ABSTRACT

THE ELECTRONIC MEDICAL RECORD AND HOW IT CAN BE USED TO COMMUNICATE THE PATIENT STORY ACROSS THE CONTINUUM OF CARE

The electronic health record (EHR) and problem list are used to communicate a patient's medical story. Increased adoption of the EHR has improved the quality and efficiency of patient care; however, emerging reports of unrecognized implications have been associated with EHR implementation. These implications have affected the quality, safety, and efficiency of patient care. The primary purpose of this project was to retrospectively assess electronically-written communication by following the EHR problem list as the patient progressed through each level of care during an inpatient stay starting in the intensive care unit (ICU). The secondary purpose of the project was to identify potential EHR tools that may improve the utilization and maintenance of the problem list. The electronic problem list is the communication tool that tells the patient story; therefore, it is essential that the story be accurate. The findings from this study indicated that the utilization and maintenance of a problem list that is accurate and complete may result in more quality, safe, and efficient care.

Kaying Vang
May 2021

ANALYSIS OF COMMUNICATION IN THE ELECTRONIC MEDICAL RECORD: COMMUNICATION OF THE PATIENT STORY ACROSS THE CONTINUUM OF CARE

by

Kaying Vang, DNPc

A project

submitted in partial

fulfillment of the requirements for the degree of

Doctor of Nursing Practice

California State University, Fresno

Doctor of Nursing Practice

May 2021

APPROVED

For the California State University, Fresno
Doctor of Nursing Practice:

We, the undersigned, certify that the project of the following student meets the required standards of scholarship, format, and style of the university and the student's graduate degree program for the awarding of the master's degree.

Kaying Vang, DNPc
Project Author

DocuSigned by:
Nisha Nair
E663F759060B426...

Nisha Nair (Chair) Nursing

DocuSigned by:
Judi Binderman
290409394FA142E...

Judi Binderman Community Medical Centers, Fresno

DocuSigned by:
Kevin Spruce
2B6F7272866F439...

Kevin Spruce Community Medical Centers, Fresno

AUTHORIZATION FOR REPRODUCTION

OF DOCTORAL PROJECT

_____ I grant permission for the reproduction of this project in part or in its entirety without further authorization from me, on the condition that the person or agency requesting reproduction absorbs the cost and provides proper acknowledgment of authorship.

__X__ Permission to reproduce this project in part or in its entirety must be obtained from me.

Signature of project author: *Kayying Vang*, DNPc

DocuSigned by:
kayying Vang
2C782BE59E6B426...

ACKNOWLEDGMENTS

There is a saying that says “it takes a village” to accomplish a goal. This project was accomplished with the help of many people who are dear to my heart for their dedication, time, and support to get this project to where it is today.

I would like to first thank my husband Yeng for his relentless support and patience while helping me to accomplish my goals in life. Thank you to my children Katalena, Dawson, Brycen, and Colton for giving me the time and understanding to accomplish my educational goals. I hope that one day I will be the role model that they envision to guide them through their own educational and career goals.

I give my biggest gratitude to my Chair and Committee members. I am so blessed to have such a wonderful group of intelligent people who offered their time and expertise in guiding me through this project.

TABLE OF CONTENTS

Page

Page

LIST OF TABLES

Page

LIST OF FIGURES

Page

CHAPTER 1: INTRODUCTION

Overview

Quality healthcare is defined by the Institute of Medicine (IOM) as "the degree to which health services for individuals increase the likelihood of desired health outcomes and are consistent with current professional knowledge" (Lohr, 1990, p. 128). There are many aspects to quality healthcare and communication is an essential one. In healthcare, communication among healthcare providers is always crucial, but especially during the transfer of care. Transfer of care communication allows for various multidisciplinary healthcare team members (doctors, nurses, ancillary staff) to receive, give, and make decisions for the continuity of care (Abraham et al., 2012). Treatment decisions derive from progress notes regarding previous and existing health issues, history of treatments, and laboratory workups. Consequently, communication regarding a patient's health story should be reliable, accurate, and complete. Effective communication, whether verbal or electronic, depends on efficiency, ease of use, acceptance per organizational guidelines, and personal preference (Abraham et al., 2012).

The electronic health record (EHR) has improved the ease of and access to patient information by transitioning progress notes from paper chart to electronic note. To improve efficiency and reduce provider burnout, EHR tools have been created to streamline documentation, such as electronic problem lists (EPLs), progress note templates, problem-based charting, and smart text. Background

Communication within the Electronic Health Record: The Patient Medical Story

Medical health records were developed to capture a patient's description of symptoms and complaints and the provider's subjective and objective assessments.

It is during patient/provider encounters that providers obtain the initial narrative about current signs and symptoms and possible connections to prior medical conditions. Thus, the definition of the "patient story" is described as "a cognitive awareness and overview understanding of the patient's (a) current status, (b) relevant history, (c) data patterns that emerged during care, and (d) the future-oriented care plan" (Varpio et al., 2015). The adoption of the EHR has fundamentally altered how appointment notes are documented, allowing for "real-time, patient-centered records that make information instantly and securely available to authorized users" (HealthIT.gov, 2017). The EHR provides new capabilities that have improved the quality and efficiency of patient care and communication among providers and across different health settings, such as the "hands-off tool" and the "discharge summary tool" (HealthIT.gov, 2017). Additionally, EHRs record acute and chronic medical diagnoses, along with dynamic information, such as vital signs, height, weight, and medication history, all of which improve data collection that facilitates better treatment plans, administrative work, quality metric reporting, and research.

The Electronic Medical Record

The EHR emerged as an initiative of the 2009 Health Information Technology for Economic and Clinical Health (HITECH) Act, which was created to improve efficiency, healthcare costs, and patient safety (Colicchio et al., 2019). It has been reported that more than 75% of physician practices and 92% of eligible hospitals received incentives to adopt certified EHR through 2014 (Graber et al., 2019). According to King et al. (2014), the EHR has improved patient care by 78% overall, remote access to patient charts by 81%, alerts to potential medication error by 65%, and critical lab values by 62%. The study also reported that between

30% and 50% of physicians who implemented EHRs improved the ordering of appropriate tests and patient communication (King et al., 2014). While the adoption of EHRs has benefitted patient care, other studies have found that they have hindered communication among care providers (Bardach et al., 2018).

The Problem List

One crucial component of a doctor's progress note is the problem list (PL), which consists of the current conditions or diagnoses a patient is managing and/or treating. The originated from the health problems listed in a patient's traditional paper chart. The point of the PL was to remind the healthcare provider about health problems at each visit, as well as facilitate the delivery of care, treatment, and services. The PL was revised by Lawrence Weed in the 1960s to improve physician documentation in the medical record (Doyle-Lindrud, 2015). Weed's work created the Problem-Oriented Medical Record (POMR) and is known today as "Problem-based charting" (Doyle-Lindrud, 2015). It includes a PL that has become the focus of a patient's documented care. Weed wanted to create a reliable, accurate, and thorough record that would promote quality, safe, and efficient care (Aronson, 2019). While there is no consensus on what to include on the PL, it usually contains undiagnosed symptoms, prior hospitalizations, surgeries, and social/family histories (Holmes, 2011).

The adoption of the EHR necessarily restructured the PL into something far less standardized, as it now varies greatly based upon an organization's EHR platform and preferences, as well as specific policies and/or procedures instituted for maintenance. The EHR has also provided new tools with which healthcare organizations can improve how the PL is used to document symptoms and diagnoses.

Recognizing the importance of accurate and complete PLs, the campaign for the adoption of the EHR by the federal government has included monetary incentives, such as the Meaningful Use Program, which requires the use of an EPL that contains past and current diagnoses, pathophysiological state, abnormal physical signs, laboratory findings, disabilities, or other abnormal signs (AHIMA Work Group, 2011). The underlying goal of the Meaningful Use Program and requirement of the PL was to establish coordinated care and lead future data needed for quality, performance, and research initiatives, as found in Stages 2 and 3 of Meaningful-Use criteria (Bormel, 2011).

Quality and Efficient Safe Care

The notion of quality and standard of care are closely associated since healthcare quality is often defined as the care that is expected while achieving the desired health outcomes, regardless of the care setting (Agency for Healthcare Research and Quality [AHRQ], 2020; IOM, 2001). Similarly, standard of care is based upon current best practices, which are recognized to be evidence-based clinical practice guidelines founded on review of evidence and assessment of the benefits and harms of alternative care options (American Academy of Family Physicians [AAFP], 2017).

The IOM reported that many Americans are not receiving the quality of care that they have come to expect. According to the IOM (2001) report, "Crossing the Quality Chasm: A New Health System for the 21st Century," many Americans are not receiving the quality of care that should have been delivered and found issues in quality of care everywhere affecting every patient. Additionally, to improve quality health care, the Crossing the Quality Chasm report provided six essential domains:

- **Effectiveness.** Providing care processes and achieving outcomes as supported by scientific evidence.
- **Efficiency.** Maximizing the quality of a comparable unit of health care delivered or unit of health benefit achieved for a given unit of health care resources used.
- **Equity.** Providing health care of equal quality to all, regardless of personal characteristics not relating to clinical condition or preferences for care.
- **Patient centeredness**. Meeting patients' needs and preferences and providing education and support.
- **Safety.** Actual or potential bodily harm.
- **Timeliness.** Obtaining needed care with minimal delay (AHRQ, 2020).

As a result of the IOM report on the quality of healthcare, in the past 2 decades, the public reporting of hospital-specific quality measures and outcomes has been realized for many healthcare organizations, as many were pressured to reform and ensure quality of care. Some of these measures included clinical outcomes or the evaluation of a patient's perception of care. However, the goal to provide quality and safe care that is also efficient has been met with great challenges as many of these organizations strive to meet these standards of care.

These standards of quality care are now benchmarks for payer reimbursement and consumer choice, leading healthcare organizations to invest in strategies that deliver results (Forthman et al., 2010). State quality improvement programs collect data using quality indicators set forth by payers, such as Centers of Medicaid and Medicare Services (CMS) and accreditation organizations, like The Joint Commission (JC), which have implemented programs such as ORYX initiatives to ensure beneficiaries are receiving high quality care (Forthman et al., 2010).

One methodology used to calculate mortality, complication, readmission, and safety is risk-adjustment methodology. This method utilizes the Medicare Severity Diagnosis Related Group (MS-DRG) to mark other elements, such as age, gender, major chronic conditions, and other significant comorbidities (Forthman et al., 2010). It is important to have accurate PLs so that comorbidities, and acute and chronic conditions, are accurately recognized and documented during inpatient stays for successive capturing by coders in the final billing. This complete capture of acute and chronic conditions allows for accurate depictions of risk adjustment scores.

Medicare Severity-Diagnosis Related Group and Geometric Length of Stay

Each inpatient encounter creates billed encounters that payers then assess for payment. Certified coders review inpatient medical records and input diagnoses recognized as treated, evaluated, and monitored during an inpatient stay. During the record review, the coder also identifies the principal reason for the admission, which becomes the "principal diagnosis" that ultimately classifies the MS-DRG payment for each inpatient encounter. The assignment of each MS-DRG also results in a GMLOS, which clarifies the number of allotted days that the payer will reimburse, based on the MS-DRG assignment. Any additional days that the patient requires outside of the GMLOS do not qualify for reimbursement, so it is essential for hospitals to provide efficient care that stays within allowed timeframes.

The GMLOS is also a marker for efficiency of care. Through vigorous studies of numerous disease processes and care management, CMS has identified the average number of days needed for treatment and evaluation, linking each MS-

DRG to an identified GMLOS. As a result, when hospitals can provide care for their patients in the defined GMLOS, this signifies that care was provided efficiently during the hospital encounter. To contain costs, hospitals are compelled and motivated to discharge patients in a timely matter.

Purpose of DNP Project

The primary purpose of this project was to retrospectively assess electronically-written communication by following the EHR PL as the patient progressed through each level of care during an inpatient stay starting in the intensive care unit (ICU). The secondary purpose of the project was to identify potential EHR tools that may improve the utilization and maintenance of the PL. Lastly, this study will employ the project findings to promote the increased use and maintenance of the problem.

Significance

The creation and management of EHRs has rapidly consumed the healthcare provider's role in the record keeping of patients stories and improving quality of care. The PL has historically represented the patient's story and the means by which providers share its content in different care settings and during. Accurate and complete EHRs and EPLs is essential to quality, safe, and efficient care. Thus, this study sought to identify gaps, challenges, and recommendations through the review of prior literature. The final intent was to add to the current knowledge and promote the increased usage and maintenance of the EPL.

Paper record keeping is problematic due to illegible handwriting and its inherently inconvenient means of sharing by way of photo copies. In addition to the medical errors due to poor penmanship, obtaining patient information has been difficult due to limited access if being simultaneously utilized. The EHR has

allowed for ease of retrieval, where multiple users can access records without disruption in care and safer comprehension and interpretation since notes are keyed in versus handwritten.

A decade before the widespread acceptance of the EHR, the IOM (2001) anticipated and emphasized in its landmark report, "To Err is Human," that "ALL technology introduces new errors, even when its sole purpose is to prevent errors. Therefore, as change occurs, health systems should anticipate trouble" (p. 175). The era of EHRs ushered in new functionalities to augment efficiency of data capture, timeliness, legibility, consistency, and completeness (Bowman, 2013). Reports of unintended consequences resulted from improper use of these functionalities, such as inaccurate documentation or acts of alleged fraud (Bowman, 2013).

As predicted and cautioned by the IOM, emerging reports of unrecognized implications because of EHR implementation have affected safety and quality care. The JC (2017) also recognized the growing concerns for safety in use of health information technology and implemented "Sentinel Event Alert #42: Safely implementing health information and converging technologies." According to The JC (2015), incorrect or miscommunicated information entered into the health IT systems may cause adverse events. Analysis by The JC found that between January 1, 2010 and June 30, 2013, 120 sentinel events were health IT-related and noted to be within these eight socio-technical dimensions: (a) human-computer interface (33%); (b) workflow and communication (24%); (c) clinical content (23%); (d) internal organizational policies, procedures, and culture (6%); (e) people (6%); (f) hardware and software (6%); (g) external factors (1%); and (h) system measurement and monitoring (1%) (JC, 2015).

The Sentinel Event database has indicated to The JC (2015) that the copy-and-paste function (CPF) has been an underlying cause of patient harm. One example resulted from "outdated weight information used for dose calculation of chemotherapeutic agents, and lengthy progress notes that decrease timely and efficient communication." The IOM (2001) reported that patient harm has led to the estimated costs of "between $37.6 billion and $50 billion for adverse events and between $17 billion and $29 billion for preventable adverse events."

The IOM report "To Err is Human" resulted in several changes within the Federal government and its affiliated agencies, such as the AHRQ, that have increased the awareness of subpar care and the quest for quality healthcare for all Americans. Statistics found by the IOM (2001) indicated that between 44,000 and 98,000 Americans die each year from medical errors. This exceeds the deaths caused by motor vehicle accidents, breast cancer, and AIDS (IOM, 2001). Additionally, "total national costs (lost income, lost household production, disability, health care costs) have been estimated to be between $37.6 billion and $50 billion for adverse events and between $17 billion and $29 billion for preventable adverse events (IOM, 2001). The adverse events were further broken down, with the report identifying that about 70% of adverse events were thought to be preventable given the following most common missteps: technical errors (44%) and misdiagnosis (17%) (IOM, 2001). Other findings from "To Err is Human" reported that 2% of admissions experienced preventable adverse events that increased lengths of stay by an average of 4.6 days, with additional costs around $4,700 per admission, totaling $2.8 million annually for a 700-bed teaching hospital (IOM, 2001).

The Electronic Problem List

Similarly, the EPL has had challenges. Even though the EHR has improved patient care, the lack of standardization and regulations on the EPL has led to inaccurate and incomplete usage. The PL is designed to facilitate communication among healthcare providers in all settings, yet, in the electronic realm, it lacks sufficient accuracy and completeness. Additionally, studies have linked them to inefficient and unsafe care (Cohen et al., 2019; Holmes, 2011; Zegars et al., 2011).

The IOM (2013) report, "Best Care at Lower Costs," estimated that that $750 billion was wasted on inefficient spending and care in 2009. One identified area resulted from care fragmentation, which has been associated with increased costs, departures from clinical best practices, higher rates of preventable hospitalization, lower quality of care in chronic conditions, medication errors, and missed opportunities to promote adherence to medication and care management (Frandsen et al., 2015; Madden et al., 2016). Frandsen et al. (2015) examined the cost of fragmented care among chronically ill patients and found that primary care providers with the highest fragmentation had higher rates of preventable hospitalizations and healthcare spending that was $4,542 higher when categorized into $10,396 for the highest quartile, versus $5,854 in the lowest quartile.

It is customary for primary care providers (PCPs) to use EHRs; but widespread use among specialists remains unfulfilled, resulting in a non-integrated EHR system that inhibits the sharing of patient data, leading to fragmented care. Madden et al. (2016) acknowledged that fragmentation may be more common in mental health care. Their study recognized that among patients with behavioral diagnoses, nearly 90% of acute psychiatric services at hospitals were not captured in the HER, leading to insufficient knowledge of mental conditions and prior treatments (Madden et al., 2016). Approximately 10% of the American adult

population suffers from mood disorders that can increase social costs due to functional impairment, suicidality, health care use, and loss of work productivity (Goetzel et al., 2003; Madden et al., 2016; Wang et al., 2003). Depression, alone, costs the economy approximately $83 billion (Greenberg et al., 2003; Madden et al., 2016). Although Madden et al. (2016) focused on mental health and EHR completeness, additional findings indicated that "rates of missingness were high among both behavioral events and overall events, both in and outside the hospital" (Madden et al., 2016, p. 1146).

Other studies have associated lower quality of care with incomplete and inaccurate PLs. A study by Hartung et al. (2005) determined that accurate PLs correlated with implemented treatments for heart failure. Their study also concluded that if "the 20% risk difference in ACE inhibitor prescribing seen in this analysis is truly due to maintaining an accurate problem list," one life for every 295 heart failure patients would be saved every year (Hartung et al., 2005, p. 144). Chan et al. (2008) analyzed the health status of heart failure patients and yearly costs and concluded that lower health status was correlated to higher rates of hospitalization and longer lengths of stay. Documenting heart failure on the PL means that healthcare providers can consider and implement care based on best practices, which can improve both direct and indirect costs, which exceed $33 billion annually in the United States (Chan et al., 2008). When patients with heart failure receive intensive disease management, morbidity and mortality decrease (Chan et al., 2008). Similarly, Wright et al. (2011) found that only 59% of patients with coronary artery disease (CAD), 62% of those with diabetes, and 51% of those with hypertension had their conditions documented on PLs, possibly indicating poor quality of care.

The implementation of the EHR resulted in an electronic form of the PL that is not generally used as intended. In addition, due to poor guidance, the EHR structure of the PL, non-standardization, or policies, there has been variability in the maintenance of the PL (Holmes et al., 2012). The disagreement over what elements should be documented in the PL has led to incomplete and duplicated entries and outdated and inaccurate PLs (Wright et al., 2012). Wright et al. (2012) found that although PCPs contribute 40.4% of all notes, they added 82.3% of all problems to the PL when compared to specialists. In contrast, out of 100,000+ notes, 500 total problems were documented by specialists, such as orthopedic surgery, psychiatry, and neurology. Their study recognized that PCPs have a greater awareness of patient needs and may be more obliged to maintain the PL; whereas the specialist may be evaluating the patient for the first time, or only annually, and may be reluctant to add new diagnoses to the PL. However, they concluded that for half of the patients included in the study and being evaluated by a specialist, many of their health problems were undocumented by a specialist, especially those without PCPs (Wright et al., 2012).

Project Assumptions

The widespread adoption of the EHR has necessarily increased electronic communication via electronically written progress notes. Therefore, it is imperative to assess its effectiveness within transition of care, documentation, and diagnoses so as to maximize accuracy, safety, and efficiency of care and outcomes. This project assumes that the final billed list of coded diagnoses is complete and accurate and that the EPL found in the medical record portrays a true reflection of the patient's story and inpatient hospitalization. The assumption is that a complete and accurate PL will also improve patient satisfaction, reduce

readmission, increase efficiency of care, and optimize MS-DRG and GMLOS for each patient encounter.

Research Questions

- Does an accurate and complete problem list improve communication in the care process, thereby improving efficiency of care, as represented by the GMLOS?
- Does the utilization of the problem list improve the accuracy of the patient story, thereby improving quality and safe patient care, as represented by an accurate MS-DRG?

Theoretical Framework–Deming Theory of Quality

Healthcare organizations face a multitude of challenges that can either close their doors or be overcome. Advances in technology and research bring change that can improve healthcare organizations. Change allows for improved patient care and outcomes and better system processes. However, change can be difficult in existing cultures. Factors that can promote change are leadership support, continuous education, and active promotion within a given environment.

Edward Deming is a physicist known for his commitment to improvement. His most notable accomplishment was in administering the transformation of the Japanese industry after World War II, along with remaking the level of quality of Japanese products and productivity (Anderson, 2018). Deming was sent to Japan in 1946 to study agricultural productions and related issues; however, afterwards, he found himself facilitating a rebranding of Japanese products from being cheap and low quality to high quality and desirable. The Japanese people had a renewed pride in their work and began manufacturing products that could compete on the global market (Anderson, 2018). Deming attempted to influence American

industries with the same processes, but conversely, following World War II, companies wanted to emphasize quantity over quality. It was not until The Toyota Motor Corporation was noticed by United States leaders that Deming became a world figure for quality improvement (Anderson, 2018).

Deming believed that the process was more important than the product. He also found that redoing work or dealing with unhappy customers was more expensive than simply doing quality work all the time (Walton, 1986 as cited in Anderson, 2018). Deming promoted continuous improvement and statistical methods that required support by leadership (Anderson, 2018). The themes that are reiterated in his framework consist of (a) having a system in place for continuous quality improvement, (b) reducing defects through higher levels of quality uniformity, and (c) understanding what quality should mean within the context (Anderson, 2018). Deming introduced a four-stage approach to quality improvement: (a) Plan, (b) Do, (c) Study, and (d) Act.

This project utilized Deming's framework for quality improvement to analyze the EPL for quality and completeness. Using the Deming framework, this study will initially implement "Planning" to complete and review the available literature on PL accuracy, inaccuracy, challenges, and recommendations. During the planning process, this study will also explore the two research questions, identify the necessary data variables and elements, and determine the predicted outcomes this study aims to accomplish. The second part of the planning will identify the two ICU groups to be evaluated in the study. This study will compare the accuracy and completeness of the PLs between the two ICU groups: Group A ICU nonutilization of problem-based charting and Group B ICU utilization of problem-based charting.

Stage 2, “Do,” will be implementation. The PL will be evaluated retrospectively against each level of care, starting from the ICU and identifying when the EPL was updated or revised and compared to the hospitals final billed list to identify potential gaps in completeness. Subsequently, to identify if there are EHR tools that can assist with the maintenance and completeness of the PL, a comparative study will be implemented for two ICU groups. Stage 3, “Study,” will be a comparison of the outcomes of the two groups in regard to PL completeness.

During the “Study” stage, a comparison of the study data and findings will be examined in relation to the research questions. This study will use statistical methods during this stage to assess the predicted outcomes. Lastly, a summary of the study findings will be provided that will include an explanation regarding the study’s limitations, assumptions, and future recommendations.

During stage 4, “Act,” this study will summarize the findings to identify challenges and validity with regard to the research questions proposed to identify the next steps. Regardless of the findings, the goal of this project was to promote the proper usage and maintenance of the PL by revealing positive and negative factors and evidence-based practices found in literature. Although, “Act” is the final stage of the cycle, the functionality of this model is cyclical; therefore, this study also hopes that others will value accurate and complete PLs and will utilize the findings and recommendations from this study to improve the functionality of the EPL.

Summary

The EHR and EPL, when combined, can promote safe, quality, and efficient care. The challenges that arise from EHR implementation can hinder its benefits to healthcare. The increased adoption of EHRs has increased

communication via electronic progress notes. The PL has historically been the vehicle of communication among healthcare providers. It is feasible to assess the value of the EPL within this function of the EHR. The goal of this project is to assess, identify, and provide evidence-based practices that can improve the accuracy and completeness of the EPL.

CHAPTER 2: LITERATURE REVIEW

The PL is an inherent component of the patient medical story, as it holds information about acute, chronic, and significant medical histories which are crucial when communicating with healthcare providers during the clinical decision-making process. Inconsistency within and non-standardization of the PL have resulted in inaccurate, duplicated, or incomplete records. Incomplete and inaccurate PLs have been associated with poor quality of care. The intention of this literature review was to identify current knowledge about the benefits and challenges associated with the PL. This review will also identify evidence-based recommendations for how to support the maintenance and completeness of PLs.

The literature search revealed only limited research on the PL. However, available literature focused on a number of meaningful factors, such as the benefits of complete PLs, the consequences of incomplete PLs, the identification of physician attitudes towards PLs, consistency of PL usage across various settings, and the identification of critical elements needed to improve the usage and maintenance of PLs.

There were also limited studies on the association between complete PLs and high-quality care. While prior studies highlighted the potential outcomes of complete PLs, they provided only partial resolutions to the problem of inaccurate PLs. Through this literature search and mining of other research article references, this study found no prior literature that examined how complete PLs contribute to effective communication of patient stories within the EHR during patient transitions through the levels of care during a hospital stay.

The literature search was completed using Google Scholar, CINAHL, PubMed.gov, and the Fresno State University Henry Madden Library using

keywords associated with communication in the HER: PL accuracy, PL completeness and benefits and consequences of PLs, quality of care, efficiency of care, geometric length of stay, problem-based charting, EHR template, clinical decision in EHR, natural language processing in the EHR, patient medical story, and patient safety. Preliminary results were selected based on the study's relation to PL accuracy and communication, PL accuracy and quality and efficient and safe care in the HER, patient story or PL completeness, and PL inaccuracy.

The resulting articles were reviewed and selected using the PICO process and the project's research questions. To fully capture the objective of this project, literature sources no older than 5 years were utilized to provide the reader a perspective of the history of the PL and the EHR.

Electronic Health Record Challenges

The EHR promotes safe and quality patient care in many ways. It has improved access to real time patient data and improved the efficiency of care received through the easily accessible patient data. However, new and emerging literature has indicated that inaccuracies in EHRs may have led to ineffective communication of medical information, further hindering efficient and quality patient care.

In a CRICO Strategies 2015 Annual Benchmark Report, communication failures in the United States accounted for 30% of all malpractice claims, resulting in 1,744 deaths and $1.7 billion in malpractice costs over 5 years. Other findings from general medicine cases found that 39% resulted from miscommunication because of poor documentation (CRICO Strategies, 2015). The report also found that inadequate information (gaps or discrepancies) can lead to mismanaged care, unmet expectations, and patient harm. The JC (2015) recognized the significance

of the CRICO 2015 Annual Report and acknowledged that ineffective communication, especially during hand-off and transitions of care, have been a long-standing problem. Because of these implications, The JC Center for Transforming Healthcare created a new "Sentinel Event Alert #58: Inadequate hand-off communication" to provide recommendations to help hospitals and other healthcare entities improve communication during transitions of care (JC, 2017).

One of the identified failures of communication in the EHR is ineffective and untimely written communication. A study by Vermeir et al. (2015) examined the quality of written communication and found that of the 69 articles reviewed, poor communication led to "various negative outcomes: discontinuity of care, compromise of patient safety, patient dissatisfaction and inefficient use of valuable resources" (p. 1258). Inefficient communication also increased hospital resource utilization, increased lengths of stay, and wasted an estimated $6.6 billion in health care dollars, annually (Vermeir et al., 2015). The studies concluded that when interventions were developed to improve communication and coordination of care, hospital admissions and readmissions declined (Vermeir et al., 2015).

Poor communication within the EHR has also led to poor collaboration in patient care, leading to unsafe care and adverse events (Bardach et al., 2017). Bardach et al. (2017) recognized that healthcare organizations across the nation have incorporated technology into their processes to improve communication and patient care. However, they were interested in looking at how technology influenced communication within a hospital setting. It was documented that the healthcare environment and the communication within it can be complex, so the goal of the study was to better understand this dynamic through the perspective of healthcare providers. The common themes found in the study included (a) information associated with patient care was difficult to find in the HER, (b)

healthcare providers may be unaware that their notes have been entered into the HER, (c) healthcare providers had difficulty finding patient data (Bardach et al., 2017).

Varpio et al. (2015) recognized that the EHR can affect a healthcare provider's clinical reasoning and interprofessional collaborative practices, leading to poor documentation in the HER and inaccurate patient stories. The qualitative study looked at the pre- and post-impact of EHR implementation in relation to clinical reasoning and interprofessional collaborative practices. The researchers found that while EHRs could hold an abundance of data, it also introduced a wealth of disconnected information that impeded health care providers from gaining fully accurate patient stories. The study recognized that EHRs have diminished the creation of narrative notes, which has been a meaningful element within a health care provider's clinical decision-making process. Narrative notes provide deep understanding, versus the template drop down menu, which makes for copious detail that has little cohesion. The study found that the EHR design did not always allow for narrative notes, thus limiting the quantity and quality of information documented, and by extension, the communication of a patient story across care settings (Varpio et al., 2015).

EHR Challenges Affecting Efficiency and Quality of Care

A substantial quantity of published work has cited poor clinical documentation within the EHR; meanwhile, little research exists on resulting adverse outcomes. The available research findings indicated that poor communication within the EHR has been associated with lower quality care and inefficiency of care. There are several ways of assessing for quality of care and associated outcomes. Government agencies use different identified measures,

which are later calculated and summarized based upon hospitals' self-reporting of the required elements. Once quality organizations such as AHRQ receive a hospital's reporting, the data are reviewed and shared publicly through Medicare websites, such as "Hospital Compare" (CMS.gov, 2020). Another method of evaluating documents care and decision-making based upon the medical record.

The patient's documented evaluation, treatment, and plan of care indicates to other healthcare providers, and those indirectly involved in the patient's care, evidence-based care versus nonevidence-based care. Clinical practice using evidence-based care is recognized as the standard for efficiency and quality. To further assess this assumption, Zegers et al. (2011) analyzed 7,926 hospital admissions within 21 Dutch hospitals to compare adverse events, the presence of patient information, and the quality of the present information. Missing medical record documentation was associated with lower rates of adverse effects, resulting in the underestimation of adverse effects during the record review. The study also found that poor quality patient information translated into higher rates of adverse effects, indicating that the quality of patient records was associated with the quality of patient care (Zegers et al., 2011).

Efficiency and quality of care can also be affected by normal variations in provider documentation in the EHR. While only limited research that explored this issue on a large scale, a study by Cohen et al. (2019) studied EHR users' perceptions of what causes the variation and their associated effects. Their findings indicated that different modalities of documentation created variations and redundancy. Additional findings suggested that when physician's failed to complete documentation, time and effort were needed to find the information after a visit. Physicians who utilized unstructured text created the risk of missing a diagnosis documented in the Assessment and Diagnosis section if it was not added

to the PL. The realization that diagnoses may be documented in the Review of System during the provider's inquiry about other organ system complaints during the patient history interview means that when providers use unstructured or free-text fields, the future search of data and information may be hindered (Cohen et al., 2019). The study concluded that when documentation was not optimized and variations in documentation were accepted, overtime increased significantly, inhibiting the delivery of high-quality care. This has challenged the interpretation of information, potentially harming patients and, more importantly, hindering many healthcare quality metrics, like accurate patient data (Cohen et al., 2019).

The Problem List

After the introduction of Weed's POMR, the PL has since been recognized by healthcare providers as an unavoidable vehicle of communication. The understanding of a patient's medical condition requires the provider to interview the patient about their current state and about prior or preexisting conditions. With today's EHR, the provider is confronted with an abundance of information that can make finding something specific difficult and time consuming to find. The purpose of the PL has been to maintain a patient's current acute and chronic conditions, as well as any other vital medical history. The electronic version of the PL is not always readily available for viewing and may require the navigation of other sections of the EHR, thus hindering the efficient and timely making of care decisions.

Benefits of a Complete Problem List

A complete PL improves efficiency and care by clearly identifying diagnoses that can be linked to evidence-based care, facilitating care coordination, and clearly communicating vital information (Li et al., 2018). The federal

government recognized the significance of complete and accurate PL. This higher-level understanding about the PL drove the federal government to create the Meaningful Use program to ensure that the PL remains in the EHR (CDC, 2020).

A study by Hartung et al. (2004) explored whether the documentation of heart failure on the PL resulted in evidence-based pharmacotherapy treatment. It was found that in EHRs that contained documentation of heart failure in the PL, 92.2% of patients were likely to be treated with the recommended medications, compared to 76.7% patients whose EHRs had this information omitted (Hartung et al., 2004). Similarly, another study retrospectively examined how the EHR can improve documentation of obesity and overweight diagnoses with the automation of the BMI. It was recognized that the incorporation of the BMI calculator, and other reminders, improved preventive services and the management of obesity (Bordowitz et al., 2007). This study established a correlation between increased documentation of obesity and treatment, whereas the automation of the BMI in the EHR did not improve documentation and treatment for overweight patients. The discrepancy between treatment and management of obese versus overweight patients was attributed to the perceptions of patients who were more noticeably obese, or had associated comorbidities (Bordowitz et al., 2007).

Care coordination is the core purpose of the PL, but that is contingent upon the clear and complete documentation of acute and/or chronic conditions. Accurate and complete PLs promote optimal care for patients with comorbid conditions. A large proportion of health care costs derive from chronic diseases, which result from fragmented care (Frandsen et al., 2015; Madden et al., 2016). Accurate and complete documentation of diagnoses allow care coordinators and providers to easily identify and manage chronic diseases appropriately (Diaz, 2016).

Problem List Challenges

Complete PLs have been associated with efficient and quality care (Krauss et al., 2016). Krauss et al. (2016) examined the differences among PLs involving the number, type, and ordering of problems across various physicians by using the physician's criteria to organize and rank diagnoses. Their study found wide variability in the creation of PLs, and found that, on average, "the referring physician's list will contain about 50% of the information … that the receiving physician would expect to get" (Kraus et al., 2016, p. 862). These findings concur with other studies that examined communication during transitions of care from hospitalists to PCPs (Munchhof et al., 2020).

Some studies have examined the transfer of care from the ICU to the hospital ward. One study looked at the progress notes of patients who were transferred from the ICU to identify communication opportunities (Brown et al., 2018). The researchers identified gaps and variations in written documentation, including discrepancies within the documentation of patient information (Brown et al., 2018). Three key observations were noted during the study: (a) discrepancy in the documentation of patient problems indicating, that prior written notes had not been reviewed by the current provider; (b) lack of continuity regarding the patient's story, indicating that the maintenance of the patient story had not been obtained, as noted, by a less detailed note explaining history and factors that may have contributed to an initial admission to the ICU; and (c) absence of documentation in decision-making (Brown et al., 2018).

Cohen et al. (2019) also agreed that variations in PLs caused physicians to be concerned about the effects on quality of care. The variations in preference of what should be kept in the PL resulted in a "longer list with 'junk' information" (Cohen et al., 2019). Additionally, long PLs that were not updated, or contained

incorrect diagnoses, concerned physicians regarding misinformation and confusion about what diagnoses were current versus resolved or ruled out (Cohen et al., 2019).

Incomplete PLs have been associated with the underreporting of diagnoses and poor quality of care. Quality care is that which provides evidence-based practices that have been linked to positive patient outcomes and proven cost-effectiveness. Evidence-based practices are considered the standard of care and are derived from the integration of scientific knowledge, as determined by an expert panel of health professionals in a consensus process (AHRQ, n.d.; Mainz, 2003). Studies have indicated that chronic conditions, such as congestive heart failure, diabetes, and obesity may not be considered in the clinical decision-making process if providers have not been successfully alerted to them (Hartung et al., 2005; Kapoor et al., 2020). Studies have shown that when chronic conditions, including obesity, are documented on the PL or EHR in general, providers are more likely to provide management and treatment gear towards that condition (Kapoor et al., 2020).

Conversely, incomplete or inaccurate PL cause inefficient care. This is reflected in the length of hospital stays and is affected by the efficiency and effectiveness of care. Therefore, the level of efficiency and effectiveness of care has been directly linked to length of stay (LOS). When the management of patient flow is inadequate, this "may lead to ineffective coordination of treatments, tests, and other interventions that can prolong diagnosis and/or recovery (Stockwell et al., 2017, p. 1). There is limited literature that has analyze the measurement of patient flow during a hospitalization secondary to the difficulty and use of administrative coding data that creates the LOS (Stockwell et al., 2017). The objective of this study was to develop and test a new method of assessing pediatric

inpatient flow. Findings from the study concluded that the metric could assist in measuring and understanding current and past performance, as well as compare against peer hospitals. A limitation was administrative coding that may have challenged the accuracy of coding and other coding procedures, such as sequencing or assigning (Stockwell et al., 2017).

The literature review revealed a major obstacle to complete and accurate PLs: lack of standardization. A good PL is key to quality patient care (Hartung et al., 2005; Holmes et al., 2012). The inadequacies of the PL continue to prompt differences of opinion with regard to what should be on it. PLs often contain minor or resolved diagnoses, making for cluttered and incomprehensible information (AHIMA, 2008; Holmes et al., 2012).

Recommendations to Improve the Problem List

The literature search did not reveal solutions for improving accuracy and completeness of PLs, but found varied studies that attempted to add additional knowledge to the problem, along with several recommendations. Studies that had similar themes or recommendation were chosen for this study.

The initial overall theme of improving the PL involves the development of policies and procedures that address the content of the PL, identify ways to update or resolve problems, and guidance on PL reviews (Homes et al., 2012; Hummel & Evans, 2012; Wright et al., 2011). Holmes et al. (2012) compared the opinions of healthcare practitioners on the PL and their rationale for decisions during clinical situations. Findings supported the problem of inefficient PLs. They concluded that although there are differences of opinion about various aspects of the PL, healthcare providers agreed that standardized policies would encourage and promote accurate and complete PLs (Holmes et al., 2012).

A retrospective review of the EHR through data analysis and interviews was accomplished at 10 top healthcare organizations that used a variety of EHR systems (four self-developed and six commercials) in the United States, United Kingdom, and Argentina. At the chosen facilities, the researchers established a measure of PL completeness by assessing for the documentation of diabetes or Hemoglobin A1c elevation > = 7.0%, meeting the clinical criteria for diabetes (Wright et al., 2011). The second part of data collection involved interviewing the informatics leaders, or EHR users and all the sites. The researchers wanted to learn about their PLs and how they were maintained and what made their techniques successful. Findings revealed that among the 10 facilities, only three had greater than 90% PL completeness, even for common diagnoses such as diabetes (Wright et al., 2011). Also noted were significant differences among the 10 facilities, 60.2% to 99.4%, suggesting that several facilities had significant room for improvement (Wright et al., 2011). The results provided examples of data integrity issues, though within only one area in the EHR. The interview data showed six common themes: (a) Financial incentives, (b) Problem-oriented charting, (c) Gap reporting, (d) Shared responsibility, (e) Links to billing codes, and (f) Organization culture (Wright et al., 2011).

Other approaches to improving the accuracy and completeness of PLs involved utilizing problem-based charting (PBC). A study exploring the effects of problem-based charting used an interrupted time series design. The sample was collected based on the selected date range of November 1, 2011 to November 1, 2015, over 24 months pre-PBC and post-PBC. The researchers used the initiation of PBC as the standard method of charting by ICU clinicians. The post PBC effect was assessed by the number of new problems added to the PL by each clinician per patient encounter and PL accuracy, “which was determined by calculating the

recall and precision of the PL in capturing 5 common ICU diagnoses" (Li et al., 2018, p. 550). The 5 common ICU conditions utilized as markers included (a) sepsis, (b) acute respiratory failure, (c) acute renal failure, (d) pneumonia, and (e) venous thromboembolism, … where the billing code list was referenced as the standard" (Li et al., 2018, p. 550). The researcher used two internal medicine physicians to perform manual reviews of 100 charts randomly selected. Comparison of interrater agreement with the billing code list was determined by calculating percentage agreement and Cohen's kappa for each diagnosis (Li et al., 2018). The findings showed that the clinicians in the post-PBC period added a higher mean number of new problems per encounter, compared to the pre-PBC period (Li et al., 2018, p. 550). The interrupted time series analysis demonstrated that an increase of 2.18 problems (> 50% increase) to the mean number of new problems added to the EPL per patient encounter was likely from the initiation of problem-based charting (Li et al., 2018).

Another study by Liu and Walsh (2018) compared pre-documentation intervention and post-documentation initiatives. Pre-intervention reflected the duration for completion of clinical documentation utilizing the traditional voice-dictated note, transcribed by a hospital-contracted transcriptionist. The post-intervention included the period where random collection included the new documentation process for problem-oriented charting. The researchers utilized the clinical documentation improvement team to verify diagnoses through the 3M 360 software and generated a prioritized list of codes that calculated the severity of illness (SOI), risk of mortality (ROM), and case mix index (CMI) (Liu & Walsh, 2018). The average expected payment was derived from the hospital finance software using the calculated All-Refined Patient Related Diagnosis Related groups (APR-DRG); SOI, ROM, and CMI were used for hospital payment

calculation. The findings concluded that during the study period, the SOI scores increased by 11.1%, monthly average ROM scores increased by 13.5%, and monthly average CMI scores increased by 7.7%, which generated a significant increase in the hospital's reimbursement (Liu & Walsh, 2018).

Other attempts at utilizing EHR tools to improve the quality of documentation and EPL accuracy and completeness included note templates that used copy-forward and auto population. Although the copy-forward and auto populate tools prompted concerns about accuracy and errors, Kahn et al. (2018) explored the impact of an educational session bundled with a progress note template focused on note quality, length, and timeliness. Interventions and preparation for the education included a note-writing taskforce at UCSF and UCLA that developed best practice guidelines and an aligned note template. The educational session included topics about documentation within the EHR, best practice guidelines, and review of the note template with instructions on accessing. The findings concluded that providing a note template with education improved quality, decreased lengthy progress notes, and improved timeliness of note completion (Kahn et al., 2018).

Similarly, another study recognized that optimized documentation in the EHR provides clinicians with better guidance and support, as well as improved quality and efficient care (Cao et al., 2017). Their study focused on completeness and timing of detection and documentation of neurovascular injuries pre- and post-implementation of an EHR template. The EHR template included a focused comprehensive physical examination of pediatric supracondylar humeral fractures (Cao et al., 2017). Overall, Cao et al. (2017) concluded that implementation of an EHR template created by a clinically-driven multidisciplinary task force improved the completeness and timing of documentation for pediatric neurological injuries.

While some efforts directed at EHR tools improve documentation, challenges with maintaining accuracy and completeness, PLs have encourage others to reevaluate the functionality of the EHR in assisting with PL issues, such as duplication. The researchers in this study recognized that when the EHR functionalities were used to simplify the process for providers, they gained behavioral economies (Liao et al., 2020). The observation of an incomplete and inaccurate PL causing "communication gaps among providers, which contributed to diagnostic delays and serious safety events" contributed to a quality project to "increase the use of the PL and quality to improve physician communication, clinical decision-making and patient care delivery" (Liao et al., 2020, p. 942). Key elements found in this study were the ability to use the EHR functions to prevent duplication of problems and provide transparent routine feedback targeting individual performance and comparative peer performance (Liao et al., 2020).

Although there is limited literature on artificial intelligence and improving documentation and PL accuracy and completeness in the EHR, previous studies have examined the automated inference of patient problems from structured EHR data and natural language processing. Doing so provided promising tools for improving accuracy; however, a lack of use and validation by others has limited its acceptance (Solti et al., 2008; Wright et al., 2012). A follow-up study by Wright et al. (2012) explored the clinical alert system and inference rules to notify providers of undocumented problems. These prior studies provide a preview into how automated inference can support clinical decisions and improve the documentation of diagnoses.

Summary

The literature findings agreed that complete and accurate EHRs and PLs contribute to care that is high quality, safe, and efficient. The literature addressed concerns related to incomplete PLs and provided suggestions for future research regarding impacts on patient care. Nevertheless, the available literature is limited how to use the PL as a communication vehicle for high quality care. Literature is also lacking in the effectiveness of the PL during transitions through levels of care. This project sought to identify current knowledge and common themes in the literature to provide recommendations and explanations on how to achieve greater accuracy and completeness in the PL. Additionally, this project sought to identify evidence-based practice tools in the EHR that can health care providers improve the accuracy and completeness of the PL. This project utilized the literature support for a templated problem-based progress note as the framework for evaluating the accuracy and completeness of the PL, as documented by two ICU provider groups (Group A: non-utilization of templates and problem-based charting versus Group B: utilization of template and problem-based charting).

Although much of the literature proposed guidelines and policies in the management and utilization of the PL, newly emerging technologies may promote the necessary changes through easier management capabilities. Future research should examine the combination of automated inference, natural language processing, and machine learning that can be embedded in the EHR as tools to create more accurate and complete medical record documentation and EPLs.

CHAPTER 3: METHODOLOGY

The EPL has replaced the traditional paper format found inside a patient's paper medical record. However, rather than a pure improvement on the old system, it has become an electronic listing of unmaintained, inaccurate, and incomplete diagnoses that no longer serves its original purpose—to fully communicate the patient story. The guiding framework for this study was Deming's Theory of Quality, which defined the problem. The review of literature provided new information on the benefits, challenges, and recommendations for PL. This chapter provides an outline of the research methods, study design, ethical concerns, data collection, and methods used to analyze the data.

Setting

The study was conducted in a 300-bed, mid-sized, not-for-profit acute care hospital located in central California, an area with a population of 3.8 million. The hospital adopted certified EHR software and offered healthcare providers the ability to document using templated progress notes, with the option to use free-text, problem-based charting (PBC) templated progress notes, or dictation, resulting in transcribed progress notes. As a requirement of Meaningful Use and accrediting agencies, such as The JC, the PL is a requirement to have within the EHR and is maintained with documentation of the patient's diagnoses (Wright et al., 2011). The hospital's PBC-templated progress notes can integrate diagnoses with the PL, and add lab values, imaging, and other documentation onto the provider's progress note. One EHR feature, known as PL management, allows the automation of diagnoses to be entered onto the EPL with the included diagnosis carried throughout each daily progress note, including the discharge note. The PBC documentation feature prompts use of the PL calculator found within the

HER, which, if used correctly, helps identify a diagnosis that is specific and complete in description. Additionally, this feature allows the provider to review and update the PL so that each medical record will have the most accurate picture of the conditions contained therein. Providers who do not utilize the hospital's PBC-templated progress notes do not have this capability and must manually enter diagnoses onto the EPL and daily progress notes.

The hospitalist group at this facility agreed to utilize PBC-templated progress notes for their team to streamline and standardize the progress note process. However, the ICU provider group had variability in the type of modality used. A higher percentage of ICU providers utilized transcription to document their consults and daily progress notes, while a small minority utilized the hospital's provided progress note template, but not PBC. In May 2019, a new ICU group was contracted and chose to use the hospital's PBC-templated progress notes. This change provided a new opportunity to analyze and evaluate the accuracy and completeness of the PL, accomplish this study's objectives with an opportunity to identify the gaps to PL usage, and maintain and identify beneficial EHR tools.

Ethics

Prior to this project's implementation, approval from the hospital's administration, the hospital's Institutional Review Board (IRB), and California State University, Fresno's (CSUF) IRB was obtained. The study was deemed of minimal risk criteria by both the hospital and CSUF's IRB.

Study Design

The methodology chosen for this study assumed that a complete and accurate PL would net effective communication during the care process, thus

improving the efficiency of care, as reflected by the GMLOS. It was also expected that better utilization of the PL would improve the accuracy of the patient story, thereby improving quality and safe patient care, as reflected in the hospital's final billed MS-DRG code. The project design utilized a retrospective chart review that assessed movement through each level of care to find common themes in the usage of EHR tools that could improve the accuracy and completeness of the EPL. Secondly, the quantitative approach was used since the study also sought to identify a correlation among the usage of templated notes, transcribed progress notes, and problem-based documentation among two ICU groups.

Prior to the implementation of this study, a data collection tool was created to identify key data variables desired for the study. The data collection tool is found in the Appendix and was utilized by the hospital's data service team to extract the requested data, which was provided to the principal investigator as obfuscated data.

Intervention

The aim of this study was three-fold:

1. Analyze the collected obfuscated data for accuracy and completeness of the EPL to assess the accuracy and completeness of the EPL as the patient transfers from each level of care.
2. Find common themes in the usage of EHR tools that may enhance the accuracy and completeness of the EPL.
3. Using the quantitative approach, identify a correlation among the usage of templated notes, transcribed progress notes, and problem-based documentation among two ICU groups to identify EHR methods that might improve the accuracy of the patient story.

Before implementing the project, a gap analysis identified the focus areas for this study. The identified foci included organizational or national policies and procedures that provided direction for usage and maintenance of the EPL, educational opportunities targeting EHR documentation and PL maintenance, and assessment and evaluation of accuracy and completeness of the current EPL.

Looking at the hospital's current usage and maintenance of the EPL, there were no defined national or organizational policies and procedures in place to guide the usage and maintenance of the PL. There were undefined contractual agreements with provider groups and basic initial education and training on the utilization of the PL calculator and documentation the EHR. There was a lack of formal reassessment and evaluation of provider documentation in the EHR and usage of the PL, along with constructive feedback to promote opportunities for improvement. This resulted in an EPL that was inaccurate and incomplete and prohibitive to the hospital with regard to research, data analytics, quality care, quality and safe transitions, and care coordination.

This information supported the importance of accurate and complete EPLs with regard to the national goal of providing high quality care for all Americans. The literature supports the creation of organizational policies and procedures, educational opportunities, and implementation of beneficial EHR tools that will improve the usage and maintenance of the EPL. Overall, existing literature and the hospital's current state and known gaps support this study's objectives to identify, recommend, and promote the usage and maintenance of an EPL, with the knowledge that an accurate and complete PL communicates a more accurate patient story with regard to transitions through care settings.

Data Collection

Study Population

This study utilized a sample size of 200 hospital accounts that had used the MS-DRGs payment system and were admitted to the ICU from December 1, 2018 to December 31, 2019. The sample was split between 100 random hospital records obtained from December 1, 2018 to April 30, 2019 and 100 random records obtained from May 1, 2019 to December 31, 2019. The actual medical record accounts meeting the pre-defined requirements, as indicated in the Appendix, resulted in 144 medical record cases for to ICU Group A and 56 medical record cases for to ICU Group B.

Inclusion

To ensure generalizability and validity of the results, the selection of the requested data was extracted from inpatient records that included patients admitted into the hospital's ICU from December 1, 2018 to December 31, 2019. The records were further filtered according to accounts where the primary DRG was a MS-DRG and where the "chief complaint" was documented discreetly. The first random 100 accounts that met the above criteria were pulled for data extraction between the date ranges of December 1, 2018 to April 30, 2019 and identified as ICU Group A. Another random 100 accounts that meet the above criteria were pulled for data extraction between the date ranges of May 1, 2019 to December 21, 2019 and identified as ICU Group B.

Exclusion

To reduce the occurrence of additional outlier variables that could interfere with the validity of the study, accounts were excluded if the chief complaint was not documented discretely, the patients were under the age of 18, those with any

pregnancy-related MS-DRG, and accounts with other types of payers. Additionally, inpatient accounts that were not identified as the first 100 records meeting the inclusion criteria were excluded.

The requested data were extracted by the hospital's data services team using the datal collection tool (see Appendix) after approval from both the hospital administration and its respective IRB, as well as the CSUF IRB. To ensure data consistency and validity, the data collection tool was used as a guide to analyze the obfuscated data.

Data Analysis

The collected data were evaluated, coded, and analyzed through the Statistical Package for Social Science (SPSS) version 27 for descriptive analysis. Additional analysis of the data utilized Pearson's Correlation Coefficient, Cross-tabulation, and the Chi-square test. The analysis phase of the study was evaluated based on the following:

1. Identify and code ICU Group A (Value = 1) versus ICU Group B (Value = 2).
2. Identify the MS-DRG and GMLOS (extracted from final bill) for each case.
3. Identify the actual length of stay for each record (time-stamp of inpatient admission orders received to time discharge orders received).
4. Identify the chief complaint (reason for admission or evaluation extracted from discrete fields).
5. Identify the principal diagnosis (primary diagnosis extracted from final billed list of diagnoses).

6. Identify and code note type used (template note type: Free-text) (value = 1), Template-PBC (value = 2), Transcription (value = 3), Template smartphrase (value = 4), Template-copy forward (value = 5), Template smart link (value = 6), Template smart text (value = 7), Template-voice recognition (value = 8), and Other (value = 9).
7. Identify PL use, as indicated by the time-stamped electronic date in reference to the date of admission to the ICU, date of transfer to the medical floor, and date of discharge summary note (coded to PL update Yes = 1 No = 2).
8. Count and total the PL diagnoses.
9. Count and total the final billed list of diagnoses.
10. Look for completeness and accuracy,

Additionally, a final evaluation of the PL of diagnoses was performed against the final billed list of diagnosis. After evaluation and coding of the collected data, the data variables and data elements were keyed into a statistical software to be calculated and manipulated for additional conclusions about the study findings.

Confidentiality and Privacy

The facility data services department utilized patient hospital account record numbers to pull the requested data, pursuant to the data collection tool (see Appendix). The extracted data was provided to the principal investigator who then reviewed, analyzed, and stored the obfuscated data electronically on an encrypted, password protected Microsoft Excel spreadsheet.

Data Security

All electronic information was stored on an encrypted, password protected Microsoft Excel document, a facility secured network-shared folder accessible only by the principal investigator. The principal investigator accessed the secured folder with network and password access as an approved facility user. All electronic documents were stored for 1 year after the study closed and then disposed of in a confidential manner, consistent with HIPAA regulations and facility policies.

Summary

This study incorporated a retrospective data analysis to evaluate the accuracy and completeness of the EPL, identify a relationship between an updated PL and EHR note type, and explore for potential EHR note type themes among two ICU groups to identify note types that could improve PL updates following release from the ICU. The study utilized the gold standard of random sampling with reference to the data collection tool requirements for inclusion and exclusion of the selected population. The extracted data were further identified with defined variables for the study prior to inputting the translated data into SPSS. The statistical tests used for the analysis included descriptive analysis, Pearson's Correlation Coefficient, Cross-tabulation, and the Chi-square test to find a relationship among the variables. The data results and findings will be discussed in chapter 4.

CHAPTER 4: RESULTS

Overview

The EPL is a vital tool for communicating health problems; therefore, it is imperative that it be accurate and complete. This project aimed to answer two research questions: (a) Does an accurate and complete PL improve effective communication in the care process, thereby improving efficiency of care, as represented by the GMLOS? and (2) Does the utilization of the PL improve the accuracy of the patient story, thereby improving quality and safe patient care, as represented by an accurate MS-DRG?

The study retrospectively reviewed of medical record data that was collected for analysis. The data were extracted by the hospital's data services department using the data collection tool (see Appendix) to ensure consistency and validity. Once the data were received, they were extracted and variables were entered into the SPSS program for analysis. This chapter will summarize the statistical tests used to analyze the data and interpret the results.

Frequency of PL Update

The first step to understanding PL usage in the medical record was to use a frequency test to identify how often the PL was updated after a patient was transferred out of the ICU. Figure 1 shows that, of 200 medical records, 150 had an updated PL, leaving 50 with non-updated PLs following transfer from the ICU.

The second step identified any variance found between the two ICU groups, which involved comparing the PL update variables with each of the identified ICU group medical record cases using frequencies and percentages. Before completing this, it was noted that among the 200 randomly selected medical records, 144 cases belonged to ICU Group A and 57 cases belonged to ICU Group B (see Table

1). It was noted that despite the lower number of cases extracted for this study, ICU Group B had a greater percentage of cases overall, with an updated PL when compared to ICU Group A.

Figure 1

PL Update After ICU Transfer

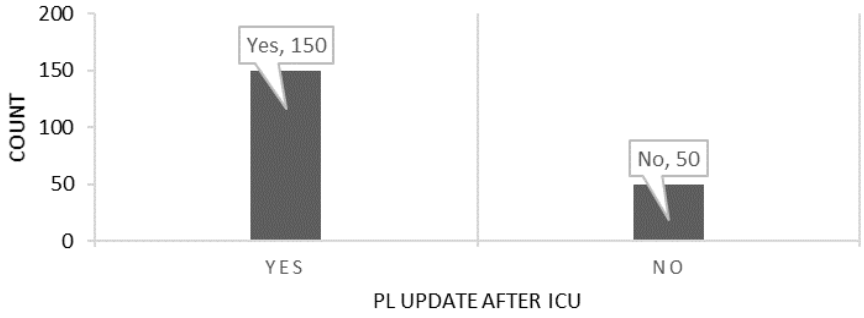


Table 1

ICU Group Problem List Update After ICU

	Yes	Percent	No	Percent	Total
ICU Group A	98	68.10	46	32.00	144
ICU Group B	52	92.90	4	0.70	56
Total					200

Note: The frequency of problem list update was compared between ICU Group A and Group B

Relationship between Problem List Update and ICU provider Consult/H&P note type

To understand if the ICU provider note type impacted the updated PL, they were evaluated for frequency. As demonstrated in Table 2, the most common type of note was Smart phrases (38.5%). The least commonly used note type was voice recognition (.5%).

Table 2

Frequency of ICU Consult/H&P Note Type

Note type	Frequency	Percent
Template-free text	38	19.0
Transcription	26	13.0
Template-Smart phrase	77	38.5
Template-Smart Link	30	15.0
Template-smart text	8	4.0
Template-voice recognition	1	.5
Other-Unknown	20	10.0
Total	200	100.0

Note: This table shows the different types of progress notes used for ICU Consult/H&P

The Crosstabulation test classified what progress notes were used among ICU Groups A and B that were associated with updated versus non-updated PLs (see Figures 2 and 3). The results for Group A indicated that the template progress note type with Smart phrases had the highest association with updated PLs (47%). Figure 2 also shows that approximately 22% of non-updated PLs were associated with templated progress notes containing Smart phrases. Nine percent of non-updated medical record cases had unidentified note types.

ICU Group B had a greater number of Template note types with Smart links (18%) associated with an updated PLs following transferred from the ICU. By contrast, a non-updated PL was noted to have just 2% of transcription notes (see Figure 3).

Figure 2

ICU Group A Note Type Compared with Problem List Update After Transfer

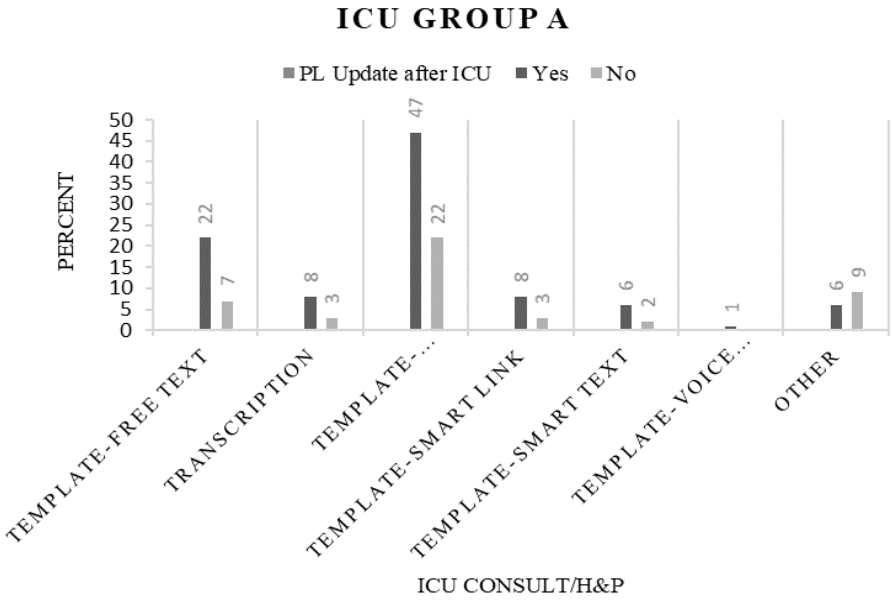
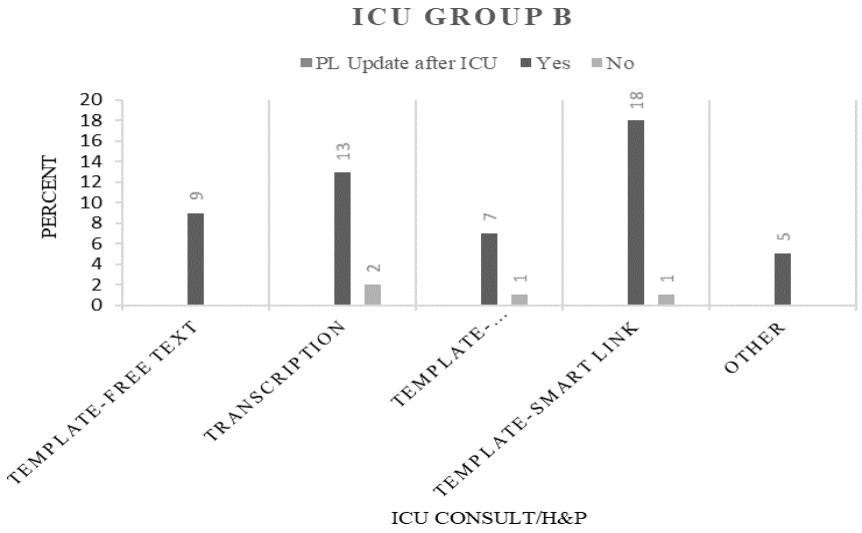


Figure 3

ICU Group B Compared with Problem List Update After Transfer



A crosstabulation test used to determine associations among the ICU Consult/H&P note types and PL updating resulted in the following: updated PL after ICU (mean = 1.25; Std deviation = .434) and ICU Consult/H&P Note type (mean = 4.24; Std deviation = 2.313; r = .105; p-value = .139). A significant statistical relationship among two variables was found if the p-value, two-tailed was ≤ 0.05. The results indicated no association among an updated PL and ICU Consult/H&P note type. This comparison group was found to have a p-value, two-tailed > 0.05, as described above.

Table 3 shows the details of the Crosstabulation with Chi-square test of independence, which indicated that there was not a statistical significance with p-value, 2-sided Asymptotic Significance > 0.05 for both ICU Group A and Group B (p-value, 2-sided Asymptotic significance = .311 and .644 respectively).

Table 3

Association Between ICU Group A and Group B Problem List Update Chi-Square Tests

ICU Group		Value	df	Asymptotic significance (2-sided)
	Pearson chi-square	7.112[b]	6	.311
	Likelihood ratio	7.006	6	.320
	Linear-by-linear association	3.507	1	.061
A	N of valid cases	144		
	Pearson chi-square	2.391[c]	4	.664
	Likelihood ratio	3.176	4	.529
	Linear-by-linear association	.115	1	.734
B	N of valid cases	56		
	Pearson chi-square	9.091[a]	6	.169
	Likelihood ratio	9.184	6	.163
	Linear-by-linear association	2.198	1	.138
Total	N of valid cases	200		

a. 3 cells (21.4%) have expected count less than 5. The minimum expected count is .25.
b. 6 cells (42.9%) have expected count less than 5. The minimum expected count is .32.
c. 6 cells (60.0%) have expected count less than 5. The minimum expected count is .36.

Relationship between Problem list Update and Hospitalist Note Type

Statistical results found no association between an updated PL and the ICU Consult/H&P note type. The next step was to follow the PL as the patient transferred out of the ICU and onto the hospital ward. The first hospitalist note type after the ICU transfer was used to analyze this relationship. The findings showed that Hospitalist Note type (mean = 3.07; Std deviation = 2.173; r = -.156; p-value, two-tailed = .967) showed no association between an updated PL and Hospitalist note type (see Table 4).

Table 4

Correlations

		PL update after ICU	ICU consult/ H&P	GLOS	Actual LOS	Hosp note type	Dschrg summ note type
PL update after ICU	Pearson corr.	1	0.105	-0.008	-.207**	0.003	-.156*
	Sig. (2-tailed)		0.139	0.907	0.003	0.967	0.028
	N	200	200	200	200	199	200
ICU consult/ H&P	Pearson corr.	0.105	1	-0.066	-0.111	-0.013	-0.044
	Sig. (2-tailed)	0.139		0.354	0.118	0.851	0.532
	N	200	200	200	200	199	200
GLOS	Pearson corr.	-0.008	-0.066	1	.619**	-0.069	0.030
	Sig. (2-tailed)	0.907	0.354		0.000	0.329	0.671
	N	200	200	200	200	199	200
Actual_LOS	Pearson corr.	-.207**	-0.111	.619**	1	-0.074	0.040
	Sig. (2-tailed)	0.003	0.118	0.000		0.296	0.573
	N	200	200	200	200	199	200
Hospitalist note type	Pearson corr.	0.003	-0.013	-0.069	-0.074	1	-0.037
	Sig. (2-tailed)	0.967	0.851	0.329	0.296		0.599
	N	199	199	199	199	199	199
Discharge summary note type	Pearson corr.	-.156*	-0.044	0.030	0.040	-0.037	1
	Sig. (2-tailed)	0.028	0.532	0.671	0.573	0.599	
	N	200	200	200	200	199	200

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Relationship between Discharge Summary Note Type and Problem List Update

The Pearson Correlation test indicated a low correlation between an updated PL and the Discharge summary note type (see Table 5). Additional analysis evaluated the statistical relationship between an updated PL and Discharge Summary note type using Crosstabulation and Chi-square test (see Table 6). The 2-sided Asymptotic significance indicated that a relationship exists between an updated PL and Discharge Summary note type.

Table 5

Association between Problem List Update and Discharge Summary

		PL update after ICU	Discharge summary note type
	Pearson correlation	1	-.156*
PL update	Sig. (2-tailed)		.028
post ICU	N	200	200
Discharge	Pearson correlation	-.156*	1
summary	Sig. (2-tailed)	.028	
note type	N	200	200

* Correlation is significant at the 0.05 level (2-tailed).

Table 6

Correlation between Problem Update and Discharge Summary Note Type

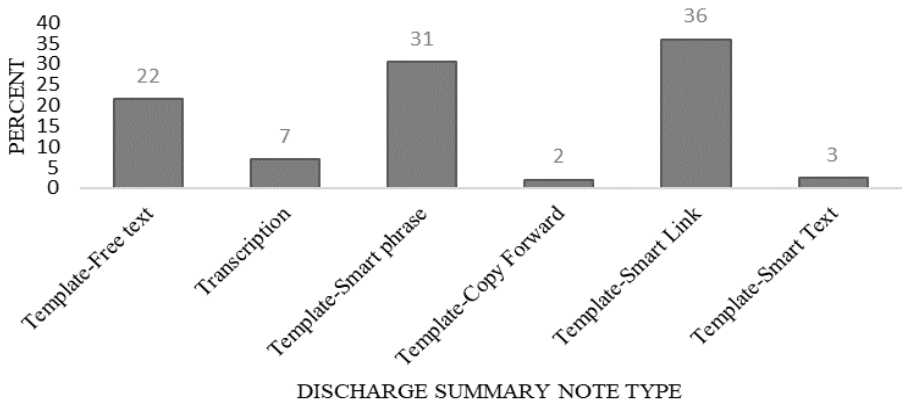
	Value	df	Asymptotic significance (2-sided)
Pearson chi-square	30.036[a]	6	.000
Likelihood ratio	31.827	6	.000
Linear-by-linear association	4.836	1	.028
N of valid cases	200		

a. 7 cells (50.0%) have expected counts less than 5. The minimum expected count is .25.

Recognizing that an updated PL and the discharge summary note type had a significant association, it was important to identify what discharge summary note type may contribute to an updated PL. To distinguish which Discharge Summary note type correlated with an updated PL, the frequency of note type for the Discharge summary was applied (see Figure 4).

Figure 4

Discharge Summary Frequency of Progress Note Types.



Other Relationship between Problem List Update after ICU

Further statistical testing using Pearson Correlation to identify if updating the PL was associated with other variables, such as (a) number of diagnoses listed on the PL, (b) GMLOS (mean = 6.734; Std deviation = 4.0253; r = -.008; p-value, two-tailed = .907), and (c) ALOS (mean = 13.68; Std deviation = 15.933; r = -.207; p-value, two-tailed = .003). The results demonstrated no significant relationship between updated PL and GMLOS (r = -.008, p-value, two-tailed = .907). A moderate association was found between an updated PL and number of diagnoses on the PL (mean = 7.66; Std. deviation = 4.921; r = -.496; p-value, two-

tailed = .000) and a low negative correlation was statistically significant between an updated PL after ICU and ALOS and a strong correlation between GMLOS and ALOS (r = .619, p-value, two-tailed = .000).

Relationship between Problem List Number of Diagnoses and Final Billed Diagnoses

To answer the research questions, the mean and frequency of diagnoses listed on the PL and on the final billed diagnoses were analyzed. A Pearson Correlation test determined a relationship between the PL and Final diagnosis list. The Frequency test showed the number of diagnoses listed on the PL, with a mean = 7.66, Std. deviation = 4.921, and variance of 24.217, compared to the number of diagnoses listed on the final billed, with a mean = 17.3350, Std. deviation = 3.96882, and variance of 15.752 (see Table 7).

The Pearson Correlation test determined a moderate relationship between the PL number of diagnoses and the Final list of diagnoses, with r = .385 and p-value, two-tailed = .000. The Pearson Correlation test also determined a low relationship between the PL number (mean 7.66; Std. deviation 4.921) and GMLOS (mean = 6.734; Std deviation = 4.0253) of r = .243, with p-value, two-tailed of 0.001.

Summary

This chapter presented the results of the analysis using the research questions, aims of the study, and Deming's "Check" process in his PDCA cycle. A total of 200 obfuscated medical records were extracted using the Data Collection tool (see Appendix) and separated into two groups: ICU Group A (144) and ICU Group B (56). The collected data were evaluated, coded, and entered into SPSS for statistical analysis.

Table 7

Comparison of Number of Diagnoses on Problem List and Final Billed List

Problem list	Mean	N	Std. deviation
0 diagnosis on PL	16.3810	21	5.06435
1 diagnosis on PL	16.0000	8	5.20988
2 diagnoses on PL	14.2000	5	6.41872
3 diagnosis on PL	16.7143	7	5.25085
4 diagnosis on PL	13.6667	12	3.49892
5 diagnosis on PL	15.4286	14	4.27361
6 diagnosis on PL	16.2381	21	4.06085
7 diagnosis on PL	15.7333	15	4.66701
8 diagnosis on PL	18.0000	13	3.16228
9 diagnosis on PL	17.6154	13	3.57161
10 diagnosis on PL	19.0714	14	1.73046
11 diagnosis on PL	20.0000	13	0.00000
12 diagnosis on PL	18.8333	12	1.89896
13 diagnosis on PL	19.8889	9	0.33333
14 diagnosis on PL	20.0000	4	0.00000
15 diagnosis on PL	19.3333	6	1.63299
16 diagnosis on PL	20.0000	4	0.00000
17 diagnosis on PL	20.0000	2	0.00000
18 diagnosis on PL	20.0000	3	0.00000
20 diagnosis on PL	19.7500	4	0.50000
Total	17.3350	200	3.96882

Note: The number of diagnoses on the Problem List was compared to the number of diagnoses on the Final billed lists. The lower the number of diagnoses noted on the Problem List the greater the variance between the two. When more diagnoses were found on the Problem List, the variance between the two variables was lower.

The data were analyzed for themes and relationships using Frequency, Means, Pearson Correlation, and Crosstabulation tests. The analysis found no statistical significance between ICU Groups A and B when comparing for EHR tool usage. Analysis found a statistically significant relationships among the updated PL and the Discharge Summary Note type, PL update and number of PLs, PL number of diagnoses and Final billed List of diagnoses, PL number of diagnoses and GMLOS; and relationships between GMLOS and ALOS. The frequency of note types used with a Discharge summary note was Smart Links and Smart Phrases. Chapter 5 will include the summary of analysis and discussion of the findings.

CHAPTER 5: DISCUSSION

The communication of the patient story is essential for efficient, high quality, and safe care. The EHR and the EPL can effectively communicate the patient story, yet evidence has shown much room for improvement. The ongoing challenges associated with the EHR and EPL have affected patient care. Recognizing the positive impact of the EPL on the communication of the patient story, this study sought to assess, identify, and provide evidence-based practices that could enhance the accuracy and completeness of the EPL.

The purpose of this retrospective data analysis of the EPL in the EHR was to assess for the completeness and accuracy of the PL and identify EHR tools that may improve the utilization and maintenance of the PL. This chapter provides an overview of the study with a discussion of the major findings as they relate to the study objectives, framework, and study methodology. The chapter concludes with a discussion of the strengths and limitations of the study, areas for future research, and a summary.

The study sought to answer the following two research questions: (a) Does an accurate and complete PL improve effective communication in the care process, thereby improving efficiency of care, as represented by the GMLOS? and (2) Does the utilization of the PL improve the accuracy of the patient story, thereby improving quality and safe patient care, as represented by an accurate MS-DRG? This retrospective study was also guided by three objectives: (a) attain an assessment of the accuracy and completeness of the EPL as the patient transfers from each level of care, (b) find common themes in the usage of EHR tools that may assist in the accuracy and completeness of the EPL, and (c) identify a correlation among the usage of templated notes, transcribed progress notes, and

problem-based documentation among two ICU groups to identify if any of these EHR methods improved the accuracy of the patient story.

Interpretation of the Findings

A complete and accurate PL provides for and supports quality, safe, and efficient care. Updated PLs also have been associated with complete and accurate patient stories. The adoption of the EHR has afforded new capabilities that may assist with the utilization and maintenance of the EPL. Each of these themes will be discussed in the following sections.

Problem List as a Communication Tool

Effective communication in the patient setting makes for care that is safe, efficient, and of high quality. The EPL is an essential tool in the medical record that allows providers to communicate a patient's pertinent history, so it is important that this tool is effective when communicating the patient's story. The discharge summary note documents the sequence of events and includes the acute and chronic medical diagnoses that were evaluated, treated, and monitored during each inpatient stay. In a sense, the discharge summary communicates the complete story of events pertaining to a hospital stay.

This study explored the relationship between an updated PL and the discharge summary note type and found a low negative statistical relationship ($r = -.156$, p-value, two-tailed $\leq .028$). The Chi-square test confirmed a true relationship (see Table 1) .5 with Pearson chi square value = 30.036, df = 6, and 2-sided Asymptotic significance = .000. This association may infer two concepts: (a) an updated PL is comparable to a discharge summary and/or (b) an updated PL correlates with the type of discharge summary note type. The discharge note type

was analyzed in SPSS and revealed that when writing the discharge summary, providers were more likely to use templated progress notes with EHR Smart links, followed by Smart phrases, and Free text. This may suggest that EHR tools improve the utilization and maintenance of the PL and improve the PL as a communication tool.

Problem List and Complete and Accurate Patient Story

The PL is utilized by health care providers when making patient care decisions. It is an essential reminder and representation of the patient story and contains current chronic and/or past medical diagnoses that influence a provider's decisions about treatments and evaluations. The results of this study suggest that a complete PL was associated with a final billed list of diagnoses that more accurately reflected the patient story. This study assumes that the final billed list of diagnoses represented an accurate and complete patient story. Therefore, the findings of a moderate relationship ($r = .385$ and p-value, two-tailed = .000) between the number of PL diagnoses and the final list of diagnoses may imply that the increased usage of the PL resulted in more diagnoses added to the final billed list of diagnoses. It is realized, as demonstrated in Table 6, that diagnoses added to the PL were reflected on the final billed list of diagnoses. Conversely, a PL with fewer diagnoses resulted in a shorter final billed list of diagnoses. This finding was unexpected and suggests a statistically significant and beneficial impact on the final billed listing of diagnoses.

The GMLOS and MS-DRG results from the principal diagnoses assigned to the final billed list of diagnoses, along with other significant comorbidities and/or major comorbidities, affects the MS-DRG and its respective GMLOS. When examining the correlation between an updated PL and GMLOS, there was no

statistical relationship; however, there was a low negative statistical relationship, indicating a connection between an updated PL and the ALOS (r = -.156, p-value, two-tailed = .028). Additionally, results showed a strong relationship between the GMLOS and ALOS (r = .619, p-value, two tailed = .000), which may imply that although there was no statistical relationship between the GMLOS and an updated PL, there may still be an association since a relationship was found between the GMLOS and ALOS. These findings support the research hypothesis, indicating that the utilization of the PL improves the accuracy of the patient story, which then improves quality and safe care, as represented by an accurate MS-DRG.

Problem List and Electronic Health Record Tools

Although this study found no statistical difference between ICU Group A and ICU Group B and an updated PL after ICU transfer, as mentioned in the earlier section under "*Problem List as a Communication Tool,"* EHR tools may benefit the utilization and maintenance of the PL. This study examined the types of progress notes used and found that the frequency of EHR tools used most across the inpatient setting was a Templated progress note with Smart phrases and Smart links. The literature supports the utilization of templated progress notes and other EHR tools, such as copy forward, as they support accurate duplication and automation that has been shown to improve documentation in the EHR (Cao et al., 2017; Kahn et al., 2018). However, few studies have studied specific EHR tools, such as Smart phrases, Smart links, and Smart text, which may improve accuracy and completeness. The findings of this study indicate that EHR smart tools may improve the use and maintenance of the EPL.

Implications

The healthcare sector is a highly complex system that demands complete and accurate knowledge to function effectively, meaning high quality patient care. This can be a difficult expectation for patients to navigate and, to make matters worse, if their own medical records contain the same inaccuracies and incomplete documentation as those of their providers, the obstacles can be insurmountable. For patients to receive evidenced-base care, the current provider and other specialists must have accurate and current information about the patient's problems. When vital information is lacking, patients with life-threatening conditions, such as heart failure or obesity, receive inadequate care. Doctors can be only so effective when the medical record system is failing to provide adequate and accurate information.

The PL communicates a patient's story; therefore, it is essential that it be accurate and complete. The findings from this study revealed a relationship between an updated PL and the type of discharge progress note and a relationship between the number of diagnoses listed on the PL and the final billed list of diagnoses. These correlations may suggest that a templated progress note with the addition of EHR tools, such as Smart phrases or Smart links, may increase the use and maintenance of the PL.

An inaccurate PL has been shown to decrease efficiency, quality, and safety of patient care. Additional findings demonstrated that outdated or inaccurate PLs made for lower final billed list of diagnoses. Although there was no statistical relationship between an updated PL and GMLOS, this study found a strong statistical relationship between the ALOS and GMLOS, which may infer a relationship outside of statistical findings. The GMLOS has been utilized by Medicare to benchmark hospitals on efficiency of care. The relationship between

an updated PL and ALOS may help explain why stays lasted beyond the expected GMLOS or why a patient stayed within the GMLOS. These interconnected relationships may stipulate that an updated PL and having a complete PL impacts the GMLOS when all patient conditions are accurately portrayed on the PL.

Strengths

The study incorporated a retrospective review of secondary data extracted from discrete fields using a data collection tool that was reliable, consistent, and precise. The PL is relatively new in its current form in the EHR. The EPL is a mandated requirement through the initiatives of Meaningful Use Criteria, which lacks policy and electronic structural guidance on its purpose and use. This meant that the present study could explore the current state of the EPL and identify beneficial EHR tools that could make this communication tool function more closely to its intended purpose.

The utilization of the statistical correlation test allowed this study to measure variables and their relationships to one another and identify complex relationships between different variables. One positive aspect to correlational studies is the finding of a statistical relationship, which can later predict the value of another variable. A strength in this study that resulted from a limitation was the limited quantity of literature on the evaluation of EPL communication and the benefits of EHR tools. The present study enjoyed a greater opportunity to contribute additional knowledge for future research and analysis.

Limitations

This study presented only a small analysis of data collected from one hospital and its results may not represent all healthcare entities. While a genuine limitation, it allowed this researcher greater efficiency of method since there were

few resources to complicate the process. Additionally, the study attempted to explore the use of EHR tools while emphasizing problem-based charting. However, the sample size contained only two medical record cases that used a problem-based note template. Future research should obtain a larger sample size when exploring this area. The findings indicated a significant improvement in PL updating associated with ICU Group B, inferring a change in documentation, increased utilization of EHR tools, or other hospital wide initiatives that may have contributed to this positive finding. Additional research should examine for factors that may have contributed to greater PL updating. The extracted data in accordance with the data collection tool and the inclusion and exclusion criteria resulted in an unequal sample size between ICU Groups A and B. This unequal sample size may have hindered this study's ability to determine why Group B exhibited a greater PL update.

Additionally, the evaluation of the PL as a guide to assess the communication in the EHR is not inclusive of all root causes of ineffective communication in the electronic progress notes. Other forms of communication were not studied and may have reflected additional barriers to ineffective communication. This project assumed that the diagnoses inputted by the certified coder resulting in the final MS-DRG and GMLOS represented accurate and complete PLs. The normal process for a certified coder involves applying coding rules and guidance of diagnosis code assignment based upon informed interpretation of what constitutes the principal diagnosis and what constitutes active diagnoses for a given stay.

The obfuscated study data were discrete areas of the progress note, as retrieved by the hospital's data service team. Future research should manually complete a chart review of the different elements of the progress note to identify

nondiscrete fields for additional attribution and relationship to EHR tool usage. The limitation of discrete data did not allow for evaluation of granular details of documentation that may have provided additional explanation or gap analysis when assessing for accuracy and completeness of the PL.

Despite the findings, the limitations of this study may have precluded a full attempt to find significant correlations. Future research should consider using this study's findings to further explore the impact of an accurate PL and the usage of EHR tools.

Conclusion

Communicating an accurate patient story is vital making adequate and safe care decisions, as well as coordinating care among different levels and settings of medicine. The available literature indicated that an accurate and complete PL alerts providers to conditions, assists other providers at each level of care, and accurately enhances the patient story. The EPL lays the groundwork for providers to improve patient health through care that is safe, efficient, and of high quality.

The EHR has been in use for over 10 years; however, a literature search revealed few studies that have examined the impact of inaccurate EPLs. The findings from this study indicated that further review is needed by manual chart review to explore progress notes and determine if and what EHR tools are aiding accuracy and completeness. Additionally, the study data were extracted from discrete fields, which may have hindered the identification of specific characteristics of data.

This study sought to identify and correlate a relationship between an accurate PL and the communication in the EHR. The study found a relationship between an accurate PL and the EHR note type associated with the discharge

summary. This relationship shows that by the time of discharge, it would be prudent to ensure the accuracy and completeness of the patient story. This study also found a relationship between the number of diagnoses listed on the PL and the number of diagnoses listed on the final billed list. In noting this hospital utilized templated progress notes, EHR smart tools, and problem-based charting, it would seem evident that they are most effective when used together.

The current condition of the average EPL has meant that the EHR is not being used as it was originally intended. A well-crafted PL benefits policymakers, leaders, and hospitals by informing decisions within America's complicated health care system. However, poorly-documented PLs result in fragmented care. This study found that EHR tools can assist in the use and maintenance of the PL and make for higher quality and more efficient patient care. It is hoped that these findings will increase the use of the PL and prove that it can accomplish the IOM's goal of high quality care for all.

REFERENCES

REFERENCES

Abraham, J., Kannampallil, T. G., & Patel, V. L. (2012). Bridging gaps in handoffs: A continuity of care based approach. *Journal of Biomedical Informatics, 45*(*2*), 240-254. doi:10.1016/j.jbi.2011.10.011

American Academy of Family Physicians. (2017). *Clinical practice guideline manual*. https://www.aafp.org/family-physician/patient-care/clinical-recommendations/cpg-manual.html

AHIMA. (2008, January). Best practices for problem lists in an EHR. *Journal of AHIMA, 79*(1), 73-77.

AHIMA Work Group. (2011, September). Problem list guidance in the EHR. *Journal of AHIMA, 82*(9), 52-58. http://www.library.ahima.org/doc?oid+104997#.YBdV0OhKhPY

Agency for Healthcare Research and Quality. (n.d.). *Topic: Evidence-based practice*. http://www.ahrq.gov/topics/evidence-based-practice.html

Agency for Healthcare Research and Quality. (2020). *Understanding quality measurement*. Department of Health and Human Services. https://www.ahrq.gov/patient-safety/quality-resources/tools/chtoolbx/understand/index.html

Anderson, P. (2018). Theoretical approaches to quality improvement. In J.B. Butts & K.L. Rich. (Eds.) *Philosophies and theories for advanced nursing practice* (pp. 375-391). Jones & Bartlett Learning.

Aronson, M.D. (2019, November). The purpose of the medical record: Why Lawrence Weed still matters. *The American Journal of Medicine, 132*(11), pp. 1256-1257. doi:10.1016/j.amjmed.2019.03.051

Bardach, S.H., Real, K., & Bardach, D.R. (2017, May). Perspectives of healthcare practitioners: An exploration of interprofessional communication using electronic medical records. *Journal Interprofessional Care, 31*(3), 300-306. doi:10.1080/13561820.2016.1269312.

Bordowitz, R., Morland, K., & Reich, D. (2007). The use of an electronic medical record to improve documentation and treatment of obesity. *Family Medicine, 39*(4), 274-279.

Bormel, J. (2011, February 1). Problem lists are the keys to meaningful use. *Healthcare Innovation*. http://www.hcinnovationgroup.com/home/article/13003529/problem-lists-are-the-keys-to-meaninful-use

Bowman, S. (2013). Impact of electronic health record systems on information integrity: Quality and safety implications. *Perspectives in Health Information Management, 10*, 1-19.

Brown, K.N., Leigh, J.P., Kamran, H. Bagshaw, S.M., Fowler, R.A., Dodek, P.M., Turgeon, A.F., Forster, A.J., Lamontagne, F., Soo, A., & Stelfox, H.T. (2018). *Critical Care, 22*(19). doi:10.1186/s13054-018-1941-0

Cao, J., Farmer, R., Carry, P., Goodfellow, M., Gerhardt, D.C., Scott, F., Heare, T., & Miller, N.H. (2017). Standardized note templates improve electronic medical record documentation of neurovascular examinations for pediatric supracondylar humeral fractures. *JBJS Open Access, 2*(4). doi:10.2106/JBJS.OA.17.00027

Cohen, G.R., Friedman, C.P., Ryan, A.M., Richardson, C.R., & Adler-Milstein, J. (2019). Variation in physicians' electronic health record documentation and potential patient harm from that variation. *Journal of Internal Medicine, 34*(11), 2355-2367. doi:10.1007/s11606-019-05025-3

CMS.gov. (2020). Hospital compare. *U.S. Centers for Medicare & Medicaid Services*. https://www.cms.gov/medicare/quality-initiatives-patient-assessment-instruments/hospitalqualityinits/hospitalcompare

Colicchio, T.K., Cimino, J.J., & Del Fiol, G. (2019). Unintended consequences of nationwide electronic health record adoption: Challenges and opportunities in the post-meaningful use era. *Journal of Medical Internet Research, 21*(*6*). doi:10.2196/13313

CRICO Strategies. (2015). Malpractice risks in communication failures. *CRICO Strategies Annual Report*. http//crico_benchmarking_communication%*20*(3).pdf

Diaz, B. (2016, March). Improved communication can reduce hospital readmissions. *American Journal of Managed Care*. https://www.ajmc.com/view/improved-communication-can-reduce-hospital-readmissions

Doyle-Lindrud, S. (2015, April). The evolution of the electronic health record. *Clinical Journal of Oncology Nursing, 19*(2), pp.153-154. doi:10.1188/15.CJON.153-154

Forthman, M.T., Gold, R.S., Dove, H.G., & Henderson, R.D. (2010). Risk-adjusted indices for measuring quality of inpatient care. *Quality Management in Health Care, 19*(3), 265-277.

Graber, M.L., Siegal, D., Riah, H., Johnston, D., & Kenyon, K. (2019). Electronic health record-related events in medical malpractice claims. *The Journal of Patient Safety, 15*(2), 77-85.

Hartung, D. M., Hunt, J., Siemienczuk, J., Miller, H., & Touchette, D. R. (2005). Clinical implications of an accurate problem list on heart failure treatment. *Journal of General Internal Medicine*, *20*(2), 143-147. https://doi.org/10.1111/j.1525-1497.2005.40206.x

HealthIT.gov. (2017, October 5). Benefits of EHRs. *The Office of the National Coordinator for Health Information Technology*. https://www.healthit.gov/topc/health-it-basics/benefits-ehrs

Holmes, C. (2011, February). The problem list beyond meaningful use: Part I: The problems with the problem lists. *Journal of AHIMA, 82*(2), 30-33. http://www.library.ahima.org/doc?oid = 103402#.YDLly-hKhPY

Holmes, C., Brown, M., St. Hilaire, D., & Wright, A. (2012). Healthcare provider attitudes towards the problem list in an electronic health record: A mixed-methods qualitative study. *BMC Medical Informatics and Decision Making, 12*(127). https://doi.org/10.1186/1472-6947-12-127

Hummel, J., & Evans, P. (2012). *Standardizing the problem list in the ambulatory electronic health record to improve patient care*. HealthIT.gov. http://www.healthit.gov/sites/default/files/standardizing_the_problem_list-in_the_ambulatory_electronic_health_record_to_tmprove_patient_care.pdf

Institute of Medicine. (2001). *Crossing the quality chasm: A new health system for the 21st century*. The National Academies Press. https://doi.org/10.17226/10227

The Joint Commission. (2015). *Preventing copy-and-paste errors in EHRs* [PDF file]. http://www.jointcommission.org

The Joint Commission. (2017). *Inadequate hand-off communication. Sentinel Event Alert*. https://www.jointcommission.org/-/media/tjc/documents/resources/patient-safety-topics/sentinel-events/sea_58_hand_off_comms_9_6_17_final_(1).pdf

Kapoor, A., Kim, J, Zeng, X., Harris, S.T., & Anderson, A. (2020). Weighing the odds: Assessing underdiagnosis of adult obesity via electronic medical record problem list omissions. *Digital Health*, 6, 1-8. doi:10.177/2055207620918715

Kahn, D., Stewart, E., Duncan, M., Lee, E., Simon, W., Lee, C., Friedman, J., Mosher, H., Harris, K., Bell, J., Sharpe, B., & El-Farra, N. (2018). A prescription for note bloat: An effective progress note template. *Society of Hospital Medicine, 13*(6), 378-382. doi:10.12788/jhm.2898

King, J., Patel, V., Jamoom, E. W., & Furukawa, M. F. (2014). Clinical benefits of electronic health record use: National findings. *Health services research*, *49*(1 Pt 2), 392-404. https://doi.org/10.1111/1475-6773.12135

Krauss, J.C., Boonstra, P.S., Vantsevich, A.V., & Friedman, C.P. (2016). Is the problem list in the eye of the beholder? An exploration of consistency across physicians. *Journal of American Medical Informatics Association*, *23*, 859-865.

Li, R.C, Garg, T., Cun, T., Shieh, L. Kishnan, G., Fang, D., & Chen, J.H. (2018). Impact of problem-based charting on the utilization and accuracy of the electronic problem list. *Journal of the American Medical Informatics Association, 25*(*5*), 548-554.

Liao, N., Kasick, R., Allen, K., Bode, R., Macias, C., Lee, J., Ramachandran, S., & Erdem, G. (2020). Pediatric inpatient problem list review and accuracy improvement. *Hospital Pediatrics, 10*(11), 941-948. http://www.doi:10.1542/hpeds.2020-0059

Liu, W., & Walsh, T. (2018). The impact of implementation of a clinically integrated problem-based neonatal electronic health record on documentation metrics, provider satisfaction, and hospital reimbursement: A quality improvement project. *The Journal of Medical Informatics, 6*(*2*), e40. doi:10.2196/medinform.9776

Lohr, K.N. (1990). *Medicare: A strategy for quality assurance, Volume II: Sources and methods*. National Academies Press (US). http://www.nap.edu/catalog/1548.html

Mainz, J. (2003). Defining and classifying clinical indicators for quality improvement. *International Journal for Quality in Health Care, 15*(6), 523-530.

Munchhof, A., Gruber, R., Lane, K.A., Bo, N., & Rattray, N.A. (2020). Beyond discharge summaries: Communication preferences in care transitions between hospitalists and primary care providers using electronic medical records. *Journal of General Internal Medicine, 35*(6), 1789-1796. http://doi.10.1007/s11606-020-05786-2

Solti, I., Aaronson, B., Fletscher, G., Soliti, M., Gennari, J.H., Cooper, M., & Payne, T. (2008). Building an automated problem list based on natural language processing: Lessons learned in the early phase of development. *Annual Symposium proceedings, AMIA Symposium.* https://www.researchgate.net/publication/23463561_Building_an_Automated_Problem_List_Based_on_Natural_Language_Processing_Lessions_Learned_in_the_Early_Phase_of_Development

Stockwell, D.C., Thomas, C., Fieldston, E.S., Hall, M., Czaja, A.S., Stalets, E.L., Biehler, J., Sheehan, M., Froglia, D., Byrd, S., & McClead, R.E. (2017). Using length of stay to understand patient flow for pediatric inpatients. *Pediatric Quality Safety, 3*(1). doi:10.1097/pq9.0000000000000050.

Varpio, L., Rashotte, J., Day, K., King, J., Kuziemsky, C., & Parush, A. (2015). The EHR and building the patient's story: A qualitative investigation of how EHR use obstructs a vital clinical activity. *International Journal of Medical Informatics, 84*(12),1019-1028. doi:10.1016/j.ijmedinf.2015.09.004.

Vermeir, P., Vandijck, D., Degroote, S., Peleman, R., Verhaeghe, R., Mortier, E., Hallaert, G., Van Daele, S., Buylaert, W., & Vogelaers, D. (2015). Communication in healthcare: A narrative review of the literature and practical recommendations. *International Journal of Clinical Practice, 69*(*11*), 1257-1267.

Wright, A., Pang, J., Feblowitz, J.C., Maloney, F.L., Wilcox, A.R., Ramelson, H.Z., Schneider, L.I., & Bates. D.W. (2011). A method and knowledge base for automated inference of patient problems from structured data in an electronic medical record. *Journal of American Medical Informatics Association, 18*, 859-867. doi:10.1136/amiajnl-2011-000121

Wright, A., Feblowitz, J., Maloney, F.L., Henkin, S., & Bates, D.W. (2012). Use of an electronic problem list by primary care providers and specialists. *Journal General Internal Medicine, 27*(8), 968-973. doi:10.1007/s11606-012-2033-5

Zegers, M., de Bruijne, M., Spreeuwenberg, P., Wagner, C., Groenewegen, P., & Wal, G. (2011). Quality of patient record keeping: An indicator of the quality of care? *BMJ Quality & Safety, 20*(4):314-318. doi:10.1136/bmjqs.2009.038976

APPENDIX: DATA COLLECTION TOOL

Appendix

Record selection Criteria

- Any patient seen in the ICU department (type of progress notes used identified: free text, Smart phrase, Smart text, PBC, transcription, voice recognition, Smart link, Template Copy-forward)
- Discharge date range: 12/01/2018 to 12/31/2019
- Only accounts where the primary DRG is an MS-DRG
- Only encounters where the Chief complaint is documented discreetly
- Only pull 100 random charts for each CY, 2018 and 2019

Data Collection Tool Variables

- Primary MS-DRG (Medicare Severity Diagnosis Related Groups)
- Hospital Account Record ID (obfuscated by data services prior to sending extracted data to PI)
- GMLOS (Geometric Length of Stay)
- This is attached to the MS-DRG. This is already in Epic.
- Actual length of stay
- First ADT IP Event to the Discharge Date. Days with a decimal point.
- Chief complaint (reason for admission or evaluation) [From ED]
- Principal diagnosis (admission diagnosis as documented in physician admission order)
- ICD Code Name and ICD Code itself
- ICU Group A Physician (12/01/2018 to 04/30/2019) Yes/No
- Based on discharge date
- ICU Group B Physician (5/01/2019 to 12/31/2019) Yes/No

- Based on discharge date
- Template Note Y/N
- Provider use a template note during the hospital encounter, note type = H&P or Consult note types. Only where note was created post the first ICU ADT event.
- Template notes creation Date Time
- Dictation Note Y/N
- This one is maybe for the discrete field. Entire encounter.
- Problem List Y/N
- Did the problem list get updated post the first ICU ADT event.
- Problem list diagnosis /ICD code first 20 (during the encounter)
- First ADT Event Date Time post leaving the ICU
- First ADT Event Department Name post leaving the ICU
- Date Time first hospitalist note post the first ICU ADT encounter event.
- Template Note Y/N
- Provider use a template note during the hospital encounter, note type = H&P or Consult note types. Only where note was created post the first ICU ADT event.
- Template notes creation Date Time
- Initial Hospitalist Progress Note post ICU ADT event
- Problem List Y/N
- Did the problem list get updated post the first ICU ADT event?
- Problem list update date time first 20 diagnoses/ICD code (during the encounter)
- Discharge Summary/Note Template use Y/N

- Template notes creation Date Time
- Problem List Updated Date/Time (at time of discharge)
- Problem list date/ diagnosis ICD code first 20 (during encounter)
- Medical History Name
- Medical History Date
- Account ICD Code Name (top 20)
- Account ICD Code (top 20)

Fresno State

Non-exclusive Distribution License (Keep for your records)

(to archive your thesis/dissertation electronically via the Fresno State Digital Repository)

By submitting this license, you (the author or copyright holder) grant to the Fresno State Digital Repository the non-exclusive right to reproduce, translate (as defined in the next paragraph), and/or distribute your submission (including the abstract) worldwide in print and electronic format and in any medium, including but not limited to audio or video.

You agree that Fresno State may, without changing the content, translate the submission to any medium or format for the purpose of preservation.

You also agree that the submission is your original work, and that you have the right to grant the rights contained in this license. You also represent that your submission does not, to the best of your knowledge, infringe upon anyone's copyright.

If the submission reproduces material for which you do not hold copyright and that would not be considered fair use outside the copyright law, you represent that you have obtained the unrestricted permission of the copyright owner to grant Fresno State the rights required by this license, and that such third-party material is clearly identified and acknowledged within the text or content of the submission.

If the submission is based upon work that has been sponsored or supported by an agency or organization other than Fresno State, you represent that you have fulfilled any right of review or other obligations required by such contract or agreement.

Fresno State will clearly identify your name as the author or owner of the submission and will not make any alteration, other than as allowed by this license, to your submission. **By typing your name and date in the fields below, you indicate your agreement to the terms of this use. Publish/embargo options (type X in one of the boxes).**

☐ X **Make my thesis or dissertation available to the Fresno State Digital Repository immediately upon submission.**

☐ Embargo my thesis or dissertation for a period of 2 years from date of graduation. After 2 years, I understand that my work will automatically become part of the university's public institutional repository unless I choose to renew this embargo here: fsdr-discuss@csufresno.edu

☐ Embargo my thesis or dissertation for a period of 5 years from date of graduation. After 5 years, I understand that my work will automatically become part of the university's public institutional repository unless I choose to renew this embargo here: fsdr-discuss@csufresno.edu

Kaying Vang

May 26, 2021

Date