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Electronic Health Record Fatigue in Patient Care at Public Hospitals in Northern California

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Requirements for the degree
Doctor of Public Administration

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ABSTRACT

This mixed methods study examined provider perceptions of electronic health record (EHR) fatigue and burnout and their effects on care efficiency and effectiveness at public hospitals in northern California. The study identified factors that affect EHR user interface experience and patient safety. The research problem is whether EHR fatigue is driving burnout among providers and (b) burnout affects patient care. The study employed a convergent parallel design, which combined interviews of medical providers and the Q-methodology. The study found that EHR utilization is associated with fatigue caused by increased work burden, especially in fast-paced clinical environments. Providers perceive the association of EHR to efficiency as positive. EHR user interface complexity, conducive organizational culture, and organizational support are factors contributing to the EHR user experience. EHR is associated with higher patient safety and fewer sentinel events. The study's findings provide further empirical affirmation of the predictions of the job demands–resources theory and Freudenberger's theory of burnout and highlight the theoretical importance of the effectiveness-efficiency theoretical paradigm of public administration, including the legacy of scientific management. The findings have implications for the management of public health care organizations and for public policy and administration.

Keywords: electronic health record, fatigue, burnout, effectiveness, efficiency, patient safety.

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First and foremost, acknowledging the King of Kings and Lord of Lords—Jesus Christ. “There is no other name under heaven given among men, whereby we must be saved”—Acts 4:12

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DEDICATION

The study is dedicated to the Lord Jesus Christ. Without Him, I am nothing.

"To the only wise God our Saviour, be glory and majesty, dominion and power, both now and ever. Amen."—Jude 1:24

This study is dedicated to my dear Emmy and Elisabeth.

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CHAPTER 1: INTRODUCTION

The research topic of the current study is the electronic health record (EHR) fatigue in patient care at public hospitals in northern California. Specifically, this study examined providers' perceptions of EHR fatigue, burnout, efficiency and effectiveness, EHR user interface factors, and how these issues influenced patient safety. The use of EHRs by providers aimed to increase health care delivery efficiency by reducing costs and medical errors. Providers spent billions of dollars transitioning to EHR and were partly incentivized by the federal government for implementing EHR systems (Schilling, 2009). The incentivization came in the form of legislation known as The Health Information Technology for Economic and Clinical Health Act (HITECH), a component of the American Recovery and Reinvestment Act (ARRA) of 2009, which was passed during the early months of the Obama administration. This law allocated $27 billion for EHR systems and incentivized providers to adopt and implement various EHR software packages. Providers who showed meaningful use of these systems would receive incentive payments for the adoption. Those who did not would face fines from the federal government. The HITECH Act was the driver of the large scale EHR software adoption at hospitals. Thus, studying the effects of EHR adoption on patient care would benefit the national health care policy discourse.

Problem Statement

The problem addressed in this study is whether EHR fatigue is driving burnout among providers at public hospitals in northern California and whether burnout affects patient care. Past research has examined the effects of EHR implementation in hospitals

on providers' fatigue and burnout and on care effectiveness, efficiency, and patient safety.

In particular, according to Downing et al. (2018), providers are being forced to divide their time and attention between patients and the EHR, which then leads to compromised patient–physician relationships. An exhaustive study by Young et al. (2018) supported this hypothesis as well. Additionally, the absence of reliable patient safety data is one of the main challenges in accurately evaluating EHR systems (Hydari et al., 2018). In turn, Meyerhoefer et al. (2018) noted that EHR systems at hospitals are disruptive and have caused dissatisfaction in providers and patients alike. Downing et al. (2018) also found that many providers and other staff in the medical community believe that the EHR could been driving dissatisfaction and burnout among providers. In turn, Young et al. (2018) concluded that "providers spent more time working in the EHR than with their respective patients face to face during office visits" (p. 97).

Overall, research on the utilization of EHR has indicated that EHR fatigue is posing a serious challenge for providers. Additionally, it appears that a standardized methodology for evaluating the impact of EHR is not in place, and patient safety data are lacking (Hydari et al., 2018). As providers are spending more time with the EHR software than with their actual patients as research by Young et al. (2018) suggests, then the much-heralded success of EHR systems can be reassessed. The patient perspective in regard to access of medical records is essential to this discussion as well. However, that issue is beyond the scope of the current study.

Purpose Statement

The purpose of this study was to evaluate EHR associated fatigue and burnout among physicians at public hospitals in northern California. This study specifically examined whether (a) EHR utilization fatigue causes burnout among physicians, and (b) EHR associated burnout affects effectiveness and efficiency of care and patient safety.

Advancing the public interest is an integral aspect of this topic. EHR adoption was largely funded by the federal government, whose dollars come from the taxpayer (Schilling, 2009). Taxpayers are patients as well and are personally impacted by EHR. Patients directly interact with EHR for themselves, their family members, friends, and caregivers.

Significance of the Study

By directly examining the opinions of providers as key informants working on the frontlines of patient care, the current study explored the effects of the implementation and the mandated use of EHR on organizational responsibility, accountability, effectiveness, and efficiency of care in sample public hospitals in northern California. According to Beaumaster (as cited in Johnson 2015), organizational responsibility, accountability, effectiveness, and efficiency are among the six pillars of public administration along with institutional legitimacy and administrative representativeness. The significance of the current study is that it evaluated these core concepts of public administration in the context of EHR-associated fatigue and providers' burnout.

The rationale for the federally mandated systemwide implementation and utilization of EHR was that this new IT tool would increase efficiency in the provision of

patient care by streamlining care through elimination of process and structural redundancies, increasing interoperability among interprofessional care teams, especially in urgent care and along the entire continuum of care, and by reducing the number of medical errors and sentinel events (Kaufman et al., 2017). Then, by achieving higher efficiency, the implementation of EHR was intended to lead to higher organizational effectiveness. Beaumaster (as cited in Johnson 2015) defined higher efficiency as "providing the best services possible for the least amount of money and resources" (p. 3) and organizational effectiveness as "making sure the work done is according to public demands." (p. 4). In turn, higher effectiveness in the provision of care should lead to more accountable and responsive healthcare organizations (Aleksovska et al., 2019; Bao & Bardhan, 2021; Hasselgren et al., 2000; Heeringa et al., 2020; Shortell et al., 2014).

The EHR implementation framework based on higher efficiency and effectiveness of care leading more accountable and responsive health care organizations has been acknowledged in literature on EHR. For instance, according to Alvandi (2015), "The powerful framework of the computer-based patient record optimizes the collection, presentation, and communication of client data, resulting in time and cost savings for anyone who participates in the healthcare delivery process, such as clients, physicians, hospitals, and insurers" (p. 27). Additionally, very early in the implementation process, Menachemi and Collum (2011) posited that there are three primary outcomes when evaluating EHR systems: (a) better clinical outcomes such as improved quality of care and lower incidence of medical errors, (b) improved healthcare organizational outcomes such as financial and operational benefits, and (c) public health outcomes, which include improved research abilities, improved population health, and reduced costs.

In such wider healthcare policy—institutional and organizational contexts—it is logical to expect that providers experiencing EHR associated fatigue or burnout can adversely affect these three outcomes as well as the entire institutional rationale for EHR implementation and the implementation framework. For a public hospital, that is, a hospital operating under the precepts of public administration, burned-out providers can hinder the goal of efficiency and effectiveness and as a result, undermine organizational accountability and responsiveness of their hospitals.

Improved patient care and safety as indicators of effectiveness of care and organizational accountability and responsiveness in the healthcare field are the ultimate goals in the use of EHR systems. In this regard, Sulmasy et al. (2017) reminded that EHR affects every aspect of health care delivery in an organization, including patient care, physician-patient relationships, clinical reasoning, and training. Furthermore, Sulmasy et al. pointed out that EHRs can be powerful tools that can facilitate high-value patient-centered care, robust patient-physician relationships, and effective EHR training programs. Some studies have shown improvement in patient care and safety following the EHR. For instance, Silow-Carrol et al. (2012) found that hospitals reported EHRs as useful tools in reducing medical errors. Truitt et al. (2016) noted that a large, 415-bed hospital reduced the overall rate adverse events by 20% due to medication barcoding since implementing its EHR system. Likewise, R. S. Evans et al. (2016) found that after EHR software was fully implemented at the Veterans Health Administration, productivity among providers increased by 6%. The findings of these studies highlight the point that use of EHR generally leads to improved efficiency and effectiveness.

It is also important to note that public health care organizations that received taxpayer dollars are accountable to the taxpayer and are responsible for providing a high standard of care with the utilization of EHR. Therefore, this study focused on EHR fatigue and burnout in public hospitals, which rely entirely on taxpayer funds to operate.

Theoretical Framework

The theoretical framework of this study combined the main tenets of the job demands-resources (JD-R) theory (Demerouti & Nachreiner, 1998; Demerouti, Bakker, Nachreiner, & Schaufeli, 2001b; Demerouti, Bakker, de Jonge, et al., 2001) and its JD-R Model (Demerouti, Bakker, Nachreiner, & Schaufeli, 2001a) with the propositions of the Freudenberger burnout theory (Freudenberger, 1974, 1975, 1980, 1989).

Job Demands-Resources Theory

The key theorists behind the JD-R theory are Demerouti and Bakker (Demerouti, Bakker, Nachreiner, & Schaufeli, 2001a) who first formulated the theory in its current form in 2001. However, Meijman and Mulder (1998) offered a precursor to the JD-R theory with their study that empirically examined the psychological aspects of workload. For practical purposes, the JD-R theory is also referred to as the JD-R model. Bakker and Demerouti (2007) pointed out that the JD-R model assumes that factors of employees' well-being can be "classified in two general categories as job demands and job resources, thus constituting an overarching model that may be applied to various occupational settings, irrespective of the particular demands and resources involved" (p. 323).

As related to this study, the job demands and resources for healthcare providers and EHRs appear to be in conflict. The study addressed the ramifications of that conflict as it relates to patient safety. According to Bakker and Demerouti (2007),

> Job demands refer to those physical, social, psychological, or organizational aspects of the job that require sustained physical and/or psychological, cognitive and emotional, effort or skills and are therefore associated with certain physiological and/or psychological costs; examples are a high work pressure, an unfavorable physical environment, and emotionally demanding interactions with client. (p. 323)

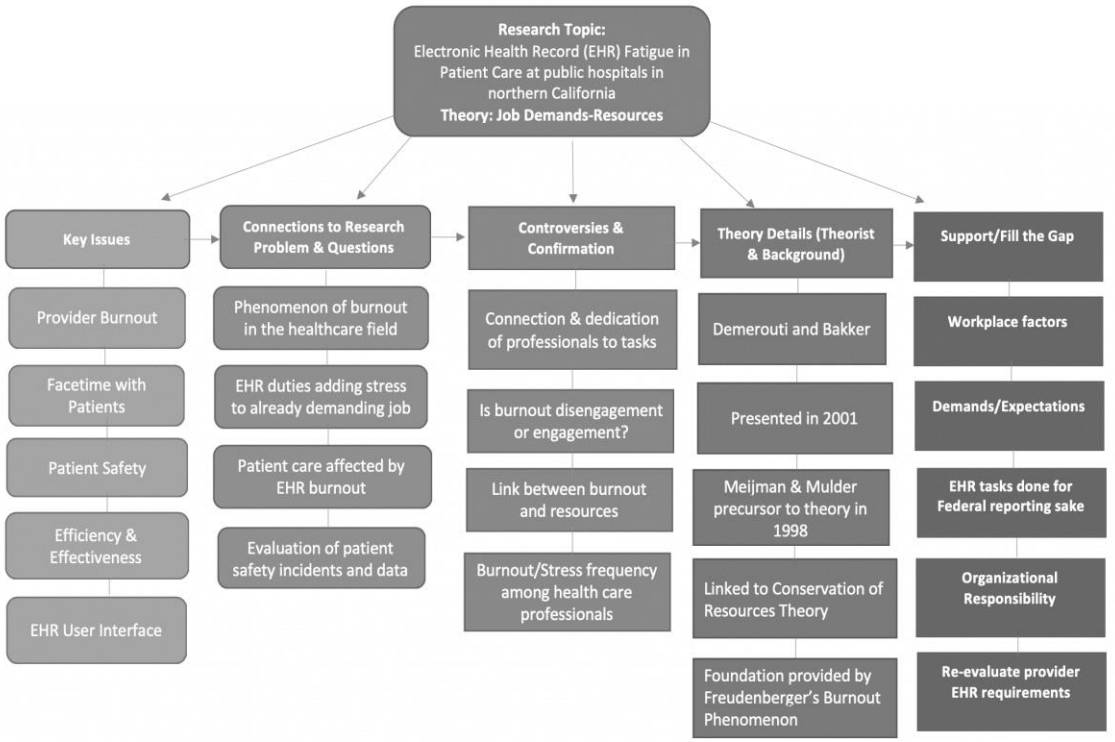
The key issues that the JD-R theory helped to address in the current study were provider fatigue, burnout, care effectiveness and efficiency, and patient safety. Both the provider and the organization have demands and resources that are in conflict. The provider's concerns are patient care but also EHR duties. The organization is also concerned with patient care but needs the provider to perform EHR duties to fulfil patient, regulatory, and reporting needs. The theory connects to this study's problem and questions by providing a framework to evaluate the effects of burnout in the health care field, specifically the effects on patient care and patient safety.

The JD-R theory has been used in an academic study pertaining to healthcare and burnout. Specifically, Xanthopoulou et al. (2007) studied the relationship between job demands and burnout among health care professionals. Using the JD-R theory as a lens, the researchers found that making job resources available can safeguard the relationship between job demands and burnout. The JD-R theory also provides for several areas of discussion related to the topic of the current study, including professionalism and dedication, the nexus between burnout and resource, and burnout in the context of provider disengagement and engagement. In the current study, the JD-R theory helped in conceptual understanding of gaps in EHR burnout literature, including internal and

external workplace factors, EHR use for the sake of reporting such as meeting federal guidelines, the evaluation of provider EHR software requirements, implementation problems, and the roles of organizational responsibility and accountability. A concept map summarizing the JD-R theory is presented in Figure 1.

Figure 1

The Job-Demand-Resource Theory



The Freudenberger Burnout Theory

The systematic research on burnout as a phenomenon originated in the works of Herbert J. Freudenberger, who focused on organizational processes and individual experiences of healthcare providers at free clinics. Discussing the job demands imposed on staff psychologists at free clinics and availability of resources available to serve

clinics' clients properly and in a timely manner, Freudenberger (1974) observed what he termed "the burn-out syndrome" (p. 160). In particular, Freudenberger (1975) noted that he and other volunteer healthcare professionals often suffered from "apathy, depression, and agitation" (p. 74). It should be noted, however, that Freudenberger never considered himself to be the author of the term. According to Fontes (2020), Freudenberger merely borrowed the slang term, which was widely used in the illicit substances scene to denote the devastating effects of chronic substance abuse. In other words, the term burnout was described by Fontes as "a collective creation of a community of volunteer workers engaged in the Free Clinic movement" (p. 4). Freudenberger (1980) described the state of being burned out as "becoming exhausted by making excessive demands on energy, strength, or resources" (p. 13). Freudenberger characterized burnout as having not only physical symptoms such as exhaustion, fatigue, headaches, and sleeplessness, but also by behavioral signs like frustration, anger, a suspicious attitude, a feeling of omnipotence or overconfidence, and cynicism.

Freudenberger (1980) theorized that burnout occurs when there is an imbalance between the demands that require sustained physical or mental effort and resources that may be insufficient to compensate for the demands in the workplace. Then, when recovery in the face of such demands is systematically lacking or inadequate, a state of physical and mental exhaustion is triggered. According to Freudenberger "job demands have a direct and positive relationship with burnout, especially emotional exhaustion, while the existence of job resources inversely influences depersonalization by minimizing or reducing its use as a coping strategy" (pp. 41–42). Thus, Freudenberger's theory of burnout is consistent with the tenets of the JD-R theory because Freudenberger

conceptualized the causes of the burnout phenomenon as originating not in individual cognitive differences, the nature of social exchanges, or in organizational processes but in the imbalance between job demands and resources (Edú-Valsania et al., 2022). In the current study, Freudenberger burnout theory was used as an analytical lens through which the individual experiences of the participants of the study were evaluated and categorized.

Research Questions

The study provided answers to the following four overarching research questions:

1. What are the perceptions of providers in regard to EHR use and its association to fatigue?
2. What are the perceptions of providers in regard to EHR use and its association to efficiency and effectiveness?
3. What variables contribute to the user interface experience with EHR use?
4. Have patient safety incidents at the hospitals in this study increased or decreased as a result of provider EHR fatigue or burnout?

Variables

This study's variables were provider EHR burnout and patient safety. Provider EHR burnout is defined as the phenomenon of providers becoming burned out with the requirements of EHR software utilization (Robertson et al., 2017). Providers are spending more time in patient charts on the computer instead of face-to-face time with patients (Young et al., 2018). Patient safety, as related to EHR software, is concerned with the well-being of patients while in the care of providers. Doing no harm to patients

is another critical issue in the provision of care (Sittig & Singh, 2013). The operationalization of the variables is summarized in Table 1.

Table 1

Operationalization of Variables

Variable: Provider EHR burnout[a]	
Dimensions of EHR burnout	Operational definition of each dimension
Dimension 1 Actual time spent in charts	Review audits and logs of EHR software usage times and compare with time spent with patients and providing care.
Dimension 2 Provider support	Evaluate if clinics/hospitals are providing assistance with charting in the form of training, quiet workspaces, and remote access.
Dimension 3 Patient feedback	Engage patients for their perspective on their providers level of care and attention as it relates to the use of EHRs (Surveys etc.).
Variable: Patient safety[b]	
Dimension 1 EHR/charting errors	Monitoring and audit for errors for human entry errors in the EHR
Dimension 2 Provider/care errors	Evaluate if providers compromise patient safety due to charting/EHR errors.
Dimension 3 Organizational history response	Examine prior patient safety reports and records of clinic/hospital. Review, responses, action plans, corrective steps and disciplinary procedures.

[a] Provider EHR burnout is defined as the phenomenon of providers becoming burned out with the requirements of EHR software utilization. Providers are spending more time in patient computer charts instead of face-to-face time with patients (Young et al., 2018).

[b] As related to EHR software, patient safety is concerned with the well-being of patients while in the care of providers. Doing no harm in the process of providing care is key.

Definitions of Terms

The following terms are defined for the benefit of the readers of this study.

Affordable Care Act of 2010 (ACA). This landmark healthcare reform legislation in the United States is also known as Obamacare.

American Recovery and Reinvestment Act of 2009 (ARRA). A legislation aimed to stimulate the US economy following the downturn of 2008.

Audit logs. Record of actions taken and time spent in EHR software by providers.

Burnout. Physical and behavioral symptoms that cause high levels of stress and dissatisfaction in the workplace.

Computerized Physician Order Entry (CPOE). A specific module in the EHR that allows doctors to assign and approve orders pertaining to patient care.

EHR Burnout Phenomenon. Burnout due to the demands and resources of interacting with EHRs for several hours a day.

Electronic health record systems (EHRs). Software that manages a patient's medical records as well as patient and provider interaction. Contains several modules from registration, billing, patient charting, medications, and imaging.

Health Care Organizations. Any organization that provides healthcare services.

Health Insurance Portability and Accountability Act of 1996 (HIPAA). A legislation that ensures sensitive patient data are secure and private when transmitted.

Meaningful use. A set of criteria established by CMS that governed the use of EHRs and incentive payments.

Mobile applications. The accessibility of EHR systems on smartphones and tablets.

Reimbursement payments. Dollars reimbursed to medical providers by the federal government if certain EHR criteria is met.

Remote access. Connecting to hospital EHR systems away from the hospital site.

Patient portal. Online website where patients can safely and securely access their EHRs and communicate directly with providers.

Patient safety. Ensuring the wellbeing of patients and doing no harm while in care.

Physician. Licensed medical doctor in the United States.

Provider. Person or entity providing care to patients such as physicians, nurse practitioners, nurses, physician assistants, and other specialized medical technicians.

Organization of the Study

Chapter 1 presented the background of the study, problem statement, purpose statement, the significance of the study, theoretical framework, research questions, variables related to the selected theory, and definitions of key terms used in the study. Chapter 2 details a review of the literature related to the topic of the study. The first part of the literature review focuses on the historical background of EHRs and the burnout phenomenon. The second part of the literature review discusses extant research related to this topic of the current study and connects findings of the literature to the research questions. Chapter 3 describes the methodology and research design used in this study. Chapter 4 presents the findings of the research. Last, Chapter 5 analyzes and interprets the results in the context of previous research on the topic and then proposes areas of further study.

CHAPTER 2: LITERATURE REVIEW

Provider and physician burnout in general has been a long-standing phenomenon in the medical field (Fred & Scheid, 2018). There have been numerous studies that focused specifically on the topic of burnout in healthcare organizational settings (Kalani et al., 2018). Because the use and implementation of the EHRs ramped up after 2009, there are over 10 years of industry data available to evaluate the effects of EHRs on provider burnout. However, there is little academic research available dealing with this particular issue.

In general, physician burnout has been a common occurrence among medical providers. It is estimated that nearly 50% of U.S. physicians will experience a burnout phenomenon during some period of time in their careers (Reith, 2018). Some causative factors for burnout include the lack of proper work–life balance, excessive workload, and job demands exceeding the capacity of individual and organizational resources. The introduction of EHRs has added another complexity to an already demanding and challenging field. The accessibility and availability of EHRs and online medical charts have created multiple challenges for providers. Physicians are often unable to break away from responding to patient inquiries or completing required charting as expected by their employers. In an ever connected and always on mobile phone world, the challenge of balancing job demands with resources becomes even more difficult to accomplish. With the mandated use of EHRs in virtually all healthcare settings, it becomes incumbent upon providers to manage their professional and personal time to achieve a positive work–life balance and avoid the burnout phenomenon. Not surprisingly, providers and

physicians who maintain a positive balance between their professional and personal lives have a higher level of job satisfaction and overall experience lower levels of burnout.

The mandated use of EHRs and related information systems and technologies was not always a reality. However, the use of technology in health care settings was heavily promoted by industry leaders in the early 2000s following the dot-com boom and explosion of personal computer and internet usage. A report released by the Institute of Medicine (US) Committee on Quality of Health Care in America (2000) entitled *To Err is Human: Building a Safer Health System* was a catalyst for the expanded use of information technology in the health care industry.

One of the key findings of the report was that medical errors in U.S. hospitals caused approximately 98,000 deaths per year. At the time of the report's publication, that figure was higher than the cumulative mortality from breast cancer, automobile accidents, and AIDS (Institute of Medicine, 2000). In view of the findings of the IOM report, providers began to encourage the use of information technology as a means to decrease medical errors. An ulterior motive possibly could have been to reduce liabilities, but improving the quality of care and reducing medical errors were priorities as well. Unfortunately, despite the expanded use of information technology in the health care industry and ubiquitous use of EHRs, as of 2015 the number of deaths due to medical errors grew to 400,000 annually (Rajasekar, 2015).

It should be noted that the federal government's required incentive programs for adopting meaningful use of EHRs did not become policy and law until 2009 during the Obama Administration (American Recovery and Reinvestment Act, 2009). However, even prior to 2009 there was a movement on the part of state and local governments,

insurance companies, and accreditation organizations to mandate the use of information technology in health care settings with the hopes of improving patient care and safety. These actions would fall under the banner of compliance and be a precursor of future regulations on the horizon for health care providers. In particular, in January of 2004, the Bush Administration outlined a plan for computerizing health records for all Americans within 10 years (The White House, 2004). President Bush presented this goal at his State of the Union Address, giving weight and legitimacy to the use of EHRs.

This period provided a foundation for the seminal moment for EHRs and public policy in the United States under President Obama—The American Recovery and Reinvestment Act of 2009 (ARRA) and The Affordable Care Act (ACA), also known as Obamacare. A component of the ARRA known as the Health Information and Technology for Economic and Clinical Health (HITECH) Act allocated $19 billion of federal funding for health information technology. These dollars would be awarded to health care providers for adopting and implementing EHRs systems. In a widespread effort to incentivize health information technology, providers who adopted these systems would receive payment for doing so, while providers who did not, would be penalized in the form of withholding Medicare reimbursement payments (Atherton, 2011).

Additionally, to receive federal incentive payments for EHR software adoption, providers were required to show meaningful use of such systems—a set of stringent criteria and reporting instruments designed to show proof to the federal government that EHRs were being implemented and used appropriately (Atherton, 2011). The mandated use of EHRs coupled with meaningful use criteria significantly pushed health information technology to the forefront for healthcare organizations and providers - large and small.

As a result, health care providers made EHRs adoption a priority and began large scale campaigns to implement new software systems and intensive educational programs to train health care staff. Providers resistant to change had little choice but to comply with these new mandates. Providers amenable to technology soon found themselves spending a significant amount of time training on the new software, and after these systems went live, they faced challenges of balancing patient facetime and computer facetime (Zhang, 2016). This uncharted territory led to what providers are increasingly reporting over 10 years later—burnout from the use of EHRs systems (Downing et al., 2018; Ozair et al., 2015).

The required use of EHRs as a result of federal public policy beginning in 2009 provides a connection to the increased use of health information technology among health care providers and could be a contributing factor to the provider EHR burnout phenomenon. The use of technology in health care is beneficial to patients, particularly those who are technologically inclined (Gellert et al., 2015). However, given the effects of the EHRs use on providers, the questions regarding provider burnout because of technology must be asked and explored further. In health care, particularly for providers who take an oath, patient care and safety are of primary concern. The following paragraphs further examine the literature and theory related to the phenomenon of provider EHR burnout and the associated impact of patient safety.

As alluded to previously, Freudenberger's burnout phenomenon theory (Heinemann & Heinemann) has long been used as a theoretical framework for examining burnout in the workplace. Therefore, burnout phenomenon theory can also be applied to physicians and providers, both preelectronic health records and postelectronic health

records. The job of a health care provider, particularly that of a physician, has long been associated with burnout. There are numerous research studies on physician burnout in general. These studies are summarized in the following sections. This review closely examined research and theory that focused on and applies to EHRs burnout phenomenon and its impact on patient care and patient safety.

The Job Demand Resources Theory

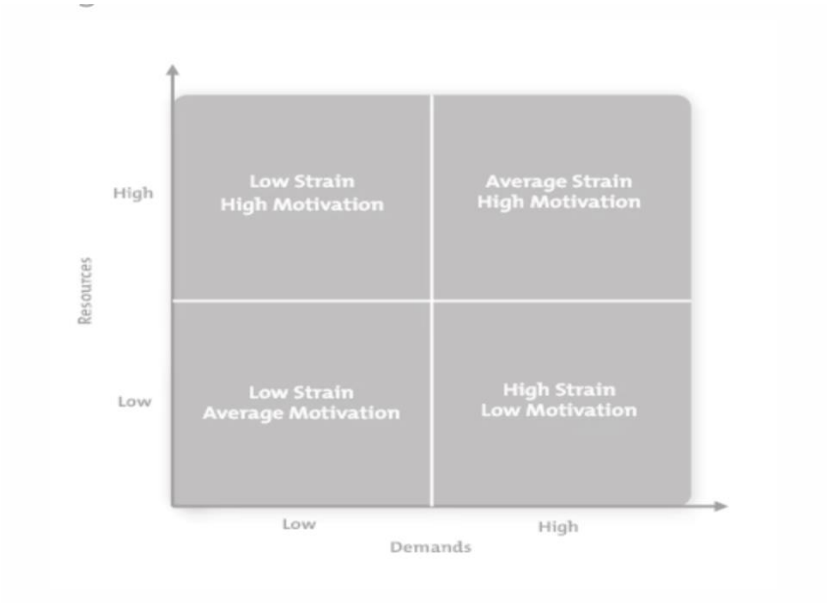
The JD-R theory appears to be more applicable to the modern era of health care and health care information technology, which includes EHR software and systems. The JD-R theory, also referred to as the JD-R model, focuses on the demands and resources of a specific occupation. Introduced by Demerouti, Bakker, Nachreiner, & Schaufeli, (2001a), the JD-R theory coincidentally aligns with the infancy stage of electronic health records EHR usage in the United States. A sole provider may have increasing demands or responsibilities in their roles but have a finite number of resources, professional or otherwise.

> According to Bakker and Demerouti (2007),
>
> Job demands refer to those physical, psychological, social, or organizational aspects of the job that require sustained physical and/or psychological, both cognitive and emotional, effort or skills and are therefore associated with certain physiological and/or psychological costs; examples are a high work pressure, an unfavorable physical environment, and emotionally demanding interactions with client. (p. 312)

The JD-R theory has been used in several studies in the following countries: Spain, Greece, Italy, Norway, Sweden, Finland, Germany, Belgium, South Africa, China, and Australia (Bakker, 2019). The logical map of the JD-R theory is presented in Figure 2.

Figure 2

The Logical Map of the Job Demand Resource Theory



Note. From "The Job Demands-Resources Model: State of the Art," by A. B. Bakker and E. Demerouti, 2007, *Journal of Managerial Psychology*, (*22*)3, p. 317. (https://doi.org/10.1108/02683940710733115)

Defining Burnout

The phenomenon of burnout, as it manifests itself in the health care field, requires a proper definition. Freudenberger's groundbreaking studies (1974, 1975, 1980, 1989) became the foundation for burnout phenomenon theory. In the context of physical and behavioral symptoms, Freudenberger (1980) defined burnout as "physical and behavioral symptoms as follows: increasing anger, frustration, suspicion and paranoia regarding

colleagues' influences on one's own personal career ambitions, excessive rigidity and inflexibility in practice, and the appearance of characteristics of one who suffers from depression" (p. 22). Increased workloads, employer instability, downsizing, budget cuts, and dysfunctional organizational culture constitute various factors that cumulatively contribute to burnout among physicians (Gnerre et al., 2017; Lasalvia et al., 2021; Lubbadeh, 2020). In 1981, building upon Freudenberger's work, Maslach created a scale for measuring burnout—the Maslach burnout inventory (MBI) (Maslach & Jackson, 1981; 2022). The summary of the MBI instrument is presented in Figure 3.

The Studies of Burnout

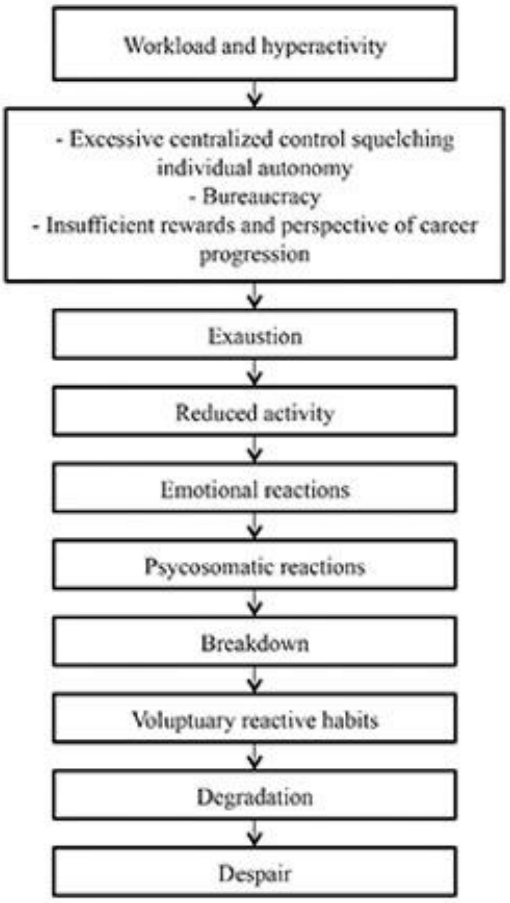
According to Dewa et al. (2014), there is a growing awareness among health care professionals that physicians have a higher exposure to workplace factors that can increase stress and cause burnout. As a result, a continual exposure to negative factors can cause high levels of burnout among physicians. Some of these workplace factors include long work hours, work overload, sleep deprivation, and work conflicts. Dewa et al. conceptualized the burnout syndrome as having the following three dimensions: emotional exhaustion, depersonalization and low personal accomplishment.

Dyrbye and Shanafelt (2011) recognized the seriousness of burnout early on during the EHRs systems implementation efforts and health care reform push by the federal government and pointed out that physician burnout was very much a potential threat to successful health reform in the United States. Dyrbye and Shanafelt posited that providers who experience burnout are more likely to report medical errors, have lower scores on empathy measurement instruments, have early retirement plans, and possess lower levels of job satisfaction. According to Dyrbye and Shanafelt, cumulatively these

factors result in reduced patient satisfaction with medical care and less patient cooperation with treatment orders.

Figure 3

The Maslach Burnout Inventory



Note. From "Work Stress and Burnout Among Physicians and Nurses in Internal and Emergency Departments," by Gnerre, P., Rivetti, C., Rossi, A., Tesei, L., Montemurro, D., & Nardi, R., 2017, *Italian Journal of Medicine, 11*, p. 152. (https://doi.org/10.4081/itjm.2017.740)

Systematic Reviews of Burnout

Various researchers conducted comprehensive reviews of burnout. For instance, Rotenstein et al. (2018) systematically reviewed literature related to burnout among physicians. The researchers examined burnout data from 182 studies involving 109,628 individuals in 45 countries. The 182 studies were published between 1991 and 2018. The focus of the literature was narrowed to practicing physicians only and excluded physicians in training. In regard to organization of the burnout data, the studies were summarized descriptively and assessed qualitatively. Rotenstein et al. found high levels of burnout among the studies and stated,

> In all, 85.7% of studies used a version of the MBI to assess burnout; studies variably reported prevalence estimates of overall burnout or burnout subcomponents: 67.0% on overall burnout, 72.0% on emotional exhaustion, 68.1% on depersonalization, and 63.2% on low personal accomplishment. (p. 1083)

However, because of the broad range of variables across the studies, the authors could not determine any further correlations based on the available data between burnout and sex, age, geography, time, and medical specialty.

Likewise, Rothenberger (2017) conducted a similar comprehensive review of burnout studies with a focus on physicians in the United States. In reviewing the data, Rothenberger concluded,

> All US medical students, physicians in training, and practicing physicians are at significant risk of burnout, with its prevalence exceeding 50%; thus burnout is the

> unintended net result of multiple, highly disruptive changes in society at large, the medical profession, and the healthcare system. (p. 576)

Rothenberger also noted that individual and organizational strategies alike have had limited success in mitigating burnout. Additionally, two highly effective strategies for combatting burnout are aligning personal and organizational values and empowering physicians to devote 20% of their work duties to areas of personal meaning.

New Data

Perhaps with providers, software designers, and physicians adjusting to EHRs as well as with adapting and evolving organizational systems and processes, there can be a decrease on physician burnout. The results of recent studies painted a rather mixed picture.

Specifically, some researchers concluded that the burnout among physicians has been abating in recent years. For example, a study conducted by the Mayo Clinic (Shanafelt & Noseworthy, 2017) provided some evidence of that occurring. The study revealed that for the first time since 2011, the physician burnout rate dropped below 50% among U.S. physicians. Approximately 5,000 physicians responded to a survey conducted by researchers from the American Medical Association, the Mayo Clinic, and Stanford University School of Medicine. According to D. D. Berg et al. (2019), "43.9 percent of U.S. physicians exhibited at least one symptom of burnout in 2017, compared with 54.4 percent in 2014 and 45.5 percent in 2011" (p. 7). In conclusion, the researchers noted that although significant progress has been made with health systems and the EHRs software, much more work in this area needs to be completed to be deemed successful.

Other researchers found that physician burnout may not be decreasing across all specialties and may be lower in some specialties because of lower physician task loads.

For instance, based on the analysis of the U.S. national survey data on physician burnout, Harry et al. (2021) found a strong positive association between physician task load and the risk of burnout among physicians. However, physicians practicing in specialties with the highest levels of physician task loads such as emergency medicine, urology, anesthesiology, general surgery subspecialties, radiology, and internal medicine subspecialties also reported significantly higher levels of burnout. They also found a close response relationship between physician task load and burnout. Specifically, for every 40-point or 10% decrease in physician task load, there was 33% lower odds of experiencing burnout, with odds ratio of 0.67, 95% confidence interval between 0.65 and 0.70, and $p < 0.0001$. Based on such results, Harry et al. concluded that the observed relationship between physician task load and burnout may suggest areas of particular focus to improve the practice environment and reduce physician burnout.

Based on cumulative empirical evidence and industry reports, other researchers argued that because health care is a high-pressure industry and because of very broad scope of clinical responsibilities and the levels of accountability, physicians are under comparatively greater pressure, which in turn causes higher levels of physician burnout (Baugh et al., 2020; Edú-Valsania et al., 2022; Hagqvist et al., 2022; Pereira et al., 2021; Tipa et al., 2019).

In this regard, it should be noted that the argument described is not new. For instance, S. Berg (2020) noted that in a survey of a subset of its members, the American Medical Association found that the pressures for higher quality of care and increased

physician task load were the primary drivers of physician burnout. More recently, Bridgeman et al. (2018), summarizing the nature of the health care field, commented on the inherent pressures of the health care industry on physicians. According to Bridgeman et al., such pressures include challenges posed by clinical work, time constraints, competing demands and resources, lack of control over work processes, scheduling, and conflicts with leadership. An even more daunting challenge for U.S. physicians is to balance the demand and resources of their jobs, which heavily involves EHRs.

In a similar fashion, several CEOs from leading health care organizations in the United States published an opinion piece in Health Affairs (Noseworthy et al., 2017) publicly labeling physician burnout a public health crisis. High level executives from the AMA, Partners Healthcare, Mayo Clinic, Cleveland Clinic, Atrius Health, and other large organizations and health systems had suggested that EHR software had adverse effects on clinical competency and burnout.

Although a provider's occupation has been traditionally known as demanding, the advent of EHRs has added another layer of complexity for the individual physician. There appears to be a struggle occurring between demands and resources, resulting in the findings of the literature on increased reports of provider burnout. According to Lubbadeh (2020), although very useful in many practical aspects, EHRs might be known as the catalyst that has yielded an increase of provider burnout. Some recent studies empirically examined the link between EHRs and physician burnout. For instance, Eschenroeder et al. (2021) examined the relationships between physician burnout with organizational EHRs support and after-hours charting. Using the large-scale nationwide physician data and ordinal logistic regression, Eschenroeder et al.

analyzed (a) associations between self-reported burnout and after-hours charting and organizational EHRs support, and (b) how these relationships differ by medical specialty, adjusting for confounders. The researchers overall concluded that poor EHR usability and time-consuming data entry contribute to burnout. Specifically, physicians (a) who reported less than 5 hr weekly of after-hours charting were twice as likely to report lower burnout scores compared to those charting more than 6 hr and (b) who agreed that their organization had done a great job with EHRs implementation, training, and support were also twice as likely to report lower scores on the burnout survey question compared to those who disagreed. Based on such findings, Eschenroeder et al. suggested that efforts to reduce after-hours charting and improve organizational EHRs support could help address physician burnout.

In addition, Nguyen et al. (2021) in a systematic review of 35 recent empirical studies of EHRs-associated burnout among physicians assessed organizational, physician, and information technology factors associated with negative effects of EHRs on physician well-being. They found that multiple predictors amenable to intervention across all levels were associated with EHR-related burnout physicians: (a) total EHRs time, (b) after-hours EHRs time, (c) on-site EHR support, (d) perceived EHR usability, (e) in-basket burden, and (f) documentation burden. Nguyen et al. strongly recommended that physicians as primary stakeholders should be included in the planning and implementation of modifications to the predictors of burnout to ensure compatibility with physician needs and clinical workflows.

More recently, the pandemic of COVID-19 exacerbated the situation with physician burnout even further. Physicians working on emergency care and in intensive

care experienced the highest levels of task load ever, which resulted in higher incidence and greater severity of burnout (Lasalvia et al., 2021). Several recent studies examined the effects of COVID-19 on physician burnout. For example, Mong and Noguchi (2021) assessed the levels of anxiety, depression, burnout, and coping strategies of 226 emergency department physicians in the United States. The researchers found that emergency department physicians reported a high level of both personal and work-related burnout even though few reported clinically significant symptoms of anxiety or depression. Mong and Noguchi concluded that the results aligned with previous research indicating that (a) active and adaptive coping skills were related to a lower level of psychological distress during the COVID-19 pandemic whereas (b) maladaptive coping strategies such as self-blame, denial, disengagement, venting, and substance abuse were related to lower overall mental health and higher levels of burnout among participants . Likewise, Sharifi et al. (2021) conducted a systematic review of 12 recent studies on burnout epidemiology among physicians during the COVID-19 pandemic. Based on cumulative evidence, Sharifi et al. concluded that paying attention to physicians' mental health issues, reducing the workload of physicians through adjusting their work shifts, lessening job-related stressors, and creating a healthy work environment may prevent or reduce the burnout among physicians working on the front lines of the pandemic. These findings are consistent with the conclusions of Al-Humadi et al. (2021), who conducted a survey-based cross-sectional study of depression, suicidal thoughts, and burnout among physicians during the COVID-19 pandemic. Al-Humadi et al. found that because of COVID-19, frontline physicians were subject to major new stressors that increasingly cause burnout. The burnout stressors include conflicting clinical and epidemiological

news, constantly evolving treatment guidelines, inadequate personal protective equipment, overflow of patients with rising exacerbations and death counts, absence of disaster training, and limitations in the implementation of social distancing. Similarly, Alrawashdeh et al. (2021) in a convergent parallel mixed-method study examined occupational burnout and job satisfaction among physicians in times of the COVID-19 crisis. Based on the analysis of empirical data, the researchers found that (a) physicians were subjected to an increased workload during the COVID-19 crisis, leaving them exposed to significant physical and psychological distress, (b) the prevalence of burnout levels has drastically increased, and (c) all measures indicated very low levels of job satisfaction caused by the onset of burnout.

However, some studies also found that in the time of COVID-19 crisis, increased workloads and new stressors had differential effects on physicians based on gender and race. In particular, in a recent cross-sectional survey study, Prasad et al. (2021) assessed the prevalence and correlates of work-related stress and burnout among women physicians and physicians of color. The sample included 20,947 frontline physicians of different specialties from all U.S. states. Prasad et al. found that 38% of the respondents reported anxiety or depression, 43% suffered work overload, and 49% had burnout. Stress scores were highest (a) among emergency and intensive care physicians, and (b) in Black and Latinx physicians compared to White physicians. Based on multilevel models, Prasad et al. (2021) concluded that odds of burnout were 40% lower in those feeling valued by their organizations regardless of race or gender.

Despite the mixed findings, the data from the new studies overall suggested that (a) although the levels of burnout among physicians may have been gradually decreasing

across physician specialties in the recent decade, at least as some data suggested, (b) physician specialties with high task loads are more likely to develop burnout, and (c) increased work-related stress, higher patient loads, and a set of new stressors associated with COVID-19 pandemic all have led to drastic spikes in the incidence and severity of burnout among physicians, but (d) proper organizational support may act as a moderator of burnout.

Effects on Patient Care

Bodenheimer and Sinsky (2014) noted that a strong dissatisfaction with EHRs because of the amount of time interacting with the software is a key factor for burnout among physicians in the United States. According to a study conducted by Meigs and Solomon (2016), of 1775 primary care physicians, the consensus was that "along with significant growth in EHR adoption by physicians is a rising level of dissatisfaction with this technology" (p. 2). Further supporting this viewpoint is a survey of 561 physicians in the state of Massachusetts in which 30% of respondents strongly stated that EHR use introduced increased opportunities for errors during the process of providing patient care (Meigs & Solomon, 2016). Meigs and Solomon's study revealed the following key points expressed by providers: using EHRs increases physician workload, physicians do not believe EHR use results in improved quality of care, EHR use may negatively affect quality of care, and EHR use both increases and decreases overall efficiency.

A recent comprehensive study by Gardner et al. (2018) aimed to quantify how stress related to health information technology can predict burnout among physicians. This exhaustive study surveyed all 4,197 practicing physicians in the state of Rhode Island. The study identified three stress measures and used logistic regression to assess

the association between health information technology-related measures and burnout. The study yielded 1,792 respondents or 43% response rate. Of those respondents, 26% reported experiencing burnout. Additionally, 91% of respondents identified as EHR software users. Among these users , 70% reported HER- and HIT-related stress incidents. Physicians who reported having poor or marginal time for EHR documentation had a 2.8 times greater chance of burnout. Physicians who had moderately high or excessive time on EHRs at home had a 1.9 times greater chance of burnout. Last, respondents who agreed that EHR utilization provides a source of daily workload frustration had a 2.4 times greater chance of burnout. The authors concluded that EHR-related stress is measurable and common. Thus, recognizing that there is a problem is the first step in addressing the issue and finding solutions.

Furthermore, a study conducted by Swensen et al. (2018) found that 83% of their membership comprised of clinicians, leaders, and health care executives surveyed viewed physician burnout as a problem at their respective organizations. Participants further noted that EHRs use reduces face-to-face interaction between patients and providers. Swensen et al. stated that "there is broad agreement on the need for more face-to-face time between clinicians and patients and less time spent on the EHRs and documentation" (p. 2).

In addition, Young et al. (2018) observed 10 residencies and family physicians. The researchers found that these physicians spent an average of 18.6 min on EHRs clinical documentation compared with 16.5 min of patient facetime. Moreover, the required EHRs clinical documentation followed them continually. Young et al. (2018) concluded that the vast majority of family physicians had the following in common:

working through lunches, staying late, and completing EHR duties and charting late in the evening and night at home.

A study by S. M. Erickson et al. (2017) found that regulatory reform in terms of EHRs clinical reporting is needed to assist with reducing the time providers spend with software as compared to their patients. Researchers referred to this administrative burden as punitive with accomplished physicians essentially being reduced to data entry personnel. From a public administration perspective, this is an area in which the concept of efficiency and effectiveness can be applied for a major public policy issue. Health care leaders and medical providers, along with health care information technology vendors and government officials, have a golden opportunity to affect positive change through collaboration and governance.

Sinsky et al. (2016) evaluated the allocation of physician time in ambulatory practice focusing on acute care or hospitals. However, the results of the Sinsky et al. study provided some interesting data for discussion. The participants included 57 physicians in four specialties across four states. On a typical office day, these providers spend 27% of their time directly interacting with patients and 49.2% of their time on EHR related duties. The results in the exam room were equally compelling—providers spent 52.9% of their face time with patients and 37% on EHR related duties. Lastly, 37% of physicians surveyed in this study reported spending 1 to 2 hr of after-hours EHR responsibilities each night. Sinsky et al. (2016) offered this assessment on EHRs and physician time with patients: "EHRs, in their current state, occupy a lot of physicians' time and draw attention away from their direct interactions with patients and from their personal lives" (p. 170).

Additionally, a study by Arndt et al. (2017) examined physician workload and time spent by physicians within the EHRs system, both during and outside standard clinic or office hours. The sample included 142 family medicine physicians in southern Wisconsin. It is worth noting that the EHRs system used by all these physicians is Epic, which happens to be based in southern Wisconsin and is the industry leader. EHR interactions by these physicians were captured over a 3-year period using event logs or reports within the system. The authors of the study noted that primary care physicians spend approximately 2 hr in the EHR per 1 hr of patient care. This means that the physicians spent more than half their workday (6 hr) working in the EHR. This included both during and after office hours. This finding supports other research in that EHR duties are following providers home, further complicating work–life balance.

Koopman et al. (2015) focused on physician needs as they relate to documentation and progress notes in EHRs software. Koopman et al. noted that "physicians face cognitive overload daily, perhaps exacerbated by the form of electronic health record documentation" (p. 316). The researchers continued and revealed that the current ambulatory progress notes format in the EHR software is antiquated and offers a visual information overload to providers. It appears that as prior research has indicated, EHR interaction and duties are cumbersome and unnecessarily complicated for providers. As a result, providers spend more time interacting with the software than in actual care provided to their patients. The following paragraphs examine literature that correlates EHRs, burnout, and the effect on patient care and safety.

The ultimate aim of any health care provider, physician or otherwise, is patient care and safety. Preventing harm and providing a high standard of care is expected and

required. As indicated previously, the stated goals of EHRs were to increase efficiency, improve care, and reduce medical errors. One study by Hessels et al. (2015) published in the *Online Journal of Nurse Informatics*, examined the relationship between EHR adoption and adverse outcomes and satisfaction in hospitalized patients. This comprehensive study analyzed 854,278 patients discharged from seventy hospitals in the state of New Jersey. Hessels et al. concluded that "advanced EHR adoption was independently associated with fewer patients with prolonged length of stay and seven-day readmissions and that advanced EHR adoption was not associated with patient satisfaction" (p. 215). Furthermore, the researchers did not find that increased EHR adoption measured by the levels of usage corresponded with a decreased adverse outcome measured by patient safety incidents or an increase of patient satisfaction.

Health care administrators realized early on in the EHR wave that patient safety is a priority (Balakrishnan & Brenner, 2019; Bowman, 2013; Graban, 2016). During the EHR implementation process, senior administrators were recommending that organizational policies move toward patient safety goals. That course of action is wise and should be the utmost priority for any health care organization (Leatt et al., 2006). In this regard, Bridgeman (2018) specifically noted that "the influence of burnout on patient safety and quality of care cannot be ignored and demands serious attention" (p. 149).

Aldosari (2017) assessed patient safety in the EHR era. Keeping the intended goals of EHRs as the foundation, the researcher found that EHRs have become a burden for the physicians as their error rates increased and their output rate was diminishing, which affected patient safety. This is the opposite of efficiency and effectiveness.

Attempting to even conduct research on patient safety improvement and EHR usage proves to be a challenge to researchers. Russo et al. (2016) detailed this finding in their study by identifying three key barriers in conducting this type of research: (a) gaining approval to access and review EHR data, (b) interpreting EHR data, and (c) working with local IT/EHR personnel. Russo et al. concluded that conducting research of this nature can help to better understand the link between EHRs burnout phenomenon and patient safety.

Friedberg et al. (2013) noted that most physicians would probably not desire a return to paper-based systems. However, physicians are frustrated with EHR systems. According to the authors, there are unfortunately many examples of errors that have resulted in patient safety issues. Additionally, health care workers have described several near misses and potentially lethal conditions in regard to EHR ease of use and patient safety.

Continuing along the lines of patient safety, Christino et al. (2013) evaluated the perceptions of medical residents on the clinical documentation requirement and its relation to patient care. The researchers surveyed 1515 residents (covering 24 specialties) over a 2-month period. The authors found that (a) of respondents felt that EHR documentation obligations were excessive, (b) 90% also reported that time with their patients had been compromised, and (c) strikingly, 73% of residents conveyed that the amount of required clinical documentation, including EHRs, had a negative effect on patient safety and care.

An earlier study by Landrigan et al. (2010) conducted prior to the federal incentivization of EHRs evaluated 2,341 admissions for patient safety incidents (harms)

in 10 hospitals across North Carolina. It found that there were 25 patient safety incidents per 100 admissions at these hospitals that utilized EHRs. Landrigan et al. concluded that patient harm remains commonplace because there is as scant proof of extensive improvement in this area. Additional measures are required to allow effective safety interventions to become standard practice and carefully monitored over time in a hospital setting.

Two recent studies examined the relationship between the use of EHRs, physician burnout, and patient safety. In particular, Mangory et al. (2021) reviewed 63 recent empirical studies on the link between burnout among physicians and observed adverse patient outcomes. Mangory et al. concluded that the vast majority of extant studies concluded that (a) physician burnout has direct harmful effects on physicians and indirectly on their patients, (b) the burden and stress experienced by physicians because of EHRs use are strong contributors to physician burnout and adverse patient outcomes, and (c) adverse patient outcomes can be reduced with more effective organizational support to physicians in their use of EHRs. Similarly, Li et al. (2021) implemented a systematic review protocol to evaluate the effects of EHRs interoperability on patient safety in health systems of high-income countries. Li et al. found that poor EHRs interoperability (a) is detrimental to patient safety and costly for health systems; (b) the consequences of poor EHRs interoperability range from increased risks of medication errors, fragmentation of patient data, to iatrogenic harm resulting from redundant testing, and additional healthcare expenditure, and (c) poor EHRs interoperability is also a significant factor in physician burnout because of increased time to overcome it.

EHR User Interface Factors

Another aspect of EHR burnout to consider is the user interface of EHRs software applications. EHRs systems are complex in nature with many screens and interfaces a user has to navigate. There has been a movement among EHR software developers to improve and streamline the experience for users (R. S. Evans et al., 2016). Reducing the number of clicks a provider has to complete as they move through a patient's chart is a top priority. Hundreds of clicks times hundreds of patients could lead to the development of EHRs fatigue.

A study by Guo et al. (2017) explored the concept of helping physicians one less click at a time through changes to the EHR user interface. According to Guo et al.,

> Physician burnout is becoming an epidemic, due to the pressures of being productive, an imperfect electronic health record (EHR) system, and limited face-to-face time with patients. Poor usability in EHR-user interface can force users to go through more steps (i.e., more clicks on the computer) in accomplishing a task, (p. 140)

Thus, reducing the so-called click burden for providers would help to alleviate EHRs frustrations. Overall, Guo et al. aimed to enhance the EHR experience for physicians at New York Presbyterian and Brooklyn Methodist hospitals with more efficient methods of documentation, chart review, ordering, and patient safety. The EHR improvements used a mobile documentation application, auto population of abnormal test results in the patient summary section, use of alerts to reduce incorrect test ordering, and the implementation of patient safety alerts on the user's dashboard. The study concluded that the use of these innovations and changes to the EHR led to lower burden and more

patient interaction. The authors believed that reducing clicks through streamlining EHR workflows should improve patient safety, reduce physician burnout, and lead to an increase in physician job satisfaction.

Collier (2018) explored ways to reduce the click fatigue for physicians when charting. The study was conducted at Yale. Yale tested the use of badges to sign into EHR applications rather than entering username and passwords. This saved physicians approximately 20 min per day. Additionally, the use of voice recognition software to interact with EHR software was tested as well. As the use of voice activated technologies is on the rise in general, extending this technology to the EHR is a logical move. The third item Yale trialed is the use of virtual scribes—professionals who listen in and document physician–patient encounters from remote locations. According to Collier, Yale's chief medical information officer, Dr. Allen Hsiao, noted the limitations of the keyboard-and-mouse user interface. Yale is looking at alternatives to that computing metaphor. The goal is to reduce the number of clicks required for physicians to complete their duties.

In a similar fashion, an earlier study by Zheng et al. (2009) conducted an interphase-driven analysis of user interaction with an electronic health record software system. The objective of the study was to discover possible navigational patterns by physician users as they performed various critical tasks in the software. The movements of 40 physicians were tracked for the study. The physicians were internal medicine residents in a primary care clinic at an urban hospital. The authors found that consistent user interface navigational patterns among these physicians were present. However,

these patterns were not anticipated by the software designers or by the hospital administrators.

A study on the effects of EHR software design and physician resident documentation quality by Rodriguez Torres et al. (2017) revealed that user interfaces play a significant role in how a physician accurately captures and charts their patient interactions. This particular study evaluated the charts of 331 ophthalmology patients examined in clinic between September 1, 2011, and March 31, 2014. The patients were being evaluated for dry eye syndrome. The study compared documentation rates among physician residents for 30 evidence-based elements in the EHR chart and notes. The presence of dialog boxes was found to be responsible for substantial changes in the EHR documentation of adnexa, puncta, proptosis, skin examination, contact lens wear, and smoking exposure. Rodriguez Torres et al. noted that

> Significant differences in documentation were correlated with electronic health record template design rather than individual resident or residents' year in training. Results show that electronic health record template design influences documentation across all resident years. Decreased documentation likely results from "mouse click fatigue" as residents had to access multiple dialog boxes to complete documentation. (p. 1)

Rodriguez Torres et al. found that EHR software design has a major impact on the quality of the clinical notes produced by doctors. The authors recommended evaluating the influence of EHR design in the context of resident education, which is crucial to producing expanded quality reporting for the EHR.

Kroth et al. (2019) researched the association of EHR design and use factors with provider stress and burnout. Their study, which provides another perspective in this specific area, surveyed 282 providers from three different organizations and measured stress, burnout, and opinions on EHR design. Kroth et al. found that there were seven EHR design and use factors associated with stress and burnout. However, the study concluded that "While EHR design and use factors may appropriately be targeted by health systems and EHR designers to address stress and burnout, other non-EHR issues, especially clinician work conditions, appear to play a substantial role in adverse clinician outcomes" (p. 1).

Two recent studies evaluated the effects of EHRs usability and EHRs interface complexity on work-related burden among physicians. Specifically, Moy et al. (2021) conducted a scoping review of 35 studies that examined the links between EHRs burden and burnout among physicians. Moy et al. found that in 85% of studies, such factors as EHRs interface complexity, average time, proportion of time, timeliness of completion, and activity rate were identified as strong contributors to increased work-related burden among physicians. The findings of Moy et al. are highly consistent with the findings of Melnick et al. (2021), who examined the association between EHRs usability and professional burnout among 5,197 American physicians using the Maslach burnout inventory (MBI). Using multivariate analysis, Melnick et al. found that adjusting for age, sex, medical specialty, practice setting, hours worked, and number of nights on call weekly, physician-rated EHRs usability was independently associated with the odds of burnout with each 1 point more favorable usability score associated with a 3% lower odds of burnout. Melnick et al. concluded that (a) the usability of current EHRs systems in the

United States remains very low, and (b) a response relationship between EHRs usability and the odds of burnout among physicians was observed.

Positive or Neutral Outcomes

A study on EHRs and the quality of diabetes care by Cebul et al. (2011) revealed a change in reported outcomes. This study evaluated the safety data of 27,207 adults with diabetes seen at 46 practices. The period reviewed was from July 2009 through June 2010. The review was conducted at the time when EHR adoption was about to skyrocket. Cebul et al. found that when adjusting for covariates, composite standards for diabetes care was 35.1% higher at sites that used EHRs versus traditional paper-based sites. Again, the time this research was conducted was prior to the regulatory mandates that currently exist. However, it is worth noting the results of this study and how they contribute to the literature review related to patient safety in the context of EHR usage.

Additionally, a significant study emanating from Switzerland in 2014 evaluated fifty-four intensive care units at hospitals around that country and attempted to determine whether there was correlation between physician burnout components and mortality, length of stay, and ratings of patient safety (Lyndon, 2015). The study discovered that clinicians demonstrating symptoms of burnout had lower perceptions of patient safety in the intensive care unit. However, higher levels of burnout among clinicians were not linked to clinical outcomes.

Patient Satisfaction

Thus far in this literature review, analysis has been presented on studies that evaluated the effects of the EHRs from the provider's perspective. However, evaluating research from another perspective is equally beneficial and worth examining in this

review. Marmor et al. (2018) focused on the impact of physician EHRs usage on patient satisfaction. It evaluated office hour provider EHR use and its correlation with patient satisfaction. The study also examined after-hour provider EHR use and its correction with patient satisfaction. Marmor et al. found that there was a "statistically significant, inverse relationship between daytime EHR usage and patient satisfaction scores for general internists and medicine sub specialists" (p. 14). Regarding after-hours provider EHRs usage, the researchers found that there was no correlation between increased after-hours EHRs usage and patient satisfaction. Marmor et al. concluded that their study proved that increased daytime EHR utilization, both inside and outside of the exam room, might negatively impact physician–patient relationships.

In the same vein, Meyerhoefer et al. (2018) examined provider and patient satisfaction with an integrated EHRs system, inpatient versus outpatient. This study focused on OB/GYN departments at hospitals and OB/GYN practices during initial go-live period of a new EHR system. Meyerhoefer et al. found that (a) patient satisfaction dropped after the excitement of the initial EHR go-live, but (b) no evidence was found to support increased satisfaction linked to system integration.

A large survey conducted by Mayo Clinic researchers Shanafelt et al. (2016) sought to examine the relationship between characteristics of the EHR and clerical burden with professional satisfaction and physician burnout. This survey was comprehensive in that physicians from all specialties across the United States were included. The survey was conducted from August 2014 to October 2014. There were 6,735 respondents, of whom 83% reported using EHRs and computerized physician order entry (CPOE). These particular physicians were found to have a lower satisfaction with

the amount of time they spent on clerical EHR tasks. This group was also found to have higher rates of burnout. Essentially, the mundane and time-consuming responsibilities of clerical EHR tasks led to low level of overall professional satisfaction. As a result, higher levels of burnout among the physician surveyed were experienced.

Connection to Public Administration Concepts

In bringing this literature review back to the concepts of public administration, national EHR implementation goals contained the ideals of efficiency, accountability, and responsibility. From a public administration construct, this study highlights the concept of efficiency and effectiveness related to EHR software fatigue. According to Manzoor (2011),

> Public administration is traditionally grounded in the achievement of efficiency in the work of public departments in pursuance of goals related to provision of public goods and services. Hence, efficiency finds a permanent place in the study of public administration and the work of government. (p. 1)

This is a direct result of Taylor's (1911) groundbreaking work regarding Scientific Management. Ledford (2018) noted that because of Taylor's significant impact on health care organizational operations, "physicians likely identify with this desire for efficiency in organizations, and opportunities exist throughout our clinics and classrooms to improve processes of care and learning" (p. 89).

Research by K. Evans et al. (2006), Silow-Carrol et al. (2012), and Truitt et al. (2016) cited in Chapter 1 of this study showed successful examples of efficiency and effectiveness because of the use of EHRs. However, not all researchers share the view that Taylor's (1911) scientific management has a place in patient care. In regard to the

concept of efficiency and effectiveness, Hartzband and Groopman (2016) warned that applying certain standardization principles in medicine can result in negative outcomes and further noted that medical Taylorism is a result of economic pressure being applied to healthcare providers and organizations.

Hartzband and Groopman (2016) unequivocally argued that the efficiency principles of Frederick Taylor and his scientific management should not be applied to critical areas like medicine and health care. Hartzband and Groopman specifically noted that the application of Taylorism can produce unsatisfactory patient care and physician burnout. It is entirely possible that the public administration principle of efficiency and effectiveness in the context of EHR use could be one of the major drivers of provider burnout. Using EHRs can certainly be efficient as well as convenient, but there are associated costs. Ledlow and Stephens (2018) provided a counter-argument to Hartzband and Groopman. Ledlow and Stephens argued that Taylor's scientific management can show the inefficiencies of EHRs. An example of the inefficiencies is that providers are spending more time in electronic charts than with their patients. If those inefficiencies are leading to issues such as burnout, then Taylor's principles can be applied judiciously to solve that specific problem.

Dastagir et al. (2012) provided an example of tackling of the EHRs inefficiency in the area of training with their study of 155 ambulatory and hospital providers at Kaiser Permanente Northwest (KPNW). Their survey instrument included the following components: self-perception of efficiency, satisfaction with the system, and job satisfaction. Additionally, a presurvey contained questions about primary support options, demographics, attitude/work–life balance, experience with the EHR. Dastagir et

al. noted that “despite our numerous years of experience in the use of an EHR, we believe that significant opportunity remains in optimizing our effective and efficient use of this powerful tool” (p. 137).

The results of the study by Dastagir et al. (2012) are revealing. The following is what the authors concluded: an intensive three-day physician peer-led proficiency training program for experienced EHR users held offsite can considerably increase provider perceptions of EHR efficiency and competency. The program also improves perceptions of organizational support related to high quality patient care and provider job satisfaction.

Many are seeking the answers to these probing questions. In the survey of the literature, Hartzband and Groopman (2016) were the first discovered to link a public administration concept, theory, and theorists to physician burnout and EHRs. Standardization is key to the growth and management of any organization. Standardization can result in improved efficiency and effectiveness as well. However, standardization must be applied where it is logical and appropriate. In information technology best practices, standardization is a key principle of operations. In evaluating EHR systems usage and provider burnout, perhaps the solution is to take a high-level view of where standardization is being applied. This evaluation process can hopefully lead to the identification of EHR problem areas for providers and triggers for EHR fatigue and burnout.

Emotional Labor Aspect

As stated previously, fatigue and burnout are associated outcomes of emotional labor (R. J. Erickson & Grove, 2008). The application of emotional labor to the field of

healthcare in the context of public administration concepts appears to be a logical progression. Although there is an increased interest in the concept of emotional labor in health care settings among physicians, a comprehensive review of the emotional labor literature from 2010-2017 by Załuski and Makara-Studzińska (2018) found that the awareness of the subject as a whole is lacking in the field. There are very few training courses offered to employees that deal with this issue, and healthcare organizations are not equipped to address emotional labor holistically.

Much of the literature concerning emotional labor deals with the health care sector, outside the frameworks of public administration. However, there are some recent studies that focused on public service personnel working in health care and provide a connection to public administration theory. These studies are discussed in the subsequent paragraphs.

Choi et al. (2016) examined relationships among emotional labor, self-efficacy, and factors that influence burnout of employees at public health centers in South Korea. The researchers surveyed 166 workers at these public health centers. The results of the data were analyzed using descriptive statistics, t-test, one-way ANOVA, and a stepwise multiple regression. Choi et al. found that employees in public health centers experienced emotional labor in some fashion. Employee burnout had a positive correlation with emotional labor and a negative correlation with self-efficacy. The age of the employees played a role because statistical significance in burnout was dependent on that variable. The researchers recommended that leadership of the public health centers implement effective intervention programs that increase self-efficacy levels and

emotional labor experiences for their employees. The programs would also assist in managing potential burnout.

A similar study by Pandey and Singh (2016) evaluated the effects of emotional labor strategies on burnout and job satisfaction among 177 public healthcare workers in northern rural India. Emotional labor was divided into two categories—surface-level and deep-level—with attributes assigned to each level. The study found that surface-level emotional labor was associated with higher job satisfaction and lower burnout rates. Conversely, deep-level emotional labor was associated with lower job satisfaction and higher burnout rates. The results clearly show a link between emotional labor and burnout among these public healthcare workers. The two studies provide a foundation to further explore public service personnel and their motivations, given the presence of intense emotional labor and potential burnout in their respective workplace roles.

Public Service Motivation and Emotional Labor

Public service motivation, also known as public service ethic, was defined by Perry and Wise (1990) as "an individual's predisposition to respond to motives grounded primarily or uniquely in public institutions and organizations" (p. 27). In other words, certain individuals in the workforce population are better suited for public service jobs rather than the private sector, profit driven environment. Based on the literature, there appears to be a strong link between public service motivation and emotional labor. The studies examined in the following paragraphs explore the nexus between these two public administration concepts. Additionally, application of the JD-R theory, utilized as the foundational theory for this study, to public service personnel motivation and emotional labor are presented.

Research by Roh et al. (2015) examined the link between emotional labor, public service motivation, and job satisfaction among public health care social workers. The authors postulated that through the application of scientific management to the public sector, emotional labor aspects of an employee and the workplace were not taken into consideration. The principles of scientific management are concerned with performance, efficiency, and effectiveness. The study by Roh et al. utilized a structural equation model to provide empirical evidence for determinants of job satisfaction and burnout. The study surveyed 2,732 social workers from various states across the United States using a combination of the GNM emotional labor survey and Perry's 1996 PSM survey. Roh et al. found that as emotional labor intensifies, the probability of burnout increases as well. Additionally, social workers were more susceptible to burnout when false emotions were used rather than natural emotions. In addition, commitment to public interest increases social workers' job satisfaction significantly. The authors recommended that organizations actively manage, educate, and train workers on the subjects of emotional labor and burnout to balance motivation and job satisfaction and decrease burnout.

Moreover, Kim and Wang (2018) assessed the role of job demands and resources between emotional labor and burnout among service workers at the local governmental level. Kim and Wang noted the increase in attention to the concept of emotional labor, along with its associated effects—burnout and stress. The researchers set out to analyze the direct, indirect, and moderating outcomes of jobs demands versus resources on burnout. The data were gathered from a sample size of 1,517 public service employees across various public departments in the province of Gyeonggi-do in South Korea. Examples included emergency services personnel, nurses, and administrative workers. In

regard to survey instruments, the study used the Schaufeli burnout measurement tool and the Brotheridge and Lee emotional labor assessment tool. The results of the study were as follows: emotional labor and surface acting increase burnout, and deep acting decreases burnout. Job demands increased burnout, and job resources decreased burnout. In that same category, customer contact resulted in a positive impact on burnout. In the area of job resources, self-efficacy and social support resulted in a negative impact on burnout. In regard to moderators that affected the impact of emotional labor on burnout, customer contact, role ambiguity, job autonomy, and social support were the key indicators. The comprehensive nature of this study yielded noteworthy results in emotional labor and jobs demands-resources theory as related to public service personnel frameworks.

Research conducted by Deng et al. (2019) along the same lines as the study previously outlined, assessed the relationship among social support, job stress, and public service motivation. Additionally, the research measured the effect of social support and job stress on public service motivation. The study utilized the JD-R theory as a framework of its objective. In regard to the sample, 973 health care workers, including physicians, in Beijing, Xiamen, and Guangzhou China were selected through random sampling by employee number, age, and role across three public hospitals. The study found that social support and job stress are the primary markers of public service motivation among hospital health care workers. Stressors that caused a negative association with public service motivation were workplace challenges and obstacles. Deng et al. noted that their study aimed to

> explain the potential psychological process of employees working in public sectors under the combined effect of job demands and job resources [and that] JD-R theory proposes that social support and job stress not only affect employees' motivation, but also significantly affect their burnout and job performance. (p. 12)

The authors recommended that public hospitals provide wellness programs for their employees and that administrators balance employee rights and responsibilities through a series of operational measures regarding scheduling and workplace culture.

Summary of Literature

The review of the literature has highlighted key studies, research, and findings in scholarly publications on EHR fatigue, burnout, and its effect on patient care. It also examined EHRs user interface aspects as well as relevance of EHRs fatigue issues for public administration theory concepts of Taylorism, efficiency and effectiveness, emotional labor, and public service motivation. In examining provider fatigue and burnout, whether because of EHRs or not, researchers primarily cited Freudenberger's burnout theory as the main theoretical framework for their studies. Of the literature surveyed, the theory used as the foundation for this study, the JD-R theory, was used in three studies.

However, despite ongoing research on the topic, if the findings of extant studies are combined, it still remains unclear whether there is a direct causative relationship between the mandated use of the EHRs by physicians and physicians EHRs fatigue. The link between the EHRs utilization fatigue and physician burnout remains underresearched. Furthermore, the true nature of the relationship between EHRs use, fatigue, and burnout in physicians and efficiency and effectiveness of medical care need

to be better understood. Therefore, these issues constitute the gap that this study aimed to fill with new empirical data and better understanding.

Chapter 3 provides the detailed descriptions of the methodology of the study and describes the research design, the research population, the sample and sampling procedures, the participants' recruitment methods, the data collection, and the data analysis plans.

CHAPTER 3: METHOD

This study examined whether EHR fatigue is driving burnout among providers at public hospitals in northern California and whether burnout affects patient care. This study provided answers the following research questions:

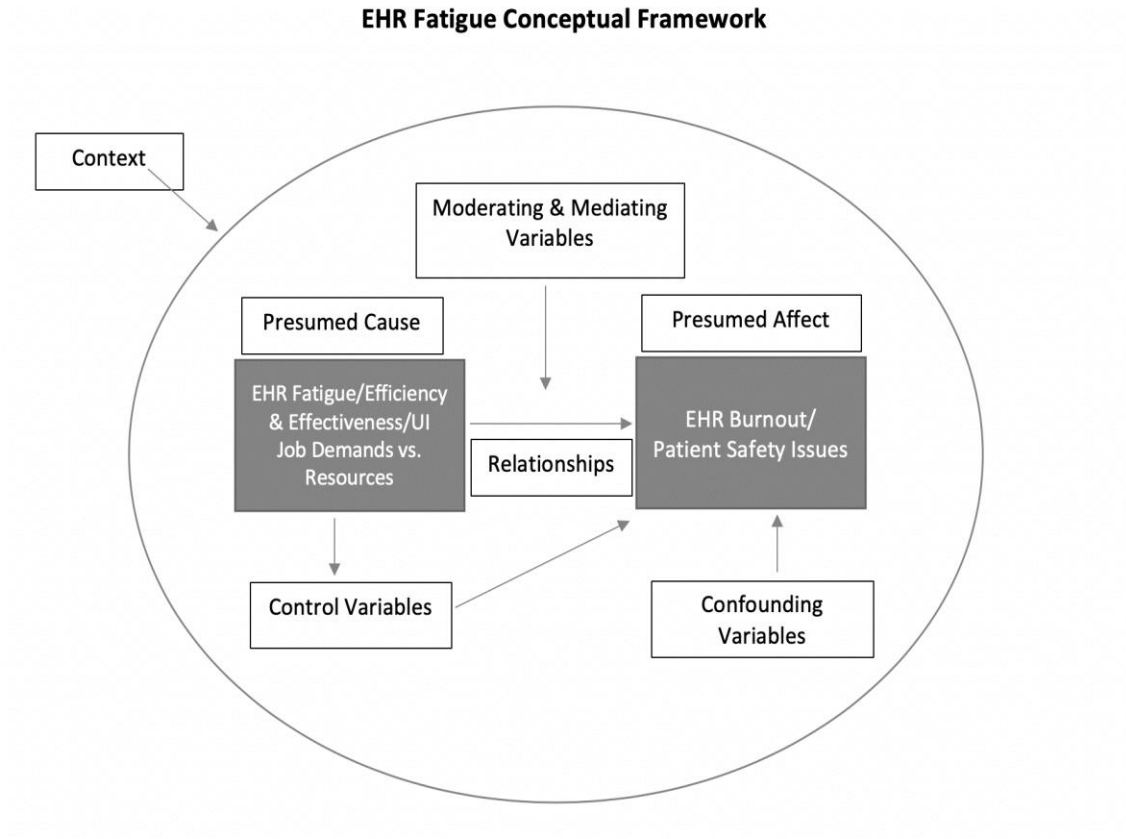
1. What are the perceptions of providers in regard to EHR use and its association to fatigue?
2. What are the perceptions of providers in regard to EHR use and its association to efficiency and effectiveness?
3. What variables contribute to the user interface experience with EHR use?
4. Have patient safety incidents at the hospitals in this study increased or decreased as a result of provider EHR fatigue or burnout?

The conceptual framework of the study is presented in Figure 4.

The study employed a mixed methods approach. Fetters et al. (2013) noted that "several advantages can accrue from integrating the two forms of data" (p. 2134). The qualitative data can be used to assess the validity of quantitative findings. In addition, Fetters et al. stated that "quantitative data can also be used to help generate the qualitative sample or explain findings from the qualitative data" (p. 2135). In this study, Q methodology was used for quantitative data, and the phenomenological content analysis was used for qualitative data. The main benefit of Q methodology is that it works well with a mixed methods approach, particularly with phenomenology (Shinebourne & Adams, 2007). The specific type of phenomenology used was transcendental phenomenology, which is most frequently associated with healthcare fields (van Manen, 2014).

Figure 4

The Conceptual Framework of the Study



The Nature of the Study and Participants

The specific aims of the study were

1. To identify and describe the reported phenomenon of electronic health record software burnout among providers at public hospitals in northern California;
2. To evaluate the perceptions of providers regarding electronic health record use and its association to efficiency and effectiveness
3. Examine what variables contribute to the user interface experience with EHR
4. To determine whether electronic health record software utilization in these specific locations adversely affect patient safety and care.

The participants in the study were providers from the internal medicine, emergency, and surgery departments at general and acute care hospitals in northern California. According to D. D. Berg (2019), providers in internal medicine, emergency, and surgery specialties are more prone to burnout because these providers also tend to work longer hours than other specialties and have higher workloads associated with EHRs. Although this study does contain representation from internal medicine, emergency, and surgery specialties, other specialties are represented as well.

A nonprobability design and purposive sampling were used in this study. As Creswell (2002) noted, nonprobability sampling involves the study of participants who are available, willing, and convenient. Specifically, hospitals and providers that used EHR software systems with a CPOE module were selected. EHR software systems are vast and complex and contain many modules. Hospitals often use EHR software applications from other companies in certain departments that are different from their primary EHR. Among the study's sample, the researcher did not find this to be the case.

Research Design and Procedures

When conducting a mixed methodology study, there are four basic research designs scholars can use. Specifically, the designs include convergent parallel design, the explanatory sequential design, the exploratory sequential design, and the embedded design (Schooneboom & Johnson, 2017). Table 2 summarizes the four designs that were considered for the study.

Because this mixed methods research study employed Q methodology for the quantitative approach and phenomenology for the qualitative approach, convergent parallel research design was utilized. According to Creswell et al. (2003),

> The convergent parallel design, also referred to as the convergent design, occurs when the researcher uses concurrent timing to implement the quantitative and qualitative strands during the same phase of the research process, prioritizes the methods equally, and keeps the strands independent during analysis and then mixes the results during the overall interpretation. (p. 70)

Table 2

A Typology of Mixed Methods Designs

Design	Key features
Convergent parallel	Simultaneous independent data collection and analysis. Results merged to provide a more complete understanding of a phenomenon.
Explanatory sequential	Strands occur in turn, with initial quantitative results being explained in more detail through qualitative enquiry.
Exploratory sequential	Methods are carried out sequentially, with the qualitative phase first. Then, quantitative method seeks to test and further quantify initial qualitative findings.
Embedded	An additional strand of research is added to a larger study to gather supplemental information about this.

Note. Adapted from *Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research* (p. 70), by J. W. Creswell, 2002, Pearson Education.

The convergent parallel research design was selected because of its prior use in past studies on the topic of this research and its recognized viability in academic research. In particular, in their review of mixed methods literature, Mayoh and Onwuegbuzie (2013) found that convergent parallel design is frequently selected by researchers who

perform a mixed methods study. The design's prevalence in the extant literature illustrates its feasibility and historical foundation. Specifically, a study on burnout by Gupta et al. (2012) used convergent parallel design in their mixed methods approach. This design's use in a burnout study offered insight and a roadmap of how the phenomenon could be researched and studied.

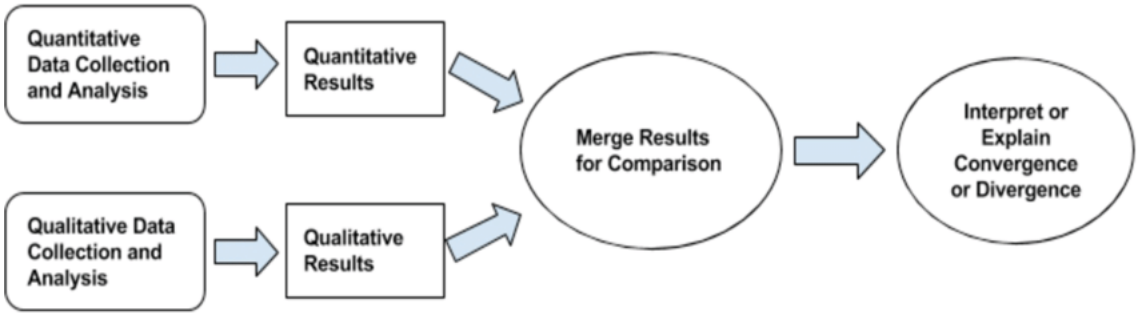
Additionally, researchers found that the parallel approach allowed the qualitative data to illuminate the qualitative findings further by providing specific experiential examples as additional texture (Mayoh & Onwuegbuzie, 2013). The goal of utilizing a convergent parallel design in this study was to illustrate the intricacy of the phenomenon being studied and to allow for substantiation and cross-validation. After the data were collected simultaneously and independently, the two data sets were compared through the development of matrices, visual representations, and joint discussion. The steps involved with convergent parallel design are detailed in Figure 5.

Validity and Reliability

According to Creswell and Creswell (2018), the convergent parallel design "can show greater validity and reliability depending upon the results" (p. 231). According to this logic, if the data are found to be convergent, the qualitative and quantitative data support each other and strengthen the validity and reliability of the study. Conversely, if the data are found to be divergent, then the validity and reliability of the research raises some questions. In either case, qualitative triangulation and quantitative constructs were used in this study to provide the research with a firm foundation.

Figure 5

Steps in Convergent Parallel Design



Note. From *Designing and Conducting Mixed Methods Research* (p.56), by J. W. Creswell and V. L. Plano Clark, 2015, Sage Publishing.

Instruments and Materials

The data collection tools used in this study were individual interviews, focus interviews, and a survey. The interviews provided the human perception and feelings about EHRs in open-ended format, and the survey provided a structured format, resulting in a viable secondary data set. The combination of both tools helped to determine the overall impact of EHRs in patient care among providers in this research study's sample.

Measures

The interviews in the qualitative and phenomenology aspect of this study were measurements of nominal data. The in-person interview questions used in this study were developed by the researcher. The interview questions contained mostly open-ended questions with a few closed-ended questions included as well. An example of an open-ended question is "Tell me about your interaction with the EHR, from when you wake up to when you go to sleep." An example of a closed ended question is "Do you feel the EHR is primary source of burnout for you?" The interviews conducted in this portion of

the study measured ordinal data. In the quantitative approach of this study, using Q Methodology, the Q-Sorts 40-item survey questions were presented, and answers were measured using a Likert scale. Likert-type scales are considered ordinal data although they contain elements of interval data. McKeown and Thomas (1988) showed the acceptable range of Q Methodology Q Sorts statements to be between 40 and 60.

Statistical Significance and Sample Size

It is important to note that statistical significance is a vital component of this mixed methods research approach. The quantitative data should provide conclusive results and provide insights for further possible study. Regarding sample size and phenomenology, there are variations among scholars about minimum sample size. The minimum widely seen is five with a maximum of 25 (Creswell, 1998). Knowing these parameters, the researcher estimated that the qualitative sample size of providers from the hospitals would likely be 12 to 15. Although the aim was to enlist more participants, the study resulted in 13 providers.

Because of COVID-19 (specifically the first wave in the United States), the researcher faced significant challenges in finding willing participants. The initial plan for the study was to contact the hospital administration departments at public hospitals and request the names of five physicians, preferably from the internal medicine, emergency, and surgery departments. Many hospitals and providers wanted to participate in this study. However, COVID-19 presented unique and unprecedented staffing issues, that resulted in several declinations. This reality caused a pivot of the enlisting approach. Through the referrals of professional colleagues, potential participants who met the study's criteria were found. Purposeful, snowball sampling was subsequently employed

to recruit the sample of interviewees. The researcher then formally contacted these providers via email or phone to request their participation in the study.

The interviews for this study were conducted via phone or Zoom with the provider participants. The interviews were scheduled well in advance at times convenient for the participants. Any scheduling issues or conflicts were managed as they arose. The provider surveys were sent electronically to the participants for ease of access, convenience, collecting, and analyzing.

Analytical Procedures

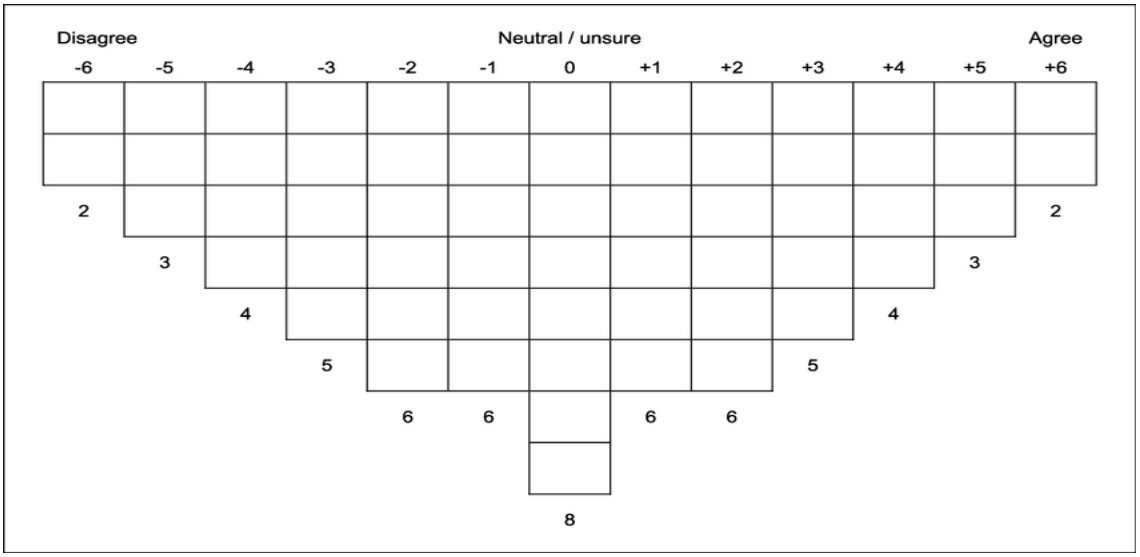
This study used a mixed methods approach. The quantitative data were derived from the use of Q Sorts statements and surveys. The qualitative data were collected from interviews.

Quantitative Analysis

According to Shinebourne and Adams (2007), "Participants in a study using Q-methodology are asked to sort a set of statements representing a broad diversity of opinions and perspectives on the phenomenon being investigated" (p. 2). These statements are referred to as Q-Sorts and generally contain forty statements. Physician participants in this study were be asked to rank-order forty opinion statements about EHRs, burnout phenomenon, and patient safety at their respective hospitals. The Q-methodology research procedure was then used to assemble a judgement typology from the rank-ordered Q-Sorts statements. The rank-ordered Q-Sorts were then analyzed using person factor analysis. A sample of Q-sorts matrix is presented in Figure 6.

Figure 6

The Q-sorts Matrix



Note. From "Self-Management of Chronic Low Back Pain: Four Viewpoints from Patients and Healthcare Providers," by P. Stenner, V. Cross, C. McCrum, J. McGowan, E. Defever, P. Lloyd, R. Poole, and A. P. Moore, 2015, *Health Psychology Open*, p. 104 (htpps://doi.org/10.1177/2055102915615337).

Rank-order Q-Sorts statements were obtained via the Q-sorTouch web application, which also served as the survey design instrument. The Q-Sorts matrix was created with extracted data from the Q-sorTouch software. The responses to these statements allowed the researcher to form distributions or groupings based on degrees of agreement that were further analyzed using IBM SPSS 28 statistical software. The interview questions are presented in Appendix A. The Q-set survey is presented in Appendix B. The survey responses were analyzed to reveal any overarching themes regarding EHRs and time spent with patients, burnout, and effect on patient safety.

Qualitative Analysis

The qualitative data for this study were collected from interviews and software audit logs. For in-person interviews, notes and recordings of those interviews were employed to capture participant responses. Those responses were then evaluated and organized using a spreadsheet software application, Microsoft Excel. Qualitative coding techniques known as descriptive, in vivo, and process coding (Miles et al., 2014) were employed to structure interview data.

All interviews were recorded using a digital recorder and then transcribed using an online transcription service. All participants consented to participate in the interviews and collaborated by providing as much information related to their respective areas of expertise as possible. The participants were not remunerated for their participation and provided their opinions on a purely voluntary basis. Once the interviews were transcribed, the contents of the interviews were examined for consistency and correctness of transcription. As a next step in the analysis, member checking was conducted with participants via email to ensure reliability and validity of the qualitative data collected.

Directed Content Analysis

The next step in the analysis of the qualitative data collected in the interviews involved conducting a directed content analysis. The analytical purpose of the directed content analysis was twofold: (a) to condense large qualities of the qualitative data collected in the interviews, and (b) to create broad sense-making categories to make reliable and consistent inferences from textual data beyond merely basic descriptions and summaries of participant's opinions. The procedure of the directed content analysis involved three steps. First, broad analytical constructs were singled out and turned into

codes. Then, using NVivo, the coding of the textual files was performed. Last, the thematic analysis of the coded data was conducted.

Analytical Constructs

Analytical constructs served as points of deductive inference and were employed in the directed content analysis to collect qualitative evidence necessary to address the research questions of this study. Analytical constructs allowed the researcher to analyze each of the 13 interviews comprehensively and also in relation to other interviews to make a deductive inference about specific factors that in the opinion of the participants may (a) be associated with EHR fatigue and (b) mediate or moderate burnout, and (c) have an effect on effectiveness and efficiency of care.

The directed content analysis involved two phases. In Phase 1, each interview was analyzed systematically and independently of other interviews for the incidence of specific thematic content signaled by codes. In Phase 2, all qualitative data were reexamined in a holistic manner as the incidence of major themes in each interview became evident. The use of the two phases ensured validity of the procedure and reliability of its findings.

Coding Procedure

The coding procedure was the next step in the directed content analysis. The coding procedure was implemented in four steps. In Step 1, word was defined as a unit of analysis. The word was selected as a unit of analysis because it allowed the researcher to assign specific analytical constructs more effectively and efficiently compared to a sentence, collocation, or paragraph. Using a sentence or a collocation as a unit of analysis would not have allowed exploring contextual relationships fully, which is

critically important for sense-making. On the other hand, using a paragraph as a unit of analysis would have resulted in application of only broad analytical constructs, which would have led to a substantial loss of thematic content.

In Step 2, codes and a coding scheme were developed based on the analytical constructs derived from the preselected theoretical framework. In total, because NVivo software was used for the analyses, the individual codes were not grouped into what is conventionally known as "themes" in a directed content analysis but into (a) main codes and (b) subcodes. The coding scheme and the definition are presented in Appendix C. In total, six main codes and 17 subcodes were developed and applied to textual files in NVivo.

In Step 3, the developed codes and the coding scheme were tested on a sample of a text through a pilot coding exercise. A file of medium size was selected because it was long enough to explore the assigning of codes, yet it had a well-developed structure, and based on an exploratory assessment of the textual file, a wide range of thematic content items that allowed the researcher to test the internal consistency of the codes and the external consistency of the coding scheme.

In Step 4, the remaining 12 interviews were coded using the codes and the coding scheme that were developed and tested in a pilot coding exercise. In this step, the coding scheme was applied based on the contextual meaning of a specific word as a unit of analysis. Because many sentences under analysis frequently contained direct and indirect references to several analytical constructs, multiple codes and subcodes were assigned in such instances as necessary to reflect the richness of the content.

Thematic Analysis

The thematic analysis of the coded data was the last analytical procedure. It was governed by the deductive approach to identification of key themes, associated with codes and subcodes, associated with provider perceptions of EHR fatigue, burnout, efficiency, and effectiveness, EHR user interface factors, and also how these issues influence patient safety. Epistemologically, thematic analysis was conducted within essentialist-realist domain, and unidirectional relationship was assumed between experience, meaning, and corresponding language used by the participants. Because essentialist-realist perspective was selected, motivations, experiences, and meanings expressed in the interviews were analyzed in a straight-forward, semantic way. Exploration of latent ideas, assumptions, and conceptualizations was not performed as it would have exceeded the scope of this study.

Once the themes were identified, they were interpreted using a semantic approach in which (a) themes were identified within the explicit or surface meanings of the textual data, and (b) the researcher was not looking for anything beyond what a participant had said or what had been transcribed. Using a semantic approach allowed the researcher to progress from descriptions, in which the data were simply organized and summarized to show patterns in semantic content, to interpretation, in which the significance of the patterns and their broader meanings and implications were analyzed. The following criteria were used for thematic analysis: (a) internal homogeneity, (b) external homogeneity, (c) incidence frequency, and (d) relative weight of sources of evidence.

To encapsulate the analytical procedures, both the quantitative data and qualitative data were examined and evaluated to determine whether they provided

answers or explanations for the stated research questions of this study, specifically, whether the data allowed to examine the provider perceptions of EHRs fatigue, burnout, efficiency and effectiveness, EHR user interface factors, and how these aspects influence patient safety at the selected hospitals. The results of both sets of data were compared. Conclusions regarding the quantitative and qualitative data are presented and summarized in Chapter 4.

CHAPTER 4: RESULTS

This mixed methods study examined whether EHR fatigue is driving burnout among providers at public hospitals in northern California and whether burnout affects patient care. The study provided answers the following four research questions:

1. What are the perceptions of providers in regard to EHR use and its association to fatigue?
2. What are the perceptions of providers in regard to EHR use and its association to efficiency and effectiveness?
3. What variables contribute to the user interface experience with EHR use?
4. Have patient safety incidents at the hospitals in this study increased or decreased as a result of provider EHR fatigue or burnout?

Results of the Qualitative Analysis

Setting and Procedure

Thirteen interviews were conducted using the standard set of interview questions. The interview questions are presented in Appendix A. All interviews were conducted in the settings chosen by the participants based on convenience. The participants were allowed to speak as little or as much as they considered necessary to answer the interview questions. All interviews were recorded using a digital recorder and then transcribed using an online transcription service. All participants consented to participate in the interviews and collaborated by providing as much information related to their respective areas of expertise as possible. The participants were not remunerated for their participation and provided their opinions on a purely voluntary basis.

Once the interviews were transcribed, the contents of the interviews were examined for consistency and correctness of transcription. As a next step in the analysis, member checking was conducted with participants via email to ensure reliability and validity of the qualitative data collected. The descriptive characteristics of the sample of the participants and the 13 textual files generated by the interviews after the transcription process are presented in Table 3. The identities of the participants were removed, and henceforward each participant is referred to as P1, P2, P3, respectively. The files were then uploaded to NVivo qualitative analysis software. Approximately 163 min of the transcribed interviews or 24,677 words were analyzed.

Table 3

Descriptive Characteristics of the Participants and the Interviews

	Participants			Interviews	
	Gender	Specialty	Years of practice	Duration (min)	Word count
P1	Male	Cardiology	11	8	1,201
P2	Male	Internal medicine	16	27	4,414
P3	Male	Emergency medicine	27	17	2,648
P4	Male	Emergency medicine	12	7	1,155
P5	Male	Orthopedic surgery	8	24	3,834
P6	Female	Internal medicine	23	3	421
P7	Male	Otolaryngology	7	16	2,470
P8	Male	Maternal medicine	10	37	5,795
P9	Male	Internal medicine	19	5	549
P10	Male	Internal medicine	24	3	236
P11	Male	Emergency medicine	9	3	233
P12	Male	Ob-gyn	28	2	189
P13	Male	Cardiology	11	11	1,532
Total				163	24,677

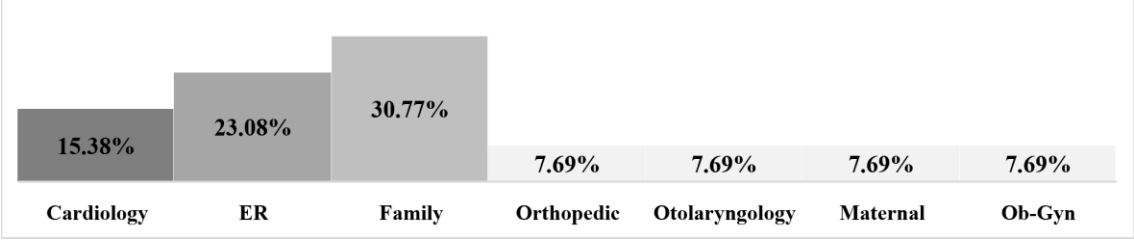
Characteristics of the Participants

Overall, the total size of the sample was $N = 13$ participants. In terms of the gender of the participants, male participants were vastly overrepresented in the sample. Specifically, 12 male participants accounted for approximately 92.3% of the sample. Correspondingly, the single female professional accounted for only ≈ 7.7% of the sample. However, such observed gender imbalance unfortunately is quite common among the population in question.

In contrast, as the results of the frequency analysis indicated, the incidence of the medical specialties in the sample varied. The results of the frequency analysis of the medical frequencies are presented in Figure 7. In particular, the most represented medical specialty among the participants was Internal/family medicine. There were four practitioners of family medicine, and they accounted for roughly 30% of the total sample. The three participants practicing emergency medicine constituted the second most frequent medical category with about 23.1% of the total sample. The two cardiologists accounted for ≈ 15.4% of the total sample. Four medical specialties, orthopedic surgery, otolaryngology, maternal and fetal medicine, and ob-gyn were represented by a single practitioner, each accounting for approximately 7.7% of the total sample.

Figure 7

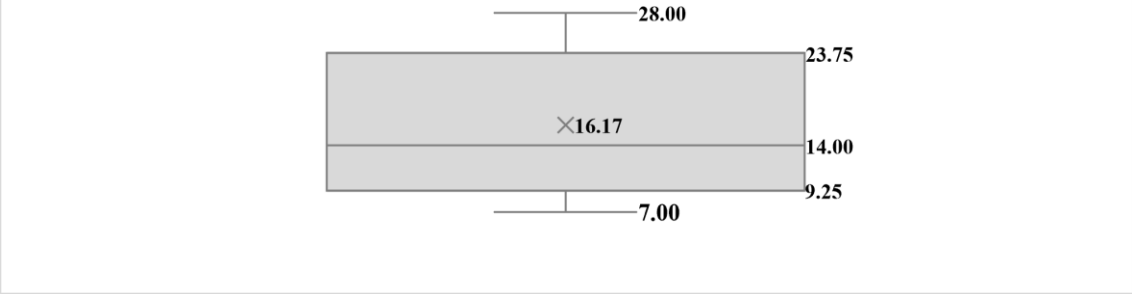
Medical Specialties of the Participants



The distribution of the self-reported years of medical practice is illustrated in Figure 8.

Figure 8

The Years of Experience of the Participants



Specifically, the distributional analysis suggested that the mean was approximately 16.2 years, the median was 14 years, the minimum was 7 years, and the maximum was 28 years. Therefore, based on the self-reported demographic characteristics of the participants, in general the sample reflected the characteristics of the population and, notwithstanding the overrepresentation of the male medical doctors, is a representative sample of qualified specialists capable of providing key insights pertinent to the research questions of the study.

The Results of the Coding Procedure

The next step in the analysis was the coding procedure. The results of the coding procedures are presented in Table 4.

Table 4

The Results of the Coding Procedure

Codes	Files	References	
		Incidence	%
Burnout	10	21	7.87
Stress	3	6	0.75
Lack of control	2	2	2.25
Effectiveness	4	5	1.87
Workload	9	29	10.86
Availability	3	3	1.12
Efficiency	2	2	0.75
Allocative	5	15	5.62
Technical	11	31	11.61
EHR fatigue	13	28	10.49
Scribe	12	23	8.61
COVID	3	9	3.37
Dictation	2	3	1.12
Specialty	1	6	2.25
Compensation	1	3	1.12
Shifts	1	1	0.37
Safety	8	11	4.12
Adverse events	6	11	4.12
Incidence	2	6	2.25
User experience	2	2	0.75
Interface complexity	12	29	10.86
Organizational support	10	20	7.49
Organizational culture	1	1	0.37
Total		267	100.00

Main Findings

The main findings of the qualitative analysis are presented henceforth based on the themes that emerged from the codes used in the directed content analysis. The findings reflect the summative interpretation of the perceptions of the medical providers regarding the main factors contributing to EHR fatigue, burnout, effectiveness and efficiency in the provision of care, EHR user interface experience, and patient safety in the provision of medical care.

EHR Fatigue

The issues of EHR fatigue and various factors contributing to EHR fatigue loomed large in the interviews. The issue of EHR fatigue per se was directly mentioned 28 times in all 13 interviews and accounted approximately for 10.49% of all coded references. The participants consistently indicated that the introduction or the organizationally mandated use of EHRs had resulted in increased workload, overall expanded burden, and various levels of fatigue.

In particular, according to P3, "They keep throwing more and more at us with EHRs; at the ER things move very fast and I do not have time to look at the computer screen." In the opinion of P1, "The two biggest components of EHRs that lead to fatigue are probably in basket [tasks] and the documentation load, or […] the point and click." This sentiment was also shared by P12 who complained that EHR fatigue occurs ubiquitously, and it occurs primarily because it is "computer all the time" as "whatever notes one has to do contribute to the feeling of fatigue or like that." In turn, both P5 and P6 confirmed in simple terms that EHR fatigue was an issue for them." The opinion of P13 was much more emphatic. P13 stated that they "were sick of doing it all day, […], I am sick of the extra steps that it [EHR] creates and the barriers it creates between me and my patients." P2 indicated that they "are looking at the computer more and more." In turn, P9 confirmed they and most of their colleagues experienced various degrees of EHR fatigue, specifying that when they use EHRs, they "get sometimes up to 20 messages a day, and that's just health online messages." In contrast to the prevailing view regarding EHR fatigue, out of all 13 participants, only P4 indicated that they "honestly do not have any EHR fatigue." As an aggregate, in 93.2% of all interviews, the participants indicated

the presence of EHR fatigue. However, it should also be noted that in one interview, a participant expressed a more nuanced view of EHR fatigue. In the opinion of P12, EHR fatigue depends on the area of medicine. In particular, P12 suggested that "basically family physicians, internal medicine, most pediatrics would probably a little bit below that, and then you get into kind of your niche specialties like dermatology." In other words, in the view of P12, less care-intensive medical specialties are generally associated with no or low levels of EHR fatigue.

Factors of EHR Fatigue

The results of the thematic analysis also indicated that the participants viewed the dictation, the level of compensation, the shifts schedule, and the burden of the COVID-19 pandemic as factors contributing to EHR fatigue. For instance, in terms of the effects of the dictation that needs to be done to fulfill all necessary EHR tasks, P11 indicated that they had "to spend more time dictating notes at the hospital because meta-tagging is horrible." Comparing their previous dictation experience with the current one using EHRs, P11 illustrated the difference by using a recent example of a case with a patient with the femur fracture, stating that it took them "8 min to do the note like in the computer [EHR]," while dictating like it was done in the past, "would have taken [them] 2 min or less." In turn, P8 indicated that they preferred "the old school dictation, where [they] just talk into the phone, and somebody transcribes it on the other end." In terms of the level of compensation as a factor of EHR fatigue, P9 indicated that "it's a lot of work and it's uncompensated." However, P9 also acknowledged that the hospital leadership "at least tried to make it somewhat palatable." The issue of the shifts schedule as a factor contributing to EHR fatigue emerged in only one interview. Specifically, P2 indicated

that they "have very long hours and [they] don't answer [EHR] messages at home as [they] are tired."

The effects of the pandemic of COVID-19 appear to have worsened EHR fatigue among the participants. As P9 explained, "COVID like exacerbated this whole thing [with EHR fatigue], just amplified everything. P1 indicated that because "there are a lot more video visits that were happening, [they] were staying fairly busy the entire time, whether it be in person or in video." In relation to the effects of increased workload because of COVID-19, P6 described that the use of EHRs has become "a challenge ever since then [the start of the pandemic] because of that."

At the same time, the results of the thematic analysis further suggested that the use of scribes is viewed as a positive factor reducing EHR fatigue. For example, P5 stated that "having a scribe to assist with EHR charting has made quite the difference," and specifically that "before [they] had scribes, EHR fatigue was definitely an issue" for them. In addition, P11 indicated that for doctors working in emergency departments, scribes are simply necessary because "ER doctors are bombarded with messages." However, acknowledging the benefits of having scribes, P8 opined that "you have to spend time, you really have to spend time training your scribe how to chart correctly." P9 indicated that having a scribe "has really been a great experience" because it "reduces the burden of EHRs and as a result reduces EHR fatigue."

Burnout

It emerged across various interviews that the participants view burnout as a direct and detrimental consequence of EHR fatigue. Twenty-one or 7.87% of all coded references in 10 interviews accounted for the issue of burnout. For example, P9 clearly

stated that “EHR fatigue could lead to, you know, burnout,” which was consistent with the opinions expressed by both P2 and P5 who unequivocally stated that “EHR fatigue can lead to burnout.” Responding to the interviewer’s direct question about the link between EHR fatigue and burnout, P6 explained that the former “was a big, big factor, oh yeah, a big factor of burnout,” and further qualified “mentally burned out and physical issues.” In turn, P7 expressed the opinion that after his employer had switched to EHRs, “gradually EHR fatigue had set in, and then the burnout.” Likewise, P8 stated that EHR fatigue “definitely contributes to burnout” especially because their medical specialty is “huge area for burnout due to the fast-paced environment it requires.” Furthermore, speculating on the mediators of the link between EHR fatigue and burnout, both P8 and P9 suggested that the use of EHRs reduces the immediate area under the doctor’s control, thus increasing the levels of workplace stress. The issue of stress as a concomitant factor also emerged in three interviews. Specifically, P1 explained that EHR fatigue leads to burnout because “EHRs add to stress when work always follows you home.” Similarly, P13 opined that the concomitant stress comes because they are “sick of doing it all day” and that they are “sick of the extra steps it creates and the barriers it creates between me and the patient care.” Unlike others, P5 offered a more nuanced view of the role of stress in the link between EHR fatigue and burnout by stating that they stress out while using EHRs only “sometimes, and if [they] let it get out of hand.” Overall, it appears that the relationship between EHR fatigue, burnout, and stress is much more complex than the scope of the interviews allowed to explore, and therefore require further empirical exploration, preferably using survey instruments validated for such research.

Care Effectiveness

Care effectiveness, defined for the purposes of the thematic analysis as the effectiveness of a health care organization, emerged as an important issue that is, in the opinion of the participants, closely and positively associated with the use of EHRs. There were five incidences of coding related to care effectiveness, which accounted for 1.87% of the total codes and was found in four interviews. Specifically, according to P1, the use of EHRs "had a beneficial part about it [as to] being able to see all patient information." P2 had a similar opinion and stated that "it is nice having the patient's historical record in one place." However, P2 also was not sure whether "the system is making my care more efficient." P9 also described EHRs as "awesome and cool" in terms of their effects on care effectiveness but did not specify how.

The results of the thematic analysis further indicated that some participants viewed the effects of EHRs on care effectiveness as having two components. Workload was one component that had 29 instances of coding and as such accounted for 10.86% of all coded data. Changes in workload associated with EHRs were mentioned in nine interviews. Overall, the participants opined that EHRs have increased their workload, but at the same time they viewed those increases as a more positive development contributing to more effective patient care. For instance, P1 while conceding the benefits of EHRs, simultaneously complained that one "has to manage your basket [of HER tasks], so you kinda feel like that onus is on you at all time to manage that basket." P12 indicated that the EHRs associated workload takes "a solid hour a day, possibly more depending on the season." Estimating the total amount of workload, P11 opined "So yeah, that was big [increase in workload], so, good 2 or 2 and a half hours a day, if not more." These

descriptions are consistent with the opinion expressed by P9 who stated that EHRs "have exponentially increased our workload." However, it appears that EHRs associated increase in workload may actually vary depending on medical specialty. For example, P3 explained that while "patient care does not follow ER docs home" but they still "have significant amount of charting requirements, after seeing patients." Yet, P4 indicated that the workload is partially reduced in their case because "our staff handles all messaging and communication for me."

Another component of care effectiveness was availability, which was defined for the coding purposes as availability of resources to facilitate the use of EHRs. Compared to the workload, mentions of availability were much less frequent. There were only three instances, but they appeared in three interviews. In particular, P10 opined that gains or positive changes in care effectiveness because of EHRs use may be realized only when "there is call support." In turn, P3 indicated that training was needed and "was a bit challenging" to realize the full potential of EHRs. However, according to P4, their "vendor provides decent enough training."

Care Efficiency

Many participants viewed care efficiency, defined for the coding purposes as efficiency in the provision of care, as an issue also closely associated with the EHRs use. Overall, the prevailing opinion was that EHRs were associated with higher efficiency of care provision. However, it also emerged in the process of the thematic analysis that the participants clearly differentiated between technical and allocative efficiency as parts of the broad care efficiency.

Technical efficiency in the provision of care loomed large in eleven interviews. There were 31 instances of this code, which accounted for 11.61% of all coded references. Regarding gains in technical efficiency, P1 explained that they "integrate with other systems, so being able to pull up ER records, labs and images if they go elsewhere outside of our office, and we integrate that rather quickly and then having access to specialist notes." P1 further pointed out that when EHRs "go to another practice that's on the same EHR, we can see everything at that part, and it is pretty slick." Furthermore, P11 indicated that their "day is much more efficient because of EHRs" because they "can look up things from home, which is nice, but you know, as an orthopedic surgeon, we don't have a lot of like, oh, look at all these times you have to." P13 pointed out that the utilization of EHRs "is good in the sense that it decreases the amount of repetitive entry, and the automation but having said that, there's so far too many steps." Additionally, P6 opined that EHRs "are great, you know you can put that in your [device] and past medical history pops up and you know all that stuff. Yes, that's great." P4 opined that because of the type of care their organization provides, which is "more like in a clinic setting, and so the EHRs work well in our environment." However, it should also be noted that not all participants were completely sure whether the use of EHRs allowed them to attain higher levels of care efficiency. For instance, P7 indicated that beyond the access to all patient information, EHRs are "not very efficient in a lot of ways," and the latter included "tons of messages, tons of refills, and then, you know, the chart thing." Similarly, P8 indicated that if one needs to quickly find just an isolated, single piece of medical information, it often "may be buried somewhere in the electronic chart or the code may be a bad one, so it takes time." P8 further explained that although

EHRs offer a very good view of the general picture about a patient, finding specific information may be cumbersome. P9 raised an interesting point, stating that EHRs do allow interactions with patients in a more efficient way as "now patients [are] being able to message directly there" but "unfortunately patients are using, utilizing [EHRs] for the wrong reasons."

Allocative efficiency appeared in five interviews and accounted for 15 incidences or 5.62% of all codes. Regarding allocative efficiency of care, P7 indicated that because of EHRs, they are able "to manage multiple of patients from a single place at single time as opposed to having to be an event sign or every single one of those." Then, P7 further explained that EHRs "in general, really increased [their] ability to care for people." Such a positive view of allocative efficiency is shared by P11 who indicated that EHRs "allow you to be more with patients, and their [EHRs] depth is probably more than meta-tag." At the same time, some participants indicated that they were not sure whether EHRs was associated with allocative efficiency. For example, P3 stated that they felt that EHRs "take away from time with [their] patients." In other words, the question of whether EHRs are in fact associated with higher allocative efficiency is nuanced and requires further investigation, preferably using questionnaire-based surveys.

EHR User Interface Experience

The thematic analysis of the interviews also revealed that the participants' views on EHRs associated burnout, care effectiveness, and efficiency may depend on user experience with EHR interface. It also emerged that EHR user experience is viewed as consisting of three components—interface complexity, organizational support, and organizational culture.

The interface complexity was extensively mentioned in 12 interviews and accounted for 29 instances or 10.86% of all codes. The prevailing sentiment was that most EHRs user interfaces were cumbersome and required a lot of learning and detailed understanding. Specifically, P10 indicated that EHRs "require way too many clicks." Likewise, P12 stated that "the number of clicks and that sort of thing, do contribute to the feeling of excessive cumbersomeness," and that "not every click was really necessary." P13 characterized their EHRs interface as "more clunky or just busier," and also stated that "it updates a lot, there is also a lag between the clicks that slows [them] down." P3 stated that "with each update the system gets more complicated it seems." P5 stated that their EHRs interface is "fairly complicated, lots of clicks, lots of layers" but further opined that they have become "adept at managing interaction with the system." P5 suggested that "it would be nice if [EHRs] were more user friendly, but with the amount of data and modules the system handles, don't know if that is possible." P6 compared the complexity of their EHRs user interface with "cause [the system is] like another language, uh, you know." Overall, P6 concluded that the EHRs interface used by their organization "you know the platform isn't user friendly, and that type of thing, way too many clicks, excessive number of clicks to make things done." Similarly, P7 described their EHRs user interface as "the most annoying, most noxious, and the most persistent in difficulty in 10 years." To overcome the negative experience with their EHRs user interface, P8 made a recommendation to the developers: "if the end user was able to help design it." P9 concurred with such suggestion.

The organizational support was seen by at least 10 participants as a mitigating factor for the EHRs interface complexity. The organizational support accounted for 20

incidences or 7.49% of all codes. Regarding the need for organizational support, P10 indicated that providers must provide more training on how to use EHRs systems. P11 specified that EHRs user training should include whole multiprofessional care teams and their levels of user competencies should be synchronized and standardized. P2 suggested that more budget resources should be allocated to training, but overall, they felt they "were supported by the organization." P8 observed that "just a few hours of training will not be enough" and that user training should become much more consistent and reflect learning about the latest updates to the EHRs systems. P8 also strongly emphasized individual learning while using. Although the majority of the participants expressed their overall satisfaction with the level of organizational support they received, P1 indicated that such organizational support should "also become an integral part of the organizational culture."

Patient Safety

Patient safety, in the opinion of the majority of the participants, constituted one of the biggest positive points of EHRs utilization. Overall, issues associated with the patient safety accounted for 11 incidences or 4.12% of all coded text. As with other issues discussed previously, the participants viewed patient safety as consisting of two dimensions—incidence and adverse events. For the purposes of the thematic analysis, incidence was defined as occurrence of sentinel events caused by fatigue and burnout associated with the use of EHRs. The overwhelming majority of the participants indicated that because EHRs keep all patient data in one place and because such data are accessible by all medical staff, EHRs have contributed to an overall reduction of sentinel events. In this regard, P6 explained that EHRs reduce sentinel events because "entering

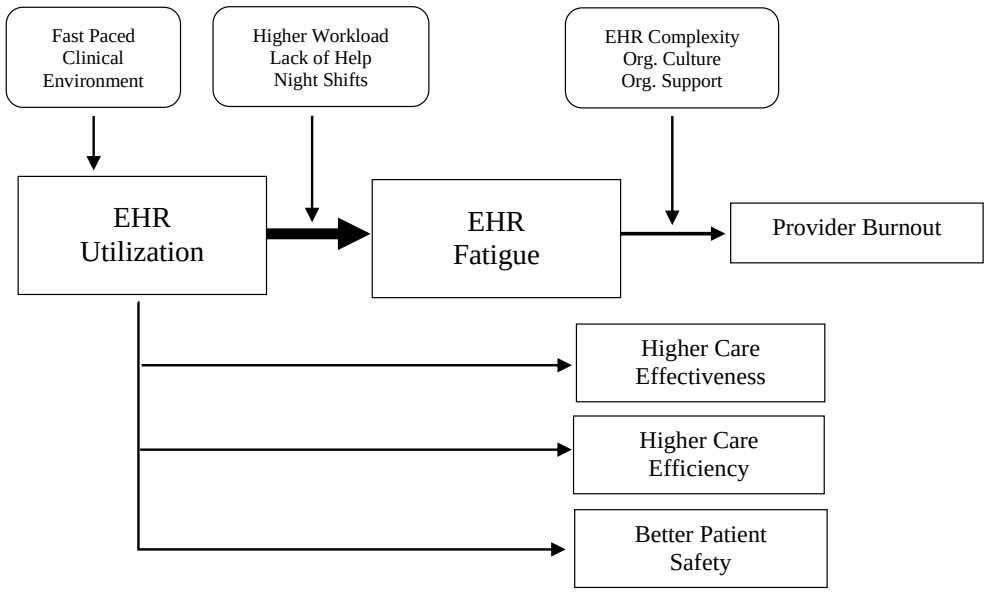
medications has to be exact, so must get the spelling right and medication would pop up, especially if you're trying to enter it or send this prescription." P8 indicated that EHRs prevent old information from being mixed up with the new data, and "you'll click on, you'll click on a patient, [and] before the computer executes the click, it will refresh the patient board." P6 further explained that EHRs system "prevents the use of abbreviations, you are not supposed to abbreviate anymore," and that EHRs "help avoid patient injuries, and speed up critical interventions, because we now know everything in real time what each person is doing."

Furthermore, while generally confirming that EHRs fatigue does in fact affect them, they opined that EHRs also contributed to a reduction of the most serious types and severity of sentinel and adverse events. For instance, P3 reported that they experienced "maybe minor medication errors but not any adverse events for any of [their] patients." Likewise, P5 concluded that they "have not experienced any adverse events due to an issue with the EHRs." P7 reported that although they experience some HER fatigue, but "that's probably that specific problem [of adverse events] for me has gone away probably 90 to 95% that almost never happens anymore." P9 indicated that EHRs help "to spot errors early on." However, P6 painted a more nuanced picture of the link between EHRs fatigue, burnout, and patient safety. P6 stated that EHRs do adversely affect patient safety because "a mistake in the EHR may be the cause of fatigue or burnout, and that's where major legal and organizational headaches begin." Yet, when prompted to elaborate, P6 failed to provide any further details.

The conceptual map of the qualitative findings is presented in Figure 9.

Figure 9

The Conceptual Map of the Qualitative Findings



Results of the Quantitative Analysis

In this mixed method study, to triangulate the findings of the qualitative analysis, a quantitative analysis was also performed. The quantitative data were collected using the Q-methodology and using electronic surveys that were sent to the participants. The same 13 participants were asked to rank order a set of 40 statements representing their personal professional opinions on the EHRs fatigue, burnout, efficiency, effectiveness, EHRs user interface factors, and on how these issues influence patient safety. The questionnaire that was used is presented in Appendix B. The collected statements represented the Q-Sorts. The rank-ordered Q-Sorts were then correlated by a person factor analysis to attain various combinations of the participants who sorted the opinion statements into proximate categories. The responses were then used to form clusters based on the degrees of agreement. The Q-Sorts had 13 variables and 520 points of

observation. An a priori power analysis indicated that to detect a medium effect size of d = .3 at α = .05 with a power of 95%, the sample size should have 134 observations. Thus, the minimum sample requirements were satisfied. The Q-Sorts then were analyzed using IBM SPSS 28 statistical analysis software, and specifically SPSS CLUSTER, ALSCAL and FACTOR procedures. Table 5 presents the results of the exploratory factor analyses.

Table 5

The Results of the Exploratory Factor Analysis

ID	Mean	STD	MSA[a]	Communalities		KMO[b]	Bartlett's[d]		
				Initial	Extracted[c]		χ2	*df*	Sig
P1	1.53	2.698	.923	.611	.623	.753	342.24	78	<.001
P2	.83	2.500	.868	.542	.526				
P3	.23	2.486	.737	.883	.959				
P4	-.15	2.259	.738	.742	.684				
P5	.00	2.801	.607	.535	.628				
P6	.35	1.578	.811	.649	.605				
P7	.00	2.051	.403	.278	.259				
P8	-.65	2.119	.121	.509	.796				
P9	.25	2.145	.709	.719	.709				
P10	.57	2.620	.868	.770	.802				
P11	.48	2.364	.896	.789	.758				
P12	.65	2.304	.785	.906	.896				
P13	.30	2.090	.599	.868	.854				

[a]MSA –Measures of Sampling Adequacy. [b]KMO - Kaiser-Meyer-Olkin Measure of Sampling Adequacy. [c]Extraction Method: Principal Axis Factoring. [d]Bartlett's Test of Sphericity. χ^2 – approximate chi-square.

Assumptions Diagnostics

The first step in the analysis of the Q-Sorts was the assumptions diagnostics of the person factor analysis. The assumption of absence of outliers was satisfied based the examination of multiple box plots. Because the factor analysis is part of the general linear model (GLM), it also assumes no multicollinearity and that data are a linear function of the common factors. The assumption of linearity was satisfied by the examination of scatterplots. The assumption of no multicollinearity was also satisfied. The review of the correlation matrix indicated that 88 or 52.1% or over 50% of all correlations between individual variables were significant, using 1-tailed Person correlation tests at $\alpha = .05$. The correlation matrix is presented in Appendix D.

Exploratory Factor Analysis

The second step in the analysis of the Q-Sorts involved conducting an exploratory factor analysis (EFA). Its purpose was to ascertain whether (a) the Q-Set did in fact contain patterned relationships, and (b) distinct and reliable factors can be produced, and (c) factors can be extracted. The Bartlett's test of sphericity was employed to explore for the presence of any patterned relationships. The Bartlett's test of sphericity tests for H_0: the variables are orthogonal, that is, not correlated. The Bartlett's test compared the observed correlation matrix with the identity matrix. The results of the Bartlett's test indicated that χ^2 (78, 520) = 342.24, $p < .001$. Thus, H_0 was rejected at $\alpha = .05$. Based on the outcome of the Bartlett's test of sphericity, it was concluded that (a) the variables were in fact fairly correlated, and that (b) the Q-Sorts did contain patterned relationships. Therefore, the data in the Q-Sorts can be reduced using person factor analysis.

To ascertain whether distinct and reliable factors can be produced, two tests were employed. The Kaiser-Meyer-Olkin (KMO) measures of sampling adequacy (MSA) were obtained for each variable and for the entire Q-Sorts. The KMO statistic indicates the degree to which each variable in the set is predicted without error by other variables. The MSA measures for each variable were collected from the diagonal element of the anticorrelation matrix. The review of the MSA for variables indicated that 76.9% of all MSA values were > .50. The KMO measure for the entire Q-Sorts was .753, which was also > .50. Based on the cumulative evidence, it was concluded that distinct and reliable factors can be produced.

To ascertain whether factors can be extracted, communalities for each variable were obtained. The communalities indicated the amount of variance in each variable that is accounted for by all possible extractable factors. All values in initial communalities were within the acceptable cut-off range of [.25, .4], and 7 values or 53.8% exceeded the value of .7, which indicates a very good suitability for extraction. Likewise, all values in communalities extracted using the principal axis factoring were within the acceptable cut-off range of [.25, .4], and 7 values or 53.8% exceeded the value of .7. Based on the review of communalities, it was concluded that factors can be extracted from the variables of the Q-Sorts.

Based on the cumulative evidence obtained in the Bartlett's test of sphericity, KMO test, MSAs for each variable, and in the review of the communalities, it was concluded that the outcomes of the EFA were satisfactory, and the actual person factor analysis can be performed.

Person Factor Analysis

Given the outcomes of the CFA, the next step involved the extraction of factors. Factors were extracted using all 13 variables of the Q-Sorts, employing the principal axis factoring applied to the correlation matrix. The factors were extracted using the common criterion of an eigenvalue > 1.0 and with a maximum of 25 iterations for convergence. Cases were excluded pairwise. The resultant coefficients were sorted by size. Small coefficients with an absolute value < .30 were suppressed. The results of the factors extraction are presented in Table 6.

Table 6

Total Variance Explained

Factor	Initial eigenvalues		Eigenvectors			
			Extracted		Rotated	
	Total	% of variance	Total	% of variance	Total	% of variance
1	5.69	43.77	5.45	41.89	3.53	27.17
2	1.95	14.97	1.65	12.73	3.13	24.09
3	1.33	10.26	1.08	8.29	1.30	10.02
4	1.04	8.03	.68	5.23	.89	6.86
5	.95	7.27				

Note. Extraction Method: Principal Axis Factoring.

Factor Extraction

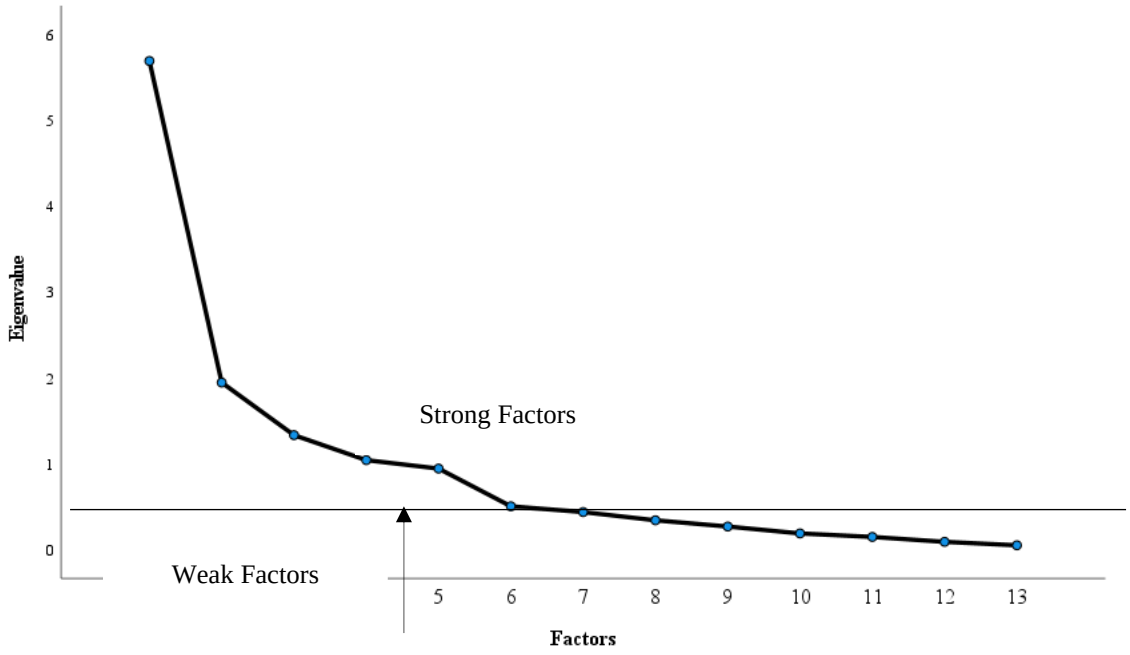
Four strong factors, that is, satisfying the criterion of the eigenvalue > 1.0, were extracted. The cumulative percentage of variance in the Q-Sorts explained by the four extracted factors was 77.34%, which is a very good measure of the success of the factor extraction. The first strong factor accounted for 43.77% of all variance in the Q-Sorts. Cumulatively, the extracted eigenvectors of the factors accounted for 68.14%. The cumulative variance explained by the rotated eigenvectors of the factors was also 68.14%. Both measures indicated negligible loss in the percentage of variance explained regardless of the type of vector rotations. In addition, to the four strong factors, one possible factor candidate was also extracted. However, as it follows from Table 6, its eigenvalue was < 1.0. It also failed to show up in the eigenvectors. The borderline eigenvalue of .95 of the fifth extracted factor suggested that although its use in the current person factor analysis was problematic, it could be reliably extracted in a larger Q-Sorts. The scree plot of all four strong factors and the other nine weak factors is presented in Figure 10.

Model Fit

To check whether the underlying GLM that was used for the factor extraction had a good fit, residuals were computed between observed and reproduced correlations and the analysis of residuals was performed. The results of the residuals analysis indicated that the model produced 16 or 20.0% nonredundant residuals with absolute values > .05. Therefore, it was concluded that the underlying GLM model had a good fit because it had < 50% of the nonredundant residuals with absolute values > .05. It was also observed that most residuals were small.

Figure 10

Scree Plot



Factor Matrix

After the four strong factors were successfully extracted, a rotated factor matrix was obtained using the varimax rotation with Kaiser normalization. The rotated factor matrix with factor loadings is presented in Table 7. The varimax is an orthogonal rotation of eigenvectors associated with the extracted factors. The varimax rotation was selected because it allows to maximize the high and low factor loading, while minimizing midvalue factor loadings. It should be noted that the factor loadings are in fact statistically significant Pearson correlations between the items and the components of the correlation matrix.

Table 7

Rotated Factor Matrix

ID	Factors[1]			
	EHR fatigue	Burnout	User interface	Effectiveness
P1	.926	.245	.130	.157
P2	.815	.113		
P3	.673	.131	.387	
P4	.612	.267	.253	-.124
P5	.610	.562	.244	
P6	.584	.437	-.266	
P7	.214		.111	
P8	.103	.880	-.201	.167
P9	.457	.813	.162	
P10		.811		
P11	.422	.602	.507	
P12	-.143		-.764	.125
P13			-.116	.884

[1]Extraction Method: Principal Axis Factoring.

Rotation Method: Varimax with Kaiser Normalization.

Rotation converged in 5 iterations.

The analysis of the rotated factor matrix suggested that the four extracted strong factors represented the participants' opinion statements into the following four proximate

categories: EHR fatigue, burnout, EHR user interface, and effectiveness. Furthermore, it was observed, based on the factor loadings, that the strongest convergence of opinions was associated with the questions regarding the EHRs fatigue. However, the strength of correlations varied and included very weak correlations associated with the opinions of P7 and P8. Furthermore, P12 was observed to have an opinion, although quite weak, that can be interpreted as denying the existence of EHRs fatigue. There was a similar convergence of participants' opinions regarding the link between EHRs fatigue and burnout, but again the strength of the observed opinions varied quite drastically. Then, the participants' opinions regarding the EHRs user interface represented a mix with a significant proportion of either weak opinions or negative opinions. In terms of effects of the EHRs use on effectiveness, the opinions of only five participants converged. Specifically, P1, P8 and P12 viewed such effects as weak. P4's opinion was that the effects were overall negative. Surprisingly, P13 viewed the EHRs effectiveness as very high.

Overall, the results of the person factor analysis are consistent with the findings of the qualitative analysis. For instance, in the person factor analysis, EHRs fatigue emerged as the strongest factor, which accounted for a 43.77% of total variance explained. Similarly, in the thematic analysis of the interviews, cumulatively there were 73 incidences of EHRs fatigue coded, which accounted for approximately 27.3% of all codes in all 13 interviews analyzed. Moreover, the EHRs associated burnout accounted for 21 or 7.87% of all coded references in 10 interviews and was observed as the second strongest factor. The EHRs interface user experience also loomed very large in the thematic analysis. Unsurprisingly, it was also observed as the third strongest factor in the

person factor analysis. The inconsistency between the emergence of effectiveness as a factor, although the weakest of the four, and its relatively low coding incidence in the thematic analysis can be explained by the lapse of time between the two points of data collection in the current study—the interviews and the electronic questionnaire for the Q-Sorts. In the period lapsed between the two points of data collection, the participants could have changed their views, or the strength of their views could have changed. The discrepancy between the number of factor loadings associated with specific participants and the number of the interview files in the thematic analysis related to EHRs fatigue, burnout, EHRs user interface experience, and the effectiveness can be attributed to the artifacts of the person factor analysis.

Summary of Findings

This mixed methods study examined provider perceptions of EHR fatigue, burnout, efficiency, and effectiveness, EHR user interface factors, and also how these issues influence patient safety. Using the cumulative evidence obtained in the findings of the thematic analysis of the interviews and in the results of the person factor analysis of the Q-Sorts, the answers to the research questions of the current study are as follows.

With regard to Research Question 1, as a whole, the results indicate that providers clearly, strongly, and consistently associate EHR utilization with fatigue. The most common factors contributing to the EHR fatigue are lack of assistance from scribes and with dictation, which increase the overall burden on the provider. However, the picture is nuanced. It was found that EHR fatigue is more likely to develop in fast-paced clinical environments like the ER or ICU departments where the providers are forced to complete all EHR tasks under more pressing deadlines. Working night shifts also appears to be a

negative factor contributing to EHR fatigue. The impact of the COVID-19 pandemic and its associated additional work commitments seem to have exacerbated the pace of onset and the severity of EHR fatigue.

With regard to Research Question 2, taken together, the results indicated that providers perceive the association of EHR to efficiency as positive. Specifically, it was found that the prevailing perceptions of providers is that EHR is associated with moderate efficiency gains. Efficiency gains are mostly achieved through substantially higher technical efficiency allowed by EHR . The higher technical efficiency allows providers to streamline many clinical and administrative processes, to aggregate the control of such processes in a single focal point, to eliminate past redundancies, to improve interoperability between multiprofessional care teams and units and departments within health care organizations, and to accelerate data transfer between points of care delivery. However, the size of efficiency gains associated with EHR appears to depend on specific organizational circumstances. Likewise, realization of gains in allocative efficiency depends on medical specialty. The providers indicated that allocative efficiency is likely to be realized in fast-paced environments in which clinical processes tend to be more complex and simultaneous. The results also indicate that providers perceive a close and positive association of EHR with effectiveness. Effectiveness gains are likely to be realized in slower paced environments in which clinical processes are less complex and tend to be more sequential. Availability of technical support and training appears to play a critical role in achieving both the higher efficiency and more effective provision of care associated with EHR.

With regard to Research Question 3, in the opinion of providers, user interface complexity, organizational culture conducive to learning, and organizational support are factors that contribute to the user interface experience with EHR. In the opinion of providers, the extant user interfaces remain excessively complex to learn and too cumbersome to use in clinical practice. The providers also indicated that developers need to take into account the end user experiences, rather than purely technical consideration of the software architecture. The providers further indicated that the excessive interface complexity can be ameliorated or even completely eliminated through the consistent implementation of organization wide user support. Such support should include standardized training focused on specific clinical specialties and training of whole care teams rather than individual team members. The providers also suggested that the organizational support of the users of EHR should be ingrained in the organizational culture. Also, the results of the analyses suggested that the synchronization of user competencies across care teams, units, departments, and providers should also contribute to a better user experience with EHR .

With regard to Research Question 4, the results of the analyses in general suggested that patient safety incidents at hospitals in the current study have overall decreased because of the use of EHR . The providers indicated that use of EHR has been associated with a measurable reduction in the number and severity of sentinel events. The specific causative factor behind such reported reduction is the fact that the use of EHR allows providers to keep all pertinent patient information in a single place fully accessible to all providers involved in the provision of care. The use of electronic records has also been reported as associated with fewer medical errors. However, regarding the

association of EHR fatigue and burnout with patient safety incidents in their respective hospitals, the opinions of providers were mixed. Most providers suggested that it largely depended on the medical specialty and the care management processes involved.

CHAPTER 5: DISCUSSION, IMPLICATIONS, RECOMMENDATIONS

Chapter 5 summarizes the entire study and provides the summary of both qualitative and quantitative findings, a detailed interpretation of the findings in the context of extant studies on the same topic, and the gap in knowledge identified in the extant literature. Then, implications of the key findings of the study for theory, research, and practice and applicability of findings to various institutional and organizational contexts are discussed. Last, Chapter 5 describes the limitations of the current study and provides recommendations for further research.

Summary of Study

The current study empirically examined whether EHR fatigue is driving burnout among providers at public hospitals in northern California and whether burnout affects patient care. Multiple past studies concluded that EHR fatigue has become a ubiquitous phenomenon of clinical practice of most medical providers (D. D. Berg, 2019; Bridgeman et al., 2018; Gardner et al., 2018; Noseworthy et al., 2017; Rotenstein et al., 2018; Rothenberger, 2017; Young et al., 2018). Furthermore, EHR fatigue has been found to be a driver of burnout (Collier, 2018; Guo et al., 2017; Kroth et al., 2019). Given the findings of past studies, this study examined provider perceptions of EHR fatigue, burnout, and their effects on care efficiency and effectiveness; this study also identified factors that affect EHR user interface experience and how the latter affects patient safety. The research problem addressed in this study was whether EHR fatigue is driving burnout among providers, and if that burnout is affecting patient care.

The significance of the current study stemmed from the public administration concepts of responsibility, accountability, efficiency and effectiveness as those apply to

the topic of this study. In particular, this study evaluated the concepts of efficiency and effectiveness as they relate to EHR fatigue. Efficiency and effectiveness have long been important concepts for the public administration theory and practice, and this study examined their relevance in the context of public organizations. The theoretical framework for this study included the JD-R theory (Demerouti & Bakker, 2001), the associated JD-R model (Bakker, 2019), and the burnout phenomenon theory (Freudenberger, 1980).

Employing the mixed methods methodology, which combined interviews of medical providers and the questionnaire-based Q-methodology, and relying on convergent parallel research design, the current study answered the following four research questions:

1. What are the perceptions of providers in regard to EHR use and its association to fatigue?
2. What are the perceptions of providers in regard to EHR use and its association to efficiency and effectiveness?
3. What variables contribute to the user interface experience with EHR use?
4. Have patient safety incidents at the hospitals in this study increased or decreased as a result of provider EHR fatigue or burnout?

The qualitative data collected in the interviews were analyzed using directed content analysis implemented utilizing NVivo qualitative analysis software. To achieve the convergent validity of the qualitative findings, a quantitative analysis was also performed using IBM SPSS statistical analysis software. The quantitative data were collected using the Q-methodology and use of electronic surveys, which were sent to the

participants. The person factor analysis of the Q-Sorts was the specific analytical tool of the quantitative analysis.

Summary of Main Findings

Using the cumulative evidence obtained in the findings of the thematic analysis of the interviews and in the results of the person factor analysis of the Q-Sorts, the current study provided the following answers to the four overarching research questions.

First, regarding Research Question 1, the findings of both qualitative and quantitative analyses indicated that in the opinion of the participants, EHR use is strongly and consistently associated with fatigue. It was also found that the most common factors contributing to the EHR fatigue are lack of assistance from scribes and with dictation, which increase the overall burden on the provider. Furthermore, it was also found that EHR fatigue is more likely to develop in fast-paced clinical environments like the ER or ICU departments where the providers are forced to complete all EHR tasks under stringent deadlines. Working night shifts also appears to be a negative factor contributing to EHR fatigue. Furthermore, the COVID-19 pandemic and additional work commitments appear to have exacerbated the pace of onset and the severity of EHR fatigue.

Second, regarding Research Question 2, the findings indicated that providers perceive the association of EHR to efficiency as positive. It was found that the prevailing perceptions of providers is that EHR is associated with moderate efficiency gains. Efficiency gains were mostly achieved through higher technical efficiency allowed by EHR. The higher technical efficiency permitted streamlining many clinical and administrative processes, aggregating the control of such processes in a single focal point,

eliminating past redundancies, improving interoperability between multiprofessional care teams and units and departments within healthcare organizations, and accelerating data transfer between points of care delivery. At the same time, it was also found that the size of efficiency gains associated with EHR depends on specific organizational contexts. Realization of gains in allocative efficiency may depend on medical specialty. The providers indicated that allocative efficiency is likely to be realized in fast-paced environments in which clinical processes tend to be more complex and simultaneous. The results also indicated that providers perceive a close and positive association of EHR with effectiveness. Effectiveness gains are more likely to be realized in slower paced environments with less complex and more sequential clinical processes. Availability of technical support and training are critical in achieving both the higher efficiency and more effective provision of care.

Third, regarding Research Question 3, EHR user interface complexity, organizational culture conducive to learning, and organizational support were identified as factors contributing to the EHR user interface experience. The existing EHR user interfaces are too complex to learn and cumbersome to use in clinical practice. It was found that there is an urgent need for developers (a) to integrate the end user experiences, not only technical issues of software architecture, and (b) to ameliorate the excessive interface complexity through the consistent implementation of user support, which should include standardized training focused on specific clinical specialties and training of whole care teams rather than individual team members. It was also found that the providers preferred that the organizational support of the EHR users should be ingrained in the organizational culture. It was found that the providers believe that the

synchronization of user competencies across care teams, units, departments, and providers should improve EHR user experience.

Fourth, regarding Research Question 4, it was found that the use of EHR is associated with lower incidence of patient safety incidents. Furthermore, it was found that the use of EHR has been associated with a measurable reduction in the number and severity of sentinel events. The specific causative factor behind such reported reduction is that the EHR use allows keeping all pertinent patient information in a single place fully accessible to all providers involved in the provision of care. The EHR was found to be associated with fewer medical errors. At the same time, the strength of association of EHR fatigue and burnout with patient safety depended on the medical specialty and the care management processes involved in specific hospitals.

Interpretation of Main Findings

The findings regarding strong association of EHR use with fatigue and burnout are consistent with the findings of past studies and reinforce the general conclusions of past research that EHR use is positively associated with fatigue and ensuing burnout among physicians. Specifically, although the current study did not directly measure the strength of EHR use fatigue and associated burnout using any quantifying instruments, its findings are in line with the results of (a) the systematic review by Rotenstein et al. (2018), which found high levels of EHR fatigue and associated burnout in physicians; (b) the comprehensive review by Rothenberger et al. (2017), which concluded that physicians in the United States are at significant risk of burnout because of EHR use; (c) the study by Bridgeman et al. (2018), which found that such challenges as the lack of or diminishing control, competing demands and resources, and various scheduling issues

all contribute to the onset of burnout associated with EHR use; and with (d) the study by Gardner et al. (2018), which found a positive correlation between time allocated to EHR duties and job-related stress and eventual development of fatigue.

Furthermore, the findings of the current study may serve as empirical evidence that confirms the prediction made by Dyrbye and Shanafelt (2011) that the federally mandated use of EHRs would likely be associated with increased incidence of burnout among physicians. The current study was conducted over a decade after the implementation of the federal EHR mandate, which is a significant time lag that allowed the effects of the mandate to take place and be felt by physicians. Thus, the fact the physicians linked EHR use fatigue directly with burnout suggests that the hypothesized relationship between EHR use fatigue and burnout does in fact exist in this population as predicted. The observations in this study also agree with the results reported by Dewa et al. (2014), which concluded that continual exposure to workplace job demand factors can increase job related stress in physicians and cause burnout.

As it follows from the findings of both qualitative and quantitative analyses conducted in the current study, the participants across the board perceive EHR use as one of the unavoidable workplace job demands, which in their views, strongly contributes to burnout. Likewise, the finding that EHR fatigue is more likely to develop in fast-paced clinical environments like the ER or ICU departments where the providers are forced to complete all EHR tasks under stringent deadlines is very consistent with the findings of the studies by Arndt et al. (2017) and Sinsky et al. (2016), both of which based on their analyses concluded that EHR fatigue and severity of job-related burnout may depend on medical specialty. Taken together, the findings regarding the association of EHR use

with fatigue and burnout in physicians in public hospitals appear to make a lot of sense and to be compatible with the expectations regarding the outcomes of the interviews and the results of the Q-Sorts analysis.

Similarly, the findings that, in the opinion of the providers, EHR use is positively associated with effectiveness of care are consistent with the conclusions of the study by Hessels et al. (2015), which found that EHR use is associated with fewer medical errors and better patient outcomes, the two main dimensions and common indicators of effectiveness in the provision of medical care. However, unlike the data from the studies by Meigs and Solomon (2016) and by Christino et al. (2013), both of which concluded that EHR use was associated with increased opportunities for medical errors and overall decreased efficiency in the provision of care, the findings of the current study suggest the opposite. The physicians reported a positive association of EHR use with efficiency. Regarding the issue of care efficiency, compared to virtually all extant studies on the topic, the findings of the current study actually paint a much more nuanced picture of the effects of EHR use on efficiency. Rather than simply stating that efficiency of care increased or decreased as a result of EHR use, the findings describe how the reported moderate efficiency gains had been achieved. In particular, the moderate efficiency gains had been primarily achieved through the attainment of higher levels of technical rather than allocative efficiency. The most plausible explanation for this offered by the participants was that EHR serves as focal point of all medical and nonmedical interaction in the continuum of care. The emergence of such a focal point allowed elimination of redundancies and overall streamlining of all care processes within units, departments, and hospitals.

Likewise, the identification of the negative effects of EHR user interface complexity, organizational culture conducive to learning, and organizational support as factors contributing to the EHR user interface experience appears to be consistent with the findings of Aldosary (2017), S. M. Erickson et al. (2017), and Koopman et al. (2015). All three studies found that (a) EHR use burden is punitive for most physicians, and (b) there is a strong perception that EHR cumbersomeness reduces accomplished physicians to ordinary data entry personnel. Furthermore, the perception of excessive EHR complexity was widespread among the participants of the study. The participants, as end users of EHR, offered their suggestions on how to improve EHR interface usability. The suggestions put forward to developers regarding the urgent need for integration of the end user experiences, simplification of excessive interface complexity through the consistent implementation of user support, and the introduction of standardized training focused on specific clinical specialties and training of whole care teams rather than individual team members are all valid suggestions. Interestingly, they virtually coincide with the proposals made by Guo et al. (2017) and Rodriquez Torres et al. (2017) regarding the need to reduce the EHR click burden. Additionally, the finding of the study regarding the positive role of the scribes is consistent with the conclusion reached by Collier (2018). Contrary to Kroth et al. (2019), the current study failed to reconfirm the purported negative association between the higher usability of EHR interface and the incidence of burnout in physicians.

Last, taken together, the findings of the current study that the use of EHR is associated with (a) lower incidence of patient safety incidents, (b) a reduction in the number and severity of sentinel events, and (c) fewer medical errors are consistent with

the conclusions of Hessels et al. (2015), which found higher levels of EHR adoption were associated with decreased adverse patient outcomes and a reduction of patient safety incidents. However, Hessels et al. also linked higher levels of EHR adoption with patient satisfaction; the findings of the current study did not provide any evidence to support this particular claim.

Implications

The findings of the current study have various implications for public administration theory and research, for the practice of public management, especially in the context of complex public organizations, including those in the field of health care. The findings are also pertinent to public policy and applicable to various administrative, organizational, and institutional contexts.

Implication for Theory

First, the findings of this study have implications for public administration theory. The current study provided the latest empirical evidence from previously underexplored segment of public organizations—public hospitals—on the effects of the implementation and the mandated use of an IT tool on organizational responsibility, accountability, effectiveness, and efficiency. Specifically, the study's findings confirm the general soundness of the entire rationale for the federally mandated systemwide EHR implementation and use. The evidence uncovered in the current study suggests that (a) it is possible to increase organizational efficiency in public healthcare organizations using innovative IT tools; and that in turn, (b) efficiency gains in the delivery of care, that is, core organizational process, allow achieving higher organizational effectiveness, which means better serving the needs of patients as taxpayers; and as a result, (c) more effective

provision of care leads to more accountable and responsive to public healthcare organizations. Efficient service and effective service delivery are key. Just as e-government initiatives have brought efficiency and effectiveness to agencies and public organizations, this study shows EHRs doing the same for public hospitals.

Thus, the findings of the study imply the broad framework for the analysis of productivity and performance management of public organizations based on efficiency, effectiveness, accountability, and responsiveness (Beaumaster, as cited in Johnson, 2015; Romzek & Dubnick, 1987, 2019; Shafritz et al., 2016) performs well as a theoretical model of public administration. As a consequence, this also implies that the model is flexible and can be successfully operationalized for application in various organizational contexts of public administration practice.

Second, the findings provide further empirical affirmation of the predictions of the JD-R theory (Demerouti & Bakker, 2001) and the associated JD-R model (Bakker, 2019). In particular, the JD-R theory posits that the organizational environment has a direct effect on employees' professional performance and well-being (Bakker & Demerouti, 2007, 2017). A central tenet of the JD-R theory is that job characteristics can be classified into two broad categories of job demands and job resources (Demerouti, Bakker, Nachreiner, & Schaufeli, 2001a). The JD-R defines: (a) job demands as aspects of employment that require sustained effort associated with physiological and psychological costs to employees, and (b) job resources as aspects of employment that help attain work goals, reduce job demands and their costs, and stimulate personal growth and development (Bakker & Demerouti, 2017; Demerouti, Bakker, Nachreiner, & Schaufeli, 2001a). The JD-R theory further posits that job demands and job resources

activate different processes in employees (Demerouti, Bakker, Nachreiner, & Schaufeli, 2001a). Excessive job demands can cause health impairment because of continual fatigue. The fatigue may lead to burnout (Bakker & Demerouti, 2017). In contrast, job resources may support motivational process. Having high job resources may lead to more motivated employees, higher work engagement, and productivity (Bakker & Demerouti, 2017). Based on these propositions, the JD-R theory postulates the existence of a linear causative relationship among excessive job demands, fatigue, burnout, and lower job performance.

The cumulative evidence obtained in the current study confirms that EHR use is positively associated with fatigue and burnout, at least based on the sample of the study. The prevailing opinion of the participants was that the EHR use represents a major job demand because it is viewed as cumbersome. Many participants also complained that EHR use, while necessary and leading to higher effectiveness and efficiency and to fewer medical errors, is also tedious, often reducing accomplished physicians to mere data entry personal. Although never stated in direct terms, the language that participants used clearly implied that some aspects of EHR use are perceived by the participants as demotivating and undermining their job performance. At the same time, some participants also informed that organizational support and organizational culture conducive to learning and improving EHR user competencies matter a lot as positive factors that can combat EHR fatigue and burnout. The organizational support and organizational culture are clearly job resources that, according to the tenets of the JD-R theory, are aspects of employment that help reduce job demands and their personal costs

and stimulate work performance (Bakker & Demerouti, 2017; Demerouti, Bakker, Nachreiner, & Schaufeli, 2001a).

Therefore, cumulative evidence obtained in the current study not only provides further empirical affirmation of the JD-R theory but also illustrates that the JD-R theory possesses both high descriptive ability and high explanatory power. Although the JD-R theory is not very parsimonious, it does possess more than satisfactory predictive capacity. The evidence of the current study further suggests that when used either as a single construct or as part of a composite theoretical framework, the JD-R theory can provide more than sufficient analytical traction. The evidence obtained in the current study also suggests that the JD-R model as a simpler derivative of the main theory can be successfully utilized as a valid practical tool.

Third, the findings of the current study also provide further empirical evidence to the Freudenberger's theory of burnout (1980) and its further conceptual development by Maslach and Jackson (1981). According to the tenets of the Freudenberger's theory and the Maslach extension of the original theory (Maslach & Leiter, 2005), (a) occupational burnout represents a complex psycho-emotional reaction of an individual to chronic work-related stress, and (b) stressors represent various job-related factors with which a person is unable to cope fully. Past studies that relied on the Freudenberger-Maslach conceptual framework (Lasalvia et al., 2021; Lubbadeh, 2020; Mong & Noguchi, 2021; Schaufeli et al., 2018) found that the strongest stressors that lead to professional burnout include repetitive and depersonalizing work tasks and processes, lack or poor balance between professional and personal lives of employees, unjustified complexity of tasks, and lack of organizational support. As mentioned in the preceding paragraphs, in

general, the participants perceive many EHR use tasks as repetitive, cumbersome, tedious, and distracting from their main clinical duties. Some participants also complained that because of EHR, their job tasks often follow them home, which clearly indicates poor balance between their professional and personal lives. The EHR user interface complexity was repeatedly identified by the participants as a major factor in EHR fatigue and associated burnout. Some also complained about the lack of organizational support needed to overcome challenges posed by complex HER user interfaces. Therefore, the evidence obtained in the current study regarding the factors associated with job-related fatigue and stressors that lead to professional burnout generally supports the descriptive and explanatory propositions of both Freudenberger's theory and its extension by Maslach. However, because the strength of fatigue and burnout were beyond the scope of the current study, its evidence falls short of a definitive test of the predictive capacity of both theories, for instance using the Maslach burnout inventory (Maslach & Jackson, 1981, 2022).

Last, by empirically exploring the relationships between EHR use and care effectiveness and efficiency in public hospitals, findings of the current study (a) highlight the theoretical importance of the entire effectiveness-efficiency theoretical paradigm of public administration (Barnard, 1938; Dahl, 1947; Simon, 1945, 1946), including the legacy of the Taylor's principles of scientific management (Taylor, 1911, 1914) and its continuing theoretical relevance to public administration; and also (b) elucidate the critical link between organizational performance, especially in the context of complex organizations (Perrow, 1972), and organizational accountability and responsibility (Romek & Dubnick, 1987, 2019).

Taylor (1911, 1914) proposed two principles in the early 20th century to maximize efficiency in industry—the appropriate choice of workers and the consequence of training workers in the paramount method. This scientific approach to management and work continues to impact how organizations function today. The findings of this study highlight that EHRs can bring about efficiency and underscore the importance of training in these environments. However, patient care is unique, and applying scientific management to EHRs without thought of nuance is highly unadvisable.

Public administration accountability involves the means by which public agencies and their workers manage the diverse expectations generated within and outside the organization. There are four types of accountability—bureaucratic, legal, professional, and political (Romzek & Dubnic, 1987). Public hospitals must manage and navigate these four challenging areas with the realities of the EHR.

Cooper (2012) presented the idea of the responsible public administrator in which he suggested that the primary responsibility of the public administrator is to deal with public interest with honesty and common good responsibility, which emerges from the fiduciary role of public administration. Both pillars of accountability and responsibility are closely connected with organizational performance. Public hospitals must keep the public interest at the forefront.

Implication for Research

The findings of the current study also have implications for public administration research. The review of the literature clearly indicated that public administration researchers paid only cursory attention to the management processes in the U.S. health care sector. The main reason for such neglect is that despite significant regulatory

oversight by various federal and state agencies, the U.S. health care sector, because of its unique institutional characteristics and underlying economic models, is often perceived as belonging to the domain of private management. However, public hospitals still do exist, and their relationships with stakeholders cannot be properly described or correctly analyzed in terms of private sector management. Studies of public hospitals remain few and rare but the management processes in these complex public sector organizations need to be investigated.

In the past 2 decades, public organizations have sought increased efficiency and effectiveness. The main driver of this change was new public management, which introduced principles that called for public administration to adopt private-sector managerial techniques to boost performance (Wise, 2002). This has been done with EHRs at public hospitals as well. However, the results of this study reveal that caution is needed in this area. A more nuanced approach is desirable. Because of their public nature, public hospital governance cannot and should not operate identically to private hospitals.

Thus, the findings of the current study underscore the need to research such important issues as the effects of IT on organizational performance, human relations, talent management, effectiveness, efficiency, production, and delivery systems as they relate to public hospitals. Furthermore, the pandemic of COVID-19 clearly demonstrated that the U.S. health care sector cannot be left to the whims of the free market. Such black swans affect all citizens, and the field of public administration should obtain the latest empirical evidence of what works and what does not work in public hospitals.

Implication for Practice

The findings of the current study also have several implications for public sector management practice, especially for administrators of public hospitals. One such implication is that the findings of the current study regarding the link between the mandated use of EHR and fatigue and burnout among physicians as end user of EHR highlight the urgent need for public sector managers in general and for administrators of public hospitals in particular to closer attention to the effects of technological innovation on organizational performance, productivity, and motivation of their employees. The results of this study clearly demonstrate that the relationship between technological innovation and organizational productivity gains is not linear and is in fact strongly affected by the human factor. Since the dot-com boom era of the late 1990s and the early 2000s, the dominant mantra in both public and private sectors has been that technology, especially IT and automation of job-related tasks and processes, inevitably leads to more effective, efficient, and accountable organizations. However, as the findings of the current study clearly demonstrate, the human needs of employees cannot be ignored, especially in high-demand and high-responsibility clinical organizational environments. The needs of employees need to be supported with additional employee services and benefits to stimulate performance and productivity. Furthermore, the main corollary of the findings of the current study is that public sector managers cannot simply technologically innovate into greater performance with more hardware and software. The entire attitude about the role of employees needs to be reformed. Specifically, technology should be treated as a means of increasing organizational productivity, not the end in itself. Employees must be provided with all necessary organizational resources to

make their environment as conducive to higher performance as possible. Managers of public sector organizations also need to motivate their employees to use the new technology in a meaningful and professionally rewarding way.

Another implication for practice is that employees as end users possess much more insight about usability and scope of application of certain information technologies than software engineers or data managers. The findings of the current study clearly indicate that this is especially true for public health care organizations where clinical knowledge and advanced expertise in care delivery of providers is of paramount importance. The participants of the current study were all experts in their respective medical specialties and were fully capable of providing practical recommendations on how to improve the use of EHR. Thus, substantial organizational learning and knowledge management needs to take place. If the leaders and managers of public hospitals could learn from their clinical and nursing personnel, this would allow the increase of organizational performance further by increasing effectiveness of care.

Third, the findings of the current study indicate that overall EHR use is positively associated with efficiency of care. However, the study also found that in general, the efficiency gains associated with EHR were moderate despite substantial investments in EHR systems. The study found that the size of efficiency gains depends on specific organizational circumstances and medical specialties. Therefore, the practical implication of these findings is that administrators of public hospitals should treat such differences as variables in organizational performance and productivity measurement tools. Also, the experience with EHR implementation should also be extended to any similar future performance improvement tools.

Fourth, the study found that participants clearly differentiated between gains in technical and allocative efficiency. It appears that gains in technical efficiency such as streamlining of clinical processes and interoperability between interprofessional teams and different units and departments of the same hospital are easier to achieve with the use of EHR than improvements in allocative efficiency, that is, how to distribute medical care more cost effectively across various stages of care delivery. It appears that this is a problem that needs to be solved. The implementation and use of EHR clearly allowed streamlining of care processes by removing various bureaucratic bottlenecks and organizational redundancies. However, in the opinion of the participants of the current study, EHR systems in their current form fall short of the promise of being what Heeringa et al. (2020) described as a "valuable decision-making tool for providers" (p. 4).

Fifth, the findings of the current study better inform management practice at public hospitals by identifying that several factors of EHR user experience may have a direct effect on EHR associated fatigue and burnout among physicians, and by extension, also possibly on other providers, for example on nurses, doctor's assistants, and medical technicians who also use EHR. Specifically, managers of public hospitals should focus their efforts on reducing complexity of EHR user interfaces. This can be achieved by better formulating the terms of reference and product specifications for EHR software designers and testers. Only such EHR systems should be accepted for use that have as few clicks as possible to achieve specified tasks. Managers of public hospitals should also foster an organizational culture of continual improvement and learning as a vehicle for better support for EHR users.

Last, although the opinions of the participants regarding the link between EHR use and fatigue were mixed, the study found that the link between EHR fatigue and burnout appears to depend on medical specialty and particular care management processes involved. This finding may serve as a starting point for managers of public hospitals to develop more flexible managerial and organizational approaches for mitigation of EHR associated fatigue and prevention of burnout. Furthermore, the study found that the effects of increased workload because of the COVID-19 pandemic have severely exacerbated already serious preexisting problem with EHR associated fatigue and burnout among physicians. Thus, managers of public hospitals should address the pressing issues of the lack of supporting scribes and translators and develop better schedules to avoid excessive night shifts and pressing deadlines. The managers should reexamine how fast-paced clinical environments aggravate EHR associated fatigue and burnout and find ways to counter their effects on physicians and other staff.

Implications for Policy

The findings of the current study have policy implications. The most obvious implication is for the evidence-based policy analysis, evaluation, and formulation of the current federal and state health care policies regarding the use of EHR. The study was conducted after over a decade of the implementation of the federal EHR mandate. For obvious reasons, the U.S. health care in general and public hospitals in particular are subjects of strong regulatory oversight. However, the issue of regulatory effectiveness of health care policies remains unclear. The findings of the current study suggest that in the opinion of the participants, the mandated EHR use has led to increased effectiveness in the provision of care. However, it was also found that the effectiveness gains most often

have been achieved in slower paced organizational environments with less complex and more sequential clinical processes. Consequently, at least some review of the effectiveness of the current health care policies may be warranted.

Another policy implication is a possible mismatch between the federal health care policy mandates regarding, for example EHR use and the resources availability on the state level to bridge gaps in federal funding of such mandates. For example, the issue of scribes emerged in the vast majority of the interviews. The participants viewed the use of scribes in conjunction with EHR use as a protective factor against fatigue and burnout. Yet, the participants also explained that the availability of scribes depended on available financial resources, most of which come from state coffers. Thus, given that public hospitals are cofinanced by the federal and state governments, it is important to identify and properly address instances when federal health care policy mandates allow certain costs but do not cover those fully while states are unable or unwilling to fill in the funding gaps. This issue is known as the problem of unfunded policy mandates. Given the evidence uncovered in the current and similar studies, this policy problem needs to be addressed as a matter of fiscal policy and subventions.

The mismatch highlighted between federal and state policy mandates illustrates the classic politics administration dichotomy, which ties back to the pillars of public administration. Administrations come and go at all levels of government, and there are many variables to consider and evaluate. At the federal level, The Office of the National Coordinator for Health Information Technology (which operates under the umbrella of the Department of Health and Human Services) published a 64-page report in February of 2020 titled *Strategy on Reducing Regulatory and Administrative Burden Relating to the*

Use of Health IT and EHRs. The COVID-19 pandemic delayed progress on this front, but as the pandemic is hopefully in the rearview mirror, state agencies and local partners can partner with the ONC on implementing the report's implementations. EHRs are complex in part because of the reporting requirements of the federal government. A reduction in this burden can improve the EHR user interface experience at public hospitals and reduce the number of clicks for providers.

Action Plan

From a practitioner's perspective, an action plan for a public hospital organization based on the findings of this study is presented as follows:

- Use surveys to gauge where providers are with EHR fatigue and burnout through targeted surveys. Analyze the results and formulate a plan to address concerns and implement changes.
- Evaluate the ONC report and determine which strategies can be implemented locally.
- Tailor the approach to each specialty—this study shows that each specialty experiences EHR fatigue and burnout differently.
- Focus on reducing the complexity of EHR user interfaces. Involve the provider in UI design. They often know the EHR inside and out and can detail interface changes with EHR developers.
- Consider implementing a scribe program to assist providers with data entry, dictation, and routine tasks.

- Expand partnerships and collaboration at the state and federal levels to address this issue. Become an active participant in CAPH and other policy advocate groups.

Implementing these items could assist organizations in fostering a culture of continual improvement and learning as a vehicle for better support of EHR users while keeping patient care the utmost priority.

Assumptions, Limitations, and Delimitations

The participants were asked to provide their opinions in the interviews and then answer a set of questions for the Q-Set. It is assumed that the participants provided accurate, truthful, and consistent information in their responses. It is also assumed that the participants had extensive understanding and nuanced professional knowledge of the issues related to EHR use, EHR use fatigue, burnout, the effects of EHR use on effectiveness and efficiency in the provision of care, and also on patient outcomes as evidence by sentinel events. For the purposes of the quantitative analysis conducted in the current study, it was also assumed that there was no endogeneity between the variables under analysis. In other words, it was assumed that unobserved confounders have not been driving the observed correlations.

The study had several limitations. First of all, the sample was limited to physicians and, because of the scope and scale of the study, did not include other healthcare professionals such as nurses and clinical administrators who might have had different opinions about the issues and the relationships investigated in the current study. Small sample was another limitation as it was not statistically representative of the larger populations of physicians. However, this limitation was overcome by the fact that even

such a small number of participants allowed the researcher to successfully achieve a saturation point in the interviews. The study was also limited by its instruments. Specifically, the opinions expressed in the interviews might have been clouded by the effects of the participants' personal and professional biases at the moment of their interviews. The Q-methodology, although an effective research instrument from the methodological and psychometric perspectives, still suffers from high levels of subjectivity. Combined, the limitations of the interviews and the Q-methodology, constrained the explanatory and descriptive powers of the current study in terms of investigating causality between EHR use fatigue, burnout, effectiveness, and efficiency.

The current study was delimited by its research purpose, research design, research questions, and the selected theoretical framework. The current study was also delimited by the fact that the participants were all from northern California and practiced in public hospitals.

Recommendations for Further Research

One of the conclusions of the qualitative analysis was that the relationship between EHR use fatigue, burnout, and job-related stress is much more complex than the scope of the interviews allowed the researcher to explore. Therefore, it requires further empirical exploration, preferably using survey instruments validated and most importantly, more suitable for such research. Thus, it would be appropriate to investigate the vectors and the strengths of these relationships using either the Maslach burnout inventory (MBI) or the Oldenburg burnout inventory (OBI).

The qualitative analysis also revealed that the question of whether EHR use is associated with higher allocative efficiency across the board or only in public hospitals

requires further study. Thus, given such an analytical finding, a future study could possibly investigate this problem using econometric models that incorporate various optimization parameters.

Because the findings of the current study provided credible evidence of the link between IT and organizational performance, a future study could possibly investigate the effects of IT on organizational performance using multidimensional operationalizations of both effectiveness and efficiency as the two most critical components of organization performance.

A future study of the relationship between EHR use fatigue and burnout could rely on a retrospective rather than a cross-sectional design. The U.S. health care sector collects plenty of data relevant to such relationships. A future study could employ a time-series analysis of the panel data or even better, the structural equation modeling. The latter would allow the combination of various comparisons between variables in the underlying model with the temporal components, that is, track how the relationship between EHR use and fatigue can evolve over time.

Conclusions

The current study empirically explored EHR fatigue and its role in the onset of professional burnout among physicians at public hospitals in northern California. The study also evaluated the opinions about the effects of EHR on organizational performance, effectiveness, and efficiency. The findings of the study confirm the existence of the direct relationship between EHR fatigue and burnout and also suggested that the participants generally agreed that the federally mandated use of EHR contributed to higher organizational effectiveness, efficiency, and fewer medical errors. The findings

of the current study have implications for the theory and practice of public administration. The findings also can be used for evidenced-based health care policy formulation. In addition, the findings of this study once again underscore the critical importance of the human factor in organizational performance and accountability.

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APPENDICES

APPENDIX A

Interview Questions

1. What are your experiences of EHR fatigue?
2. Do you feel this leads to burnout?
3. Do you feel more efficient and effective by using the EHR?
4. Do you find that EHR duties follow you home?
5. Do you feel pressured to complete documentation and answer inbox messages?”
6. Do you feel that the EHR user interface contributes to feeling of EHR fatigue and/or burnout?
7. Do you use scribes?
8. Have you experienced any patient safety issues because of EHR issues?
9. Do you feel supported from organization? Training etc.

APPENDIX B

Q-Set Questions

Q1. I feel mentally exhausted due to my normal workload and EHR duties.

Q2. I feel empty emotionally by the time I finish working and complete EHR responsibilities.

Q3. I feel exhausted at work and fear EHR fatigue will lead to burnout.

Q4. The amount of time I spend on EHR tasks related to direct patient care is reasonable.

Q5. EHR fatigue has led me to behave impersonally to some of my patients as if they were objects.

Q6. I feel somewhat apathetic about some of my patients due to EHR fatigue.

Q7. EHRs have improved my efficiency.

Q8. The EHR helps me deal with my patient's problems effectively

Q9. I feel that the EHR helps me to positively affect my patient's lives through my work.

Q10. I feel full of energy and ready to tackle patient care challenges with the aid of the HER.

Q11. The EHR has prevented an adverse event for one of my patients.

Q12. At the end of the day I am in a good mood because I worked in close contact with my patients.

Q13. I am allotted a sufficient amount of time for EHR duties.

Q14. I have a high level of EHR proficiency.

Q15. I spend a significant amount of time on the EHR at home.

Q16. I am emotionally exhausted at work and EHR fatigue contributes to this.

Q17. I like to use my EHRs.

Q18. I find my EHR unnecessarily complex.

Q19. I think my EHR is easy to use.

Q20. I think that I would need the support of technical personnel to use my EHR better.

Q21. I am less connected with my patients because of the EHRs.

Q22. I find the various functions in my EHR are well integrated.

Q23. I think there is too much inconsistency in my EHR

Q24. I would imagine that most people would learn to use my EHR quickly

Q25. I find my EHRs very cumbersome to use.

Q26. I feel very confident using my EHRs.

Q27. My work is meaningful to me, EHRs duties included.

Q28. I'm contributing professionally (patient care, teaching, research, etc.) in the ways I value most.

Q29. I feel the EHR causes fatigue.

Q30. I feel EHR fatigue contributes to burnout.

Q31. The organization's EHR demands are unreasonable.

Q32. EHR duties reduce facetime with patients.

Q33. EHR user interface design factors into burnout.

Q34. I feel an obligation to work on EHR tasks after I go home.

Q35. EHR utilization resulting in burnout compromises patient care.

Q36. EHR usage decreases my level of efficiency.

Q37. EHRs reduce the effectiveness of my care for patients.

Q38. I utilize a scribe to assist with EHR duties.

Q39. COVID-19 has amplified EHR fatigue, which has led to increased feelings of burnout.

Q40. EHR fatigue has led to an adverse event for one of my patients.

APPENDIX C

Coding Scheme

Codes and Subcodes	Definitions
Burnout	An occupational phenomenon characterized by the feelings of exhaustion, mental and physical fatigue, lack of interest in one's job, and over sense of helplessness.
Lack of control	Lack of control or diminished control over patient care due to the utilization of EHRs.
Stress	Increased complexity of care provision due to the utilization of EHRs.
Effectiveness	Effectiveness of healthcare organization.
Availability	Availability of resources to facilitate the utilization of EHRs.
Workload	Increases, decreases, or improvements in workload associated with the EHRs utilization. May refer to too much of workload or a lot of uncompensated work.
Efficiency	Efficiency of care provision
Allocative	Allocative efficiency in the provision of care.
Technical	Technical efficiency in the provision of care.
EHR Fatigue	The sense or feeling of fatigue associated with the requirement to use EHR.
Compensation	Poor or insufficient compensation for the services provided.
COVID	COVID-19 as a factor adding more demands in addition to utilization of EHRs.

Codes and Subcodes	Definitions
Dictation	Use of dictation software.
Scribe	Effects of having/not having a scribe on EHR fatigue.
Shifts	Working long or night shifts.
Specialty	Medical specialties as a factor in the emergence or EHR fatigue.
Safety	Patient safety.
Adverse Events	Types and severity of sentinel and adverse events associated with the fatigue, burnout due to utilization of EHRs.
Incidence	Occurrence of sentinel events that occurred in the opinion of the interviewees due to fatigue and burnout due to utilization of EHRs
User Experience Factors	Factors contributing to the user experience with EHRs utilization.
Interface Complexity	EHRs interface excessive complexity or cumbersomeness.
Organizational Culture	Organizational culture conducive to successful utilization of EHRs.
Organizational Support	Operational support and training provided by the care provider organization to facilitative the use of EHRs.

APPENDIX D

Correlation Matrix

Correlation Matrix[1]

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13
P1		.000	.000	.000	.009	.017	.256	.317	.305	.000	.000	.001	.245
P2	.000		.000	.001	.050	.005	.077	.224	.083	.000	.000	.000	.046
P3	.000	.000		.000	.089	.000	.080	.148	.044	.000	.000	.000	.036
P4	.000	.001	.000		.383	.000	.122	.486	.296	.009	.001	.000	.075
P5	.009	.050	.089	.383		.150	.057	.109	.490	.006	.136	.232	.060
P6	.017	.005	.000	.000	.150		.130	.442	.001	.010	.000	.000	.003
P7	.256	.077	.080	.122	.057	.130		.345	.260	.385	.337	.193	.471
P8	.317	.224	.148	.486	.109	.442	.345		.371	.305	.261	.488	.100
P9	.305	.083	.044	.296	.490	.001	.260	.371		.000	.002	.000	.000
P10	.000	.000	.000	.009	.006	.010	.385	.305	.000		.000	.000	.002
P11	.000	.000	.000	.001	.136	.000	.337	.261	.002	.000		.000	.001
P12	.001	.000	.000	.000	.232	.000	.193	.488	.000	.000	.000		.000
P13	.245	.046	.036	.075	.060	.003	.471	.100	.000	.002	.001	.000	

[1] *Determinant = 4.0004; Sig. (1-tailed)*