaths due to those errors in 2012, leading to approximately $21 billion dollars in wasteful medical spending.

The Health Information Technology for Economic and Clinical Health (HITECH) Act was created in 2009 to increase patient safety and streamline patient care through electronic health records (EHRs) (Charles et al., 2014). According to Charles et al. (2014), the aim of HITECH was to take patient information from each specialty physician and any hospital encounter and combine them into one electronic record. Although EHRs have been created to increase patient safety, the researcher has found no evidence to support that EHRs increase patient safety more than paper charts.

Quality and Safety Initiatives

Acknowledgement and monitoring of anesthesia related adverse events led to the creation of multiple initiatives in the United States that focus on the safety and quality of anesthesia in the pediatric population. Pediatric anesthesia quality improvement (QI) initiatives in the United States include: Wake Up Safe (WUS) and the Pediatric Perioperative Cardiac Arrest Registry (POCA).

The Society for Pediatric Anesthesia (2005) created *Wake Up Safe* (WUS), a QI initiative, in 2005, to increase the safety and quality of pediatric anesthesia. Currently there are 25 participating institutions who report adverse events to the organization for peer-review. Currently there are 25 participating institutions who report adverse events

to the organization for peer-review. Participating institutions report serious adverse events related to anesthetic medication errors to WUS. In 2011, WUS reported 23 medication-related adverse events of which 12 were inaccurately calculated dosage, 5 were incorrect medication, 3 were possible reactions to drugs, 2 drugs that were needed but not administered and 1 wrong route. The Society of Pediatric Anesthesia concluded that the majority of serious adverse events are due to the administration of an incorrect dose of anesthesia medications (Society of Pediatric Anesthesia, 2011).

The Pediatric Perioperative Cardiac Arrest (POCA) Registry was created after a reporting by the ASA Closed Claims Study, which concluded that of the 22 medication-related adverse events 10 were due to incorrect medication calculations (Jimenez et al., 2007). The goal of the POCA Registry is to identify the common causes of anesthesia associated cardiac arrest (Varughese et al., 2013). The initial POCA report in 2000, documented 150 anesthesia-related cardiac arrests (Morray & Bhananker, 2005). According to Morray and Bhananker (2005), the most common cause of cardiac arrests was due to incorrect medication calculations and substituted medications (n = 55). Root cause analysis of each incident is conducted and the POCA Registry then provides educational resources and QI techniques to all participating institutions.

Wake Up Safe and the Pediatric Perioperative Cardiac Arrest Registry both recognize pediatric medication calculation errors to be a common, avoidable and preventable critical event in the perioperative period. These QI initiatives provide training and education for the safe delivery of pediatric anesthesia. There are, however, institutions that are not involved with these initiatives. Therefore, institutions worldwide are not provided with new techniques and research. Unfortunately, the numbers of

institutions who are not involved in these initiatives far surpass the number of institutions who are a part of these initiatives. Emerging technology has the potential to reach each institution worldwide. Software has vastly improved over the years and has the potential to significantly decrease the number of medication errors.

Technology

The Health Information Technology for Economic and Clinical Health (HITECH) Act was created in 2009 to implement electronic health records (EHRs) in hospitals nationwide (U. S. Department of Health and Human Services, 2009). Electronic health records (EHRs) have been created to increase the safety and quality of patient care (U.S. Department of Health and Human Services, 2009). Although combining patient information onto one platform has been shown to increase patient safety, no evidence has been located that supports the increased safety within the anesthesia environment (U.S. Department of Health and Human Services, 2009).

The Institute for Healthcare Improvement (IHI) (2015) reported that although the use of EHR has increased, patient adverse events related to the implementation of technology continue to occur. One of the newly identified risks includes having multiple patient charts open at the same time, leading to the potential to order medications or chart on the incorrect patient and copying and pasting an old patient assessment as your shift assessment which can document incorrect current patient information. According to IHI (2015), identifying areas where vulnerabilities exist is the first phase in creating new solutions.

Despite the availability of technological tools to improve quality and safety in the perioperative environment, anesthesia providers have yet to be afforded the complete

implementation of the EHR. To ensure the highest quality and safest care, anesthesia providers need effective knowledge, skills and technology to safely administer anesthesia medications. The literature reports that utilizing quality improvement initiatives, recent technology, and computer software can help to decrease human errors and improve the safe administration of pediatric anesthesia.

Electronic health records have been implemented within hospital organizations in order to increase the quality and safety of patient care. The creation of National Patient Safety Goals to increase patient safety through technology has had mixed results. Inconsistencies exist within the EHR throughout the various departments within the organization. In order to decrease patient risks, gaps need to be identified and processes changed. National QI initiatives have been created to recognize, educate and change pediatric anesthesia outcomes. Although the development of technology has accelerated into hospital organizations, its incomplete functionality still leaves a high risk for error in pediatric patients.

Problem Statement

Pediatric medication errors are a preventable, yet critical patient safety issue. Prevention of pediatric medication dosage errors must be addressed throughout all phases of patient care and in every health care facility nationwide. The implementation of a consistent pediatric computerized charting system can significantly decrease time for staff to correctly chart, allow other departments to easily evaluate what medications the patient has been administered, and provide a higher quality of patient care.

Needs Assessment

In the perioperative area, the environment is fast paced, highly stressful, and there's a high amount of responsibility and accountability for caring for another persons' child, which magnifies the importance of pediatric safety. On top of all these adversities, the anesthesia provider now has to calculate the weight-based medication dosage for the pediatric patient. Oftentimes, anesthesia providers need to provide medications to a patient population they are not used to caring for on a daily basis.

In my own experience as a student registered nurse anesthetist, I have worked alongside certified registered nurse anesthetists (CRNAs) who have provided anesthesia for the typical healthy pediatric patient. The medications administered during those surgical procedures were commonly given and the weight-based dosages are well known by anesthesia providers. Occasionally, a pediatric trauma presents to the operating room where additional critical rescue medications are administered. These life-support medications are not the daily medications anesthesia providers are accustomed to provide. This creates the potential to decrease the safety and quality of pediatric anesthesia.

One CRNA described a scenario in which he provided anesthesia for an infant who suffered a traumatic brain injury. This CRNA explained his anxiety of administering medications in which he did not recall the correct weight-based dosages, as this patient population is not his typical patient. Although the patient maintained his hemodynamic stability throughout the case, this CRNA suffered a near adverse event miss. This led the researcher to wonder if there were gaps within the technology tools that contributed to the concern of anesthesia providers. The researcher determined that a

thorough analysis of all pediatric care departments is pivotal to the improvement, safety and quality of pediatric care.

The evaluation of the computerized charting system spanned across all departments that care for pediatric patients. A consistent charting system, with the same standard features and functionalities is imperative to safe patient care. However, EHRs are created in an incremental nature, where the system is built piece by piece specifically for each department. A top down approach is typically utilized while producing and implementing an EHR. Decision makers and programmers create the charting system, instead of using a user-up method. This method consists of the end-user recognizing the needs and creating an EHR based on those needs. The purpose of this capstone project is to identify inconsistencies and streamline electronic charting for the pediatric population in this practice environment.

Positionality Statement

I believe the information gained from this project has identified areas in the current EHR that can be better optimized in order to provide safer and higher quality pediatric care. Also, this project can increase the consistency of patient charting and accuracy of medication administration in all providers while delivering care to pediatric patients.

Purpose

The purpose of this project was to optimize the electronic charting system in efforts to streamline the pediatric charting system, thereby improving medication administration throughout all departments caring for pediatric patients. Electronic health records were created to increase patient safety, but without a consistent use of system

features and functions, is the organization fully maximizing the capabilities and impact of technological tools available?

CHAPTER II – THEORETICAL FRAMEWORK

The Donabedian model affords a structure for dissecting health amenities and appraising the value of health care (McQuestion, 2006). Specifically, the Donabedian Model assesses the quality of care in clinical practice by utilizing the structures, processes, and outcomes approach (Donabedian, 1988). The utilization of a systems model adequately evaluates the EHR and how patients are processed in a hospital organization. According to Donabedian (1988), stimuli in the clinical practice environment compromise the structure in which care is delivered. Process, in this model, is the communication between patients and providers during the provision of care (Donabedian, 1988). Lastly, outcomes are the results of healthcare on the well-being of patients and inhabitants. Table 1 presents the conceptual model of the relationship between the healthcare system and the Donabedian quality improvement model.

Table 1

Conceptual QI Model

Structure	**Process**	**Outcomes**
Technology	Provider-technology	Patient Safety
Healthcare Organization	Organization-technology	Healthcare Quality
Healthcare Provider	Organization-provider	
Patients		

A further analysis of the Donabedian Model dimension of structure leads to the identification of several environmental stimuli through which patient health can be effected. Structure consists of all of the factors in the environment in which care is delivered (Donabedian, 1988). Examples of structures include: technology, the healthcare organization, the healthcare provider, and the patient. These multiple factors provide a

framework in which providers and patients in a healthcare organization perform and assess quality of care. Therefore, it is necessary to identify the capabilities of the EHR that can affect quality and safety. Performance aspects of EHR technology include functionality of the interface and system reliability. Organizational mission and policies also affect quality outcomes and impact how well technology is used to attain patient safety and healthcare goals. The quality and safety of care can be influenced by both the level of patient acuity and the function of the EHR structure. Structure often is quick to discern and quantify. Structure can also be the reason the problems are acknowledged in processes (Donabedian, 1988).

The entirety of all actions that make up healthcare is called process (Donabedian, 1988). The category of process can be subcategorized into technical processes, (i.e., how care is delivered) and interpersonal processes. Some of the various events that make up processes include: provider use of technology, organizational utilization of technology, and organizational impact of provider use of technology. Whether or not the provider and organization fully utilize the features of the EHR affects the quality of the system as a whole. These events incorporate the way in which care is provided (Donabedian, 1988). According to Donabedian (1998), the extent of process is almost comparable to the amount of quality of care because process comprises of all pieces of healthcare delivery. The quality and safety of pediatric anesthesia rely on the full capabilities of the EHR. The organization affects the quality and safety of pediatric anesthesia when failing to implement all system features and functions.

Outcomes consist of the safety of healthcare on patients and the quality of healthcare delivered. Oftentimes, outcomes are considered to be the utmost significant

gauges of healthcare quality because increasing the importance of patients' health is the primary goal of healthcare. Providing safe and high quality anesthesia for pediatric patients in the perioperative environment is the main outcome. The full utilization of the features and functionalities within the EHR can provide a safer anesthesia delivery system.

The Donabedian Model provides a quality assessment framework that is applicable in diverse healthcare settings (McQuestion, 2006). At its most rudimentary point, the Donabedian structure can be utilized to change structures, measure overall quality, align assessment findings with improvements, and modify processes within a healthcare delivery system, as well as in a large hospital system. This leads to improvement of patient flow and the exchange of information. These improvements are measured as outcomes for care such as patient satisfaction, safety, and quality.

System optimization can align the use of technology to increase the quality and safety of pediatric anesthesia. The consistent documentation within an EHR allows for improved patient safety and quality by increasing time at the bedside. The automatic weight-based medication calculations ensure that the provider has access to the appropriate dosage. This increases the quality and safety of pediatric anesthesia.

Doctor of Nursing Practice Essentials

This project supports the Doctor of Nurse Practice (DNP) Essentials in that it deals with systems, analysis, leadership, patient quality and safety, practice change and technology. Through the application of Donabedian's model to the electronic health record optimization, this project most meets DNP essentials II, IV, and VI (refer to Appendix A).

Objectives

The goal of this doctoral project is to promote and increase the quality and safety of pediatric care at a local hospital. Instituting the Donabedian model (Donabedian, 1988) to assess the processes, outcomes, and the duty to follow procedural policies will have a profound effect on reducing medication errors. This project is designed to use evidence to increase the safety of pediatric care by streamlining and providing a consistent electronic charting system. This will ultimately decrease the potential incidence of medication errors or near misses and improve pediatric patient safety. For a SWOT analysis of this project see Appendix B.

CHAPTER III - METHODOLOGY AND ANALYSIS

The purpose of this DNP project was to optimize the current electronic health record (EHR) and medication administration record (MAR) by identifying the standard features and functions available to departments that care for the pediatric population. Using the Donabedian Model (Donabedian, 1988) along with a system analysis of the current EHR and MAR has allowed for the discovery of changes that can increase the safety of pediatric medication administration and quality of care.

Methods

This doctoral project involved the evaluation of the electronic charting system. Upon approval from the Institutional Review Board (IRB) of both the University of Southern Mississippi (USM) and the host organization, the EHR was accessed and evaluated. The departments providing pediatric services were the Emergency Department (ED), Neonatal Intensive Care Unit (NICU), Post Anesthesia Care Unit (PACU), Operating Room (OR), pre-operative area, anesthesia, nursery and pediatric floor (see Table 2).

The system review was conducted with the assistance of the host organization Director of Clinical Information Systems and director of education and clinical training. This doctoral project involved reviewing and comparing the EHR and MAR systems of all pediatric departments. The features and functions of the electronic charting systems in departments that care for pediatric patients were evaluated for consistent availability and use of standard features and functions (refer to Table 2).

Analysis of Data

The purpose of this project was to increase awareness of the inconsistencies of the EHR and to streamline electronic charting. The ultimate goal is to improve the accuracy and consistency of electronic charting for pediatric patients through a QI initiative. The data obtained from the analysis of the features and functions available for each department that cared for pediatric patients, were used to determine if the electronic charting system was consistent and if information was easily crossed from department to department.

The information obtained from the evaluation of the electronic charting system consisted of two categories which included: the features and functions of patient assessment flowsheets and the medication administration record. The data were recorded on an electronic table (Table 2).

Table 2

Comparison of EHR & MAR Systems

	Pediatric Floor	PACU	Pre-Op	OR	Nursery	NICU	ED	Anesthesia
Vital signs	●	●	●		●	●	●	●
Pain	●	●	●		●	●	●	●
Oxygen	●	●	●		●	●	●	●
Height / weight	●	●	●		●	●	●	
Assessment								
Neurological	●	●	●	●	●	●	●	
Respiratory	●	●	●		●	●	●	●
Cardiac	●	●	●		●	●	●	●
Peripheral Vascular	●	●	●		●	●	●	
Integumentary	●	●	●		●	●	●	
Musculoskeletal	●	●	●		●	●	●	
Gastrointestinal	●	●	●		●	●	●	
Psychosocial	●	●	●	●	●	●	●	

Intake/Output	●	●	●	●	●	●	●	●
IV Assessment	●	●	●		●	●	●	●
Daily Care	●	●	●		●	●	●	
Moderate Sedation							●	
Blood Administration	●	●	●	●	●	●	●	●
Massive Transfusion				●				
Universal Protocol				●				
Wounds	●	●	●	●	●	●	●	
Walking Rounds	●	●	●		●	●	●	
Medication Dose Calculation	●	●	●	●	●	●	●	*

*the only medication calculation that was automatically computed was limited to Sufentanil.

Gap Analysis

Patient Assessment

Patient assessment flowsheets consist of a variety of information (see table 2) including: vital signs, pain assessment, oxygen requirement, physical assessment, IV assessment, wounds, intake/output, daily care, walking rounds, blood administration and universal protocol. It was determined that the NICU, PACU, nursey, pre-operative and pediatric units all had the same screen, functions, features and flowsheets for pediatric documentation which include: vital signs, pain assessment, oxygen requirement, physical assessment, IV assessment, wounds, intake/output, daily care, walking rounds, and blood administration.

The OR nursing EHR does not include: vital sign, pain assessment, oxygen requirements, intake/output, IV assessment, or daily care documentation. These items while absent in the OR EHR, are all part of the anesthesia EHR and provider responsibilities. However, there is a flowsheet for universal protocol and blood

administration, including the massive transfusion protocol. The OR documentation for blood administration differs from other departments. It has the same basic features and functions as other departments however it also contains documentation for the massive transfusion protocol. The universal protocol flowsheet was only located within the OR EHR. Also, the OR does not utilize the same patient assessment flowsheets on their main screen but additional flowsheets can be added to their platform. The patient assessment flowsheet only contains neurological and psychosocial assessment.

The anesthesia EHR has the most variance in patient documentation platform of any department. The flowsheets within the anesthesia EHR include: Lines/drains/airways, positioning, assessment, vital signs, intake/output, medications, notes, and machine check. Although these flowsheets are vastly different from the other departments that care for pediatric patients, they are directly related to anesthesia and the care they provide.

The ED EHR was also very different from other departments caring for pediatric patients. There are similar features and functions however the layout of the EHR is quite different. The flowsheets in the ED are all located on the left hand column in an expandable format. The flowsheets for the NICU, PACU, nursery, pre-operative and pediatric units are all located on the top of the screen. The same flowsheets that are available in the NICU, PACU, nursery, pre-operative and general pediatric units are also utilized in the ED. It was noted that the ED did not have the massive transfusion function in their blood administration flowsheet, as many massive transfusions are ordered and initiated in the ED and then brought to the OR. The ED EHR has additional documentation flowsheets that include: provider assisted procedures (lines, drains,

moderate sedation), post-mortem disposition, triage narrator, trauma narrator, stroke narrator, and ST elevation myocardial infarction (STEMI) narrator.

Medication Administration Record

The medication administration record (MAR) was evaluated and determined to be the same for the NICU, PACU, ED, OR, nursery, pre-operative, and pediatric department. Documentation of medication administration within the anesthesia department was greatly different from the aforementioned departments.

The MAR for the NICU, PACU, ED, OR, nursery, pre-operative, pediatric department consisted of a list of medications from physician entered orders. This MAR included medications to be administered, discontinued medications and medications administered during procedures. The bar listing the medication name and dosage was on top of boxes that contained the time to be administered. Also included within that bar was the calculated weight-based pediatric medication dosage. For example, if a 20kg pediatric patient was ordered morphine. The bar would list: Morphine, 0.01mg/kg, dose 20kg x 0.1mg/kg = 2mg. It was noted that the pediatric weight-based dosages were for all pain medications and antibiotics.

The anesthesia medication record is a completely different format, with different features and functions. The anesthesia provider clicks on the medication box on the left of the screen, which populates another screen with various tabs on the top. These tabs are named for the various medication classes which include: fluids, narcotics, amnestics, local anesthetics, paralytics, cardiovascular, antibiotics and miscellaneous. The advanced practice nurse or anesthesiologist can choose any medication and then input the dosage administered. While evaluating the documentation of medications and dosages, it was

noted that not one medication provided the recommended dose range. Also, only one medication, sufentanil, calculated the weight-based dose for the anesthesia provider. The medications that are administered during a surgical procedure within the anesthesia environment are transferred onto the MAR. Therefore, the PACU, ICU or pediatric floor nurses will have the ability to see all administered medications.

CHAPTER IV – RISK ASSESSMENT

What is the Problem?

When the NICU, PACU, ED, OR, pre-operative, pediatric, nursery, and anesthesia department EHR and MAR were compared a difference was noted. The NICU, PACU, nursery, pre-operative, and pediatric departments had the same documentation features and functions within their EHR. The OR had minimal differences within their patient assessment and blood transfusion flowsheets from the NICU, PACU, nursery, pre-operative, and general pediatric departments. The ED also had differences within the EHR layout and additional assessments. However, these assessments (triage, trauma, STEMI, stroke) are specific to the ED. The department with the most differences within the features and functions for the EHR is anesthesia. Although the features and functions are specific to anesthesia, the design and layout are completely different from every other department documenting on a pediatric patient.

The NICU, PACU, OR, ED, nursery, pre-operative, and pediatric departments had the same documentation features and functions within their MAR. The medications that are added onto the pediatric patients' MAR are from physician entered orders and the weight-based dose is calculated. The anesthesia charting environment again had the most differences within their medication administration documentation. Advanced practice nurses and anesthesiologists have the ability to choose the best medication and dose for the pediatric patient. However, only one of those medications, sufentanil, was noted to have the weight-based dose calculated for the provider.

The administration of medications by anesthesia in the perioperative department for the pediatric population is connected with a high safety risk. The fast-paced, stressful

situation of caring for another persons' child also adds more pressure where adverse events could occur. Anesthesia providers are responsible for having knowledge of medication dosages. Then correct dosages are self-calculated potentially leading to a great risk for pediatric patients.

Why is it a Problem?

The Institute of Medicine [IOM] (1999), reported approximately 98,000 deaths yearly related to medication errors. However, this report was based on medical reviews from 1984. This information led to an initiative to provide a safe health system and report medication errors. This staggering number of deaths had many questioning the truth behind this research, it was quickly evident that the estimation was incorrect. The Journal of Patient Safety (2013), utilized recent reports of medical errors and concluded that there are approximately 220,000 to 400,000 deaths per year.

The National Priorities Partnership [NPP] (Anderson, 2010), reported an estimated four million patients had experienced medication errors. This accounted for approximately $16.4 billion annually. Of those medication errors, thirty-seven percent were due to incorrect dosages. Preventing medication errors is an ongoing process and the use of new technology can help to ensure proper adherence to hospital policies and procedures and also calculate correct medication dosages (Anderson, 2010).

After recognizing the correlation between inaccurate medication dosages and adverse outcomes, the *Wake Up Safe* pediatric anesthesia quality improvement initiative was created (Kurth et al., 2014). Participating institutions report serious adverse events related to anesthetic medication errors to WUS. Serious critical events are defined as situations where advanced medical intervention (ventilator support, medications,

admission to the Intensive Care Unit, etc.) is required. In 2013, institutions reported 734 serious adverse events (Kurth et al., 2014). The most common anesthesia related adverse events were respiratory complications (*n = 254*), cardiac arrest (*n* = 241), care escalation (*n* = 228), and cardiac events (*n* = 148) (Kurth et al., 2014). Respiratory events were primarily due to bronchospasm, layngospasm, or obstruction. However, more than a third (35%) were due to incorrectly calculated medication dosages (Kurth et al., 2014). Cardiac arrest, secondary to respiratory or cardiovascular events, was related to inaccurately computed medication dosages (Kurth et al., 2014). Care escalation was explained as when the patient required a prolonged hospital stay, without long-term effects. This category represented 20.3% of the serious adverse events and 65% of those were due to errors in both improperly calculated medication doses and administration of the wrong medications (Kurth et al., 2014). Incorrectly calculated medications and incorrect medication administration also accounted for 29% of adverse cardiovascular events (Kurth et al., 2014). The evidence suggests that respiratory complications due to improper medication doses were the most common serious adverse event.

Hospitalized patients are plagued by medication errors which continues to be the main cause of morbidity and mortality in hospitals across the United States (Tobias, Yadav, Gupta, & Jain, 2013). Numerous medications are rapidly administered to pediatric patients during the perioperative period, magnifying the concern of medication errors. According to Tobias et al. (2013), medication errors in pediatric patients are most commonly due to miscalculation. These calculation mistakes are related to calculating doses on weight in pounds instead of kilograms, misplacing the decimal point or simply by a math mistake (Tobias et al., 2013).

The goal of the implementation of EHRs and computerized provider order entry (CPOE) was to improve patient safety and quality of patient care. According to Nuckols et al. (2014), the effectiveness of computerized order entry has reduced in-patient adverse events by 50%, as CPOE make errors easier to detect. However, the research did recognize that features were not available across all departments and more system optimization is necessary for further reduction in medication errors (Nuckols et al., 2014).

Radley, Wasserman, Olsho, Shoemaker, Spranca, and Bradshaw (2013) reported a 48% decrease in medication errors since the inception of CPOE systems. However, at the time of this research only approximately 34% of hospitals in the United States had adopted CPOE. Therefore, a greater reduction in medication errors is expected over time. Radley et al. (2013) described CPOE and in-patient medication errors as an area that necessitates more functionalities and clinical decision support.

Medication administration is a pivotal and enormous part of pediatric patient care. Therefore, the potential to commit a medication error is great. The administration of medications in the pediatric environment consists of determining the correct medication and dosage for each patient (Nagelhout & Plaus, 2014). Providing a consistent and functional electronic charting system and continuing education on administering correct medications and dosages can reduce the incidence of medication errors.

Recommendations for Change

The research and results of this doctoral project both conclude that adverse events within the perioperative period were of great concern. The high level of stress reported by anesthesia providers could lead to errors and devastating consequences. The research

provided the results to the Director of Information Services and the Director of Clinical Education at the host organization. Along with the findings from this doctoral project, the researcher recommended the following changes: add the massive transfusion protocol to the ED blood administration flowsheet, add dose ranges to the medications in the anesthesia medications list and add weight-based calculations to the medications in the anesthesia flowsheet. The latter two suggestions can help to decrease medication errors, which is the 4th most common adverse event within the perioperative environment (Tobias et al., 2013).

Conclusion

The project assessed and compared the features and functions within the EHR and MAR for pediatric patients. In 2007, the IOM suspected that the use of health information technology for quality improvement (QI) was being underutilized. The purpose of the HITECH act in 2009, was to streamline patient information and increase patient safety and the quality of care. James (2013), utilized recent reports of medical errors and concluded that there are approximately 220,000 to 400,000 deaths per year, which questions the increased patient safety that was promised with electronic health records.

The Institute for Safe Medication Practices [ISMP] (2013) reported that there were 210,648 medication errors and 45,421 deaths due to those errors in 2012. Although this study does not specify the department in which these errors occurred, it is evident that medication errors are a major medical problem.

The outcome of this doctoral project determined the department with the greatest differences in the EHR and MAR is the anesthesia environment. The medication

administration record is the area with the most concern. The ability to calculate the weight-based dose for a pediatric patient is available for all other departments, therefore the same feature should be accessible to anesthesia providers. Another suggestion is to add the dose range for each medication utilized by anesthesia providers as an additional method to reduce or end medication errors.

APPENDIX A – DNP Essentials

Doctor of Nursing Essentials		How the Essential is Achieved
I.	Scientific Underpinnings for Practice	By using nursing sciences, which include knowledge in the fields of biophysical, psychosocial, analytical, organizational, and ethical sciences in order to complete this doctoral project.
II.	Organizational and Systems Leadership for Quality Improvement and Systems Thinking	The goal of this doctoral project was to evaluate the EHR through a quality improvement project, by improving current practice and function.
III.	Clinical Scholarship and Analytical Methods for Evidence-Based Practice	This essential was met through the development of an evidence based review for this doctoral project. Analytical methods and critical appraisal were utilized to eliminate undesirable literature.
IV.	Information Systems/Technology and Patient Care Technology for the Improvement and Transformation of Health Care	This essential was met by utilizing technology to evaluate the consistency, features and functions within the EHR. The use of technology can increase patient safety and the quality of patient care.
V.	Health Care Policy for Advocacy in Health Care	Essential V was met by disseminating the results of the evaluation and making recommendations for change.
VI.	Interprofessional Collaboration for Improving patient and Population Health Outcomes	The doctoral project relies upon interprofessional collaboration. Collaboration between the director of IS and the researcher was essential for this capstone.
VII.	Clinical Prevention and Population Health for Improving the Nation's Health	The evaluation of the electronic health record and medication administration record meets this requirement by increasing patient safety by streamlining and providing a consistent EHR.
VIII.	Advanced Nursing Practice	The analysis of evidence, the synthesis of data, and the comparison of the features and functions of the EHR and MAR are all expected of the advanced practice nurse.

APPENDIX B – SWOT Analysis

SWOT
Strengths: • Streamline and provide a consistent EHR and MAR to increase patient safety and the quality of patient care. • Improves patient safety by ensuring all features and functions are available to practitioners who care for pediatric patients. • With a prior Bachelors of Science in computer programming, I can effectively evaluate and assess the EHR and MAR. • The addition of missing features and functions can increase patient safety and the quality of care.
Weakness: • This project can reveal disconnects within the EHR and MAR. • In a rural or non-trauma pediatric hospital (Forrest General), providing anesthesia for pediatric trauma patients is very stressful when an anesthesia provider has not provided care to a pediatric trauma patient in years or since clinicals.
Opportunities: • This project could be submitted for publication, which can increase patient safety within other organizations. • The host organization has the opportunity to make changes to their system, therefore increasing patient safety and streamlining the EHR and MAR. • The HITECH Act was created to put all health information on electronic media. This also leads to a greater opportunity for greater revenue and growth. Many hospitals have not yet completed the transition to electronic medical records both throughout the hospital and in the anesthesia environment. • The recommended changes can be made by the in house EHR programmers, therefore decreasing any additional costs to the hospital. • This comparison has the opportunity to decrease any pediatric adverse events.
Threats: • The host organization may not be receptive to hearing the post comparison results and recommendations.

[redacted] General Hospital
Patient Care Services
Application for Research Project/Study

1. ***Title of Study*** A comparison of the features and functionalities in the electronic health record across pediatric nursing services.

2. ***Purpose of Study*** To maximize and optimize the electronic health record use for documenting care of the pediatric patient undergoing anesthesia. I will be mapping the available features and functions used for documenting perioperative care delivered by certified registered nurse anesthetists in the Epic Play System.

3. ***Benefits*** (Please describe benefits to agency and/or mankind) The potential benefits to this study would be to provide new features and functions that can improve patient care and streamline pediatric electronic charting.

4. ***Risks*** (Describe risks to subjects and precautions that will be taken to minimize them. This includes physical, psychological and/or sociological risks. How will confidentiality of data be maintained? Final disposition of Data: What will be done with questionnaires, inventories, and electronic recordings?)
The comparison of feature and functions used will be kept on a password protected laptop that will be kept at my residence. The data will be destroyed one year following completion of this study.

5. ***Subjects*** (Number, age group, characteristics, patient or staff population, and sampling technique)

N/A

6. ***Procedure*** (Describe in detail Who collects What data, Where, How, and When. Please include a copy of your instruments, if any materials and/or equipment are required, and indicate how they will be provided.)
I, Kathryn Tetreault, will be the sole researcher in this project. I will be collecting all the data from the training electronic health system and no patient information will be accessed. I will be evaluating the features and functions within all pediatric electronic charting environments in Epic Play System. I will then compare each department's current functions with other departments' functions and determine if the other departments would benefit from the other available features.

7. Are hospital personnel to be involved? YES If so, how? Members of the CIS department and EPIC training team at [redacted] have agreed to assist me in evaluating the current features in each department that cares for pediatric patients.

8. Indicate time frame for the study (Please give exact dates desired for collection of data and completion of report. Specific dates and times to be established in collaboration with training personnel within the months of August, September, October and/or November 2016. The final report will be produced in December 2016

9. Name(s) of Researcher(s) involved Kathryn Tetreault

Approved Linda Holmes MSN, ed RN Date 8/18/2016
Nursing Research Committee

Approved [signature] Date 8/31/16
Nurse Practice Council

Not Approved _____ Date _____

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