# Autonomy Disrupted: Law, Technology, and its Impact on Professions' Autonomy Following the Implementation of the Electronic Health Record

By

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## Table of Contents

## List of Tables

## List of Figures

## List of Appendices

## Chapter 1: Introduction

This dissertation considers the impact of a disruptive technology across an organizational field. It focuses on the interaction between law and innovation to consider how law can support/encourage, deter/block, and/or standardize/codify a disruptive technology. And it takes a holistic approach by tracing the processes that produce the law on the books and the subsequent implementation of law in action.

Specifically, it examines the case of the electronic health record (EHR), as a disruptive technology in healthcare that "challenge[s] conventional understandings of medical knowledge, professional roles and the structure and organization of the larger healthcare system" (Brennan and Suchman 2020:173). Like the traditional paper medical record, the EHR documents a patient's medical history, diagnoses, and treatment plan; however, the EHR is more than a mere data repository. Advances in data analytics facilitate the incorporation of evidence-based medicine, the generation of metrics, and streamline the billing process—all functionalities that promise to improve patient care while addressing the rising costs of healthcare (Hillestad et al. 2005; Pagliari, Detmer, and Singleton 2007; DesRoches et al 2008; Angst 2009). These are also all functionalities that make the EHR a disruptive technology that "displace[s] older technologies by developing new markets and disrupting existing markets" (Fennell, Causer, and Plavin-Masterman 2014:206) and also requires clinicians and administrators to develop new skills, develop new care practices, and alter the delivery of care.

For example, following his lecture at the Alpert Medical School, Carl Dvorak, President of Epic Systems Corporation, explained to a medical student that because modern medicine is extremely complex, "a single physician is not going to be able to make a difference" (Dvorak 2017). Instead, a physician will need to rely on the data documented in Epic's EHR by many

physicians and analyzed by its algorithms in order to make the best care decisions. The difference in a patient's care will soon be the result of the collective, not the individual physician.

Dvorak's description of the future of medical care is a remarkable shift from the image of a physician operating independently and drawing upon his or her expertise to treat a patient. This radical transformation will not be limited to single medical specialty like other technological advances in healthcare, e.g., CT scan and MRI, but will impact every medical profession. In addition, it alters healthcare administrators' experiences as the EHR not only automates their tasks, such as billing, but also allows them to oversee and review their clinicians' discretion. Finally, to innovate and support these systems, a new profession has emerged, the Health Information Technologists.

As we can see, the scope of the EHR is extensive as it spans across the field of healthcare. However, despite the technology's potential and its promises, the adoption and diffusion of the EHR was slow. It was not till the passage of the Health Information Technology for Economic and Clinical Health (HITECH) Act, a federal incentive program, in 2009 that the diffusion of the EHR took off. Prior to the HITECH Act, only 25% of hospitals had an EHR in place (Jha et al. 2006), but by 2016 96% of hospitals certified they were using an EHR (Office of the National Coordinator for Health Information Technology 2017c).

Thus, the case of the EHR also provides an opportunity to examine how a law is shaped and shapes a disruptive technology. The codification of the federal EHR policy and its subsequent regulatory processes were critical in not only the promotion of the technology but also in its standardization.

Therefore, the EHR presents a fascinating case to examine the impact of a disruptive technology across an organizational field, as well as the legal intervention that not only encouraged its adoption but also its standardization. For the purposes of this dissertation, I ask the following research questions:

- How does a disruptive technology impact an organizational field?
- What role does law play in supporting, shaping, standardizing, and/or deterring a disruptive technology?
- How does a disruptive technology impact a profession's sense of autonomy?
    - Since prior research has highlighted the link between autonomy and perceptions of an EHR (a) How do the different professions experience/perceive the EHR and (b) How does the EHR enable or constrain a professional's work within a healthcare organization?

To address these research questions, I conduct a multi-method qualitative project. I employ a historical analysis of federal EHR policy to examine law's role in shaping and standardizing the EHR. Drawing on a variety of Congressional documents, federal legislation, and policy reports, I construct a detailed narrative of the legislative and regulatory processes that resulted in the HITECH Act and its federal incentive program, Meaningful Use. I also highlight how politicians and key stakeholders (such as industry, clinicians, early adopters of EHRs, and patient advocates) constructed an envisioned EHR that was used to standardize and accelerate advancements in EHR technology. To understand the implications of this policy and technology on a profession's autonomy, I also conducted fieldwork, including semi-structured interviews with physicians/clinicians, administrators, and health information technologists, as well as observations at these professionals' association meetings and webinars. This field work provides

insight into how the EHR impacted not only these professions' use of the technology, but also its implications for their autonomy. Taken together, this methodological approach allows me to see how the law on the books came to be and how the law in action played out. These methods also provide a rich analysis of how the EHR, as a disruptive technology, impacts on the field of healthcare.

This dissertation builds upon the organizational scholarship on innovation and technology, healthcare organizations, and professions, as well as sociolegal scholarship on the role of law. Together these literatures consider the iterative process by which technology and policy impact each other within the context of healthcare and produce a more comprehensive understanding of how law/policy and technology interact and have the potential to develop a disruptive technology. And importantly, the dissertation then considers the subsequent consequences for the professions within the field as the technology alters workflows, routines, and relationships. While the dissertation focuses on and contributes to an examination of this phenomenon in the field of healthcare, its contributions may extend to other organizational fields. Although the iterative interplay between technology and policy could vary by organizational field, that interaction still plays a critical role in how the innovation is developed, designed, and deployed. Finally, a note that I also draw upon a sociotechnical approach in my analysis of the EHR as a technology to consider the materiality of the EHR itself—it's design, abilities, and limitations—and how these interact with the professions.

Therefore, in this dissertation, I argue that law plays a significant role in the innovation and adoption of disruptive technologies. To understand the implication of these legal processes – both for the materiality of the technology itself and for the experiences of its users, especially regarding a profession's autonomy – I examine the codification of law on the books and the

implementation of law in action. Usually, these two sides of law are analyzed separately. However, by employing a more holistic approach, I contribute a more detailed understanding of the entanglement of law and technology, and show that their iterative relationship has direct, yet varied, consequences for the professions who use it. Specifically, when law standardizes and supports the widespread adoption of a technology across an organizational field, the technology can impact a profession's autonomy. I argue that in the case of the EHR, it impacts the medical profession's autonomy across three dimensions: time, interaction, and cognition. But this impact varies by medical specialty, where generalists experience a negative impact to their autonomy across all three dimensions, while specialists experience negative autonomy on time but no effect on interaction and cognition.

*A Brief History of the Medical Record: From Paper to Electronic*

To provide context for this dissertation, I will now provide a brief history of the medical record, tracing its transformation from a paper-based to electronic system. A medical record documents a patient's health information, including diagnoses, treatments, and outcomes. Originally a tool of the medical profession (Freidson 1988), the medical record's purpose shifted over time to reflect advances in medical care and changes in the organization of the healthcare system. As a rich source of information, the medical record came to be viewed as way to integrate a fragmented healthcare system by facilitating consolidation across healthcare organizations, cutting costs, and improving patient care (Reiser 2009).

Originally, the medical record served as a memory device for a physician to assist in tracking a patient's health (Reiser 2009). The notes, if written down, were unique to each physician. The emergence of the medical record, as we know it today, coincided with the organization of healthcare into hospitals. These early logs of patient care informed rotating

physicians of the patient's diagnosis and treatment. Over the course of the 19th century, record keeping improved and became more standardized as the medical record's uses expanded. Physicians at Harvard Medical School advocated for improved record keeping to better understand patient outcomes, thereby enhancing the training of new physicians (Reiser 2009). Professional groups, such as the American Surgical Association, required submission of patient care records as part of their membership application thereby legitimizing the medical record as a way to gauge the quality of a physician's expertise.

The medical record took off in the 1920s, and again in the 1950s, as the scope of medical information expanded due to advances in medical technology and the increasing number of specialist physicians, who treated particular organ systems. Consolidating this information from physicians and ancillary clinicians within the hospital created a more comprehensive document of the patient's diagnoses, treatments, and outcomes. While this was thought to improve patient care, it also facilitated the work of administrators, especially for coordinating billing following the passage of Medicare and Medicaid in 1965. Thus, the paper medical record expanded its role from being a physician tool to an administrator tool as well.

Paper medical records, however, were not perfect. Searching for information across multiple volumes was time consuming; handwriting could be difficult to decipher; pasted in notes, lab results, etc., could fall out. While an improvement over no notes, the paper medical record wasn't guaranteed to be a complete and well-organized document.

*The Electronic Medical Record*

The invention of the computer and the introduction of the personalized computer presented an opportunity to revolutionize the medical record. These advances in technology allowed for a transition from a paper-based system to an electronic system. Not only could

information be stored electronically, but new functionalities promised to address the shortcomings of the paper system.

Like the paper chart, the electronic health record is "an electronic version of a patient's medical history, that is maintained by the provider over time, and may include all of the key administrative clinical data relevant to that person's care under a particular provider, including demographics, progress notes, problems, medications, vital signs, past medical history, immunizations, laboratory data and radiology reports" (CMS.gov 2012). At its base, the EHR is a data repository that consolidates these notes into a single record. In its electronic format, a patient's health information can more easily be displayed and searched (in theory), and is no longer undecipherable due to illegible handwriting.

But the EHR promised more than just the ability to store patient information in one location. From a patient care perspective, new functionalities could assist in the delivery of more efficient and better care. For example, the EHR enables the sharing of information across various stakeholders, such as physicians, nurses, administrators, insurers, etc. (Angst 2009). It also incorporates a clinical provider order entry (CPOE) system, which allows the attending physician to enter care instructions that are quickly shared with members of the care team. The EHR also facilitates the incorporation of medical standards into the treatment of patients by drawing on evidence-based medicine, which "…strengthen[s] the scientific base of health care and determine[s] the effectiveness of care" (Timmermans and Kolker 2004:177). Healthcare organizations can elect to have evidence-based medicine protocols and other local standards of care incorporated in their EHR system, which will then automatically alert or prompt a certain response from a physician based on the patient information entered into the EHR (Reich 2012). These alerts can include reminders for immunizations and screening, as well as highlight

potential negative interactions between a newly prescribed drug and the patient's current medications (Richards 2009). The EHR can also auto populate prescriptions and order lab tests based on the diagnosis entered into the record (Herrin et. al. 2012). Subsequently, this "use of the prompts has been shown to improve adherence to evidenced based guidelines" (Schenarts and Schenarts 2012:108) thereby reinforcing standards of care. By using EHRs, physicians and clinical staff can adopt clinical guidelines with greater ease into their everyday practice.

From an administrative perspective, the EHR becomes a tool for coordination and control. First, the EHR promised to lower costs, as the accessibility of complete health information would allow providers to make informed decisions and avoid duplicate tests. In addition, the information in the record would ease the billing process by allowing coders to access complete and detailed information remotely as they assigned ICD codes. Recently, some EHR systems allow physicians to code/bill as they go, while other systems automatically assign the codes, which should further streamline the billing process. Finally, the EHR can generate metrics, which can be used to check and ensure that policies and standards are being following. As Freidson (1970) pointed out, in the past with a paper chart, a physician's work couldn't be tracked/evaluated easily and so the paper medical record was only reviewed when something went wrong. Now through its data aggregation, the EHR can render a clinician's work visible at any time.

The development of the EHR also created the opportunity for a new professional group to emerge—the Health Information Technology (HIT) professionals. While the consolidation of this group into a profession is debated and likely still in process (Suchman and Dimick 2010), for the purposes of this dissertation I will briefly describe the various roles within this profession. This new knowledge-based profession not only innovates and designs the system, but also plays

an integral role in framing its potential. On the industry side, HIT professionals include the computer software developers tasked with designing and maintaining an EHR system, as well as the professionals who create the strategic vision and framing that not only attracts customers, but also designates its position within the market. On the healthcare organization side, HIT professionals include trainers and support staff that maintain the EHR system within a healthcare organization. Frequently, HIT professionals are closely tied to Health Information Management (HIM), which focuses on the storage, maintenance, and integrity of the medical record. Because HIM was responsible for the paper medical record, many healthcare organizations locate HIT within its HIM department. And several HIM professional associations, the American Health Information Management Association (AHIMA) and Health Information and Management Systems Society (HIMISS), have incorporated the EHR into their domain. Overall, the professional project that brings these HIT professionals together, especially spanning jobs in industry and healthcare organizations, is still underway. However, it is important to recognize that this group of professionals is not only innovating the technology itself but also framing an EHR system's meanings in its publicity and in its training and support services. Therefore, in this dissertation, I adopt this broad definition of an HIT professional.

Returning to the technology itself, the first EHR was created in 1969 and was primarily for billing (Colleen and Greenes 2015). Epic Systems Corporation and Cerner were both founded in 1979, though these early EHR companies were primarily patient tracking systems that provided administrative support. These two companies would expand their technology to offer EHR functionalities and would come to dominate the EHR market space in the 2010s. However, most healthcare organizations did not adopt an EHR. Of the healthcare organizations that were early adopters of EHRs, the majority developed their own homegrown systems.

*Adoption and Diffusion of EHRs*

However, despite the promises of clinical and administrative improvement, adoption of EHRs was slow. This slow adoption was attributed to clinicians' negative perceptions of EHRs and refusal to use them (Holden 2010); clinicians' lack of technical skills, poor EHR design, high costs of purchasing computer equipment and record systems and time-consuming data entry (Colleen and Greenes 2015). In addition, several studies documented failed adoptions of EHR systems (Brown and Jones 1998; et al. 1998; Stoop, Bal and Berg 2007) Even as computer technology advanced and became less expensive, and the workforce became more skilled in using personal computers, only 25% of hospitals in the United States were using a basic EHR in 2005 (Jha et al. 2006).

However, the US federal government played an important role in accelerating the adoption and diffusion of EHRs[1]. In 2009, Congress passed the American Recovery and Reinvestment Act (ARRA), which included the Health Information Technology for Economic and Clinical Health (HITECH) Act. This incentive program allocated $18 billion to support the adoption of EHRs across the US healthcare system and establish a system of federal governance over "a nationwide health information network" (Manos 2014; Burke 2010:141). Physicians and healthcare organizations qualified for incentive programs to purchase and implement EHRs. But the incentives required the healthcare organizations to demonstrate "meaningful use" of the EHR, which includes prescribing medications electronically, connecting to a health network, and the ability to submit quality measures to Health and Human Services (HHS). Simultaneously, the HITECH Act also established penalties for providers and healthcare organizations if they did not meet the requirements of Meaningful Use by 2015. These penalties consist of a 1% to 3%

[1] This history of federal EHR policy will be addressed in more detail in chapter 4.

reduction of Medicare payments (Burke 2010). Thus, by offering incentives and including penalties, the HITECH Act becomes a federal mandate for the adoption of EHRs (Richards 2009). This incentive program led to the rapid adoption of EHR technology, as physicians and healthcare organizations bought systems from vendors or worked to expand and improve upon homegrown systems. As of 2016, 96% of hospitals eligible to participate in the incentive program certified they are using an EHR system and 90% of hospitals had completed the first stage of Meaningful Use (Office of the National Coordinator for Health Information Technology 2017c). Therefore, this one policy massively altered the adoption and diffusion of EHRs, creating an exogenous shock through the healthcare system as organizations and professions responded.

Following the rapid adoption of EHRs across the United States' healthcare system over the last decade, we are beginning to see whether this technology is delivering on its promises to improve patient care and lower healthcare costs. In one study, 78% of physicians reported that the EHR improved patient care and 65% of physicians indicated that EHRs reduced medical error (King et al. 2013). However, another study demonstrated a short-term decline in the quality of surgical care following the adoption of the EHR (Thirukumonan et al. 2014). On the administrative side, one study found that despite initial high costs associated with purchasing and implementing an EHR system, it improved the accuracy of billable services resulting in higher charge-to-collection ratios (Edwardson, Kash and Janakiraman 2017), while other researchers found substantial billing and insurance costs remained despite the presence of an EHR system (Tseng et al. 2018).

While improvements in outcomes and decreases in costs are still under debate; the EHR also has important ramifications for the medical profession as the technology impacts not only

the clinicians' practices, but also their sense of autonomy. Research highlights how physicians are spending long hours in the record—5.9 hours of an 11.4 hour day working the EHR (Arndt et al. 2017)— and in some cases physicians are now spending more time engaged with the EHR than interacting with patients (Young et al. 2018). The documentation also continues after work hours and over the weekend (Sinsky 2018). In addition to this added documentation burden, physicians criticize the EHR as interfering with their ability to interact and treat their patients based on their training and experience (Reich 2012; Levinson, Price and Saini 2017). Together this creates a sense of lost autonomy—the ability to use their expertise to diagnose and treat patients free of supervision—which has been identified as a contributing factor to physician burnout (Shanafelt et al. 2015; Shanafelt et al. 2016; Southwick and Southwick 2018). Physician burnout is characterized as a state of emotional exhaustion, loss of satisfaction in work, and detachment from the patient relationship (Deckard, Meterko, and Field 1994; West, Dyrbye, and Shanafelt 2018). It is also associated with negative impacts on patient care, increases in cost, and attrition of the workforce (Halbesleben and Rathert 2008; Dyrbye and Shanafelt 2011; Babbott et al. 2014; West et al. 2016). However, we do not know how and to what extent this loss of autonomy varies among physicians in relation to the EHR. By focusing on this relationship, this dissertation not only contributes to our understanding of physician autonomy from a theoretical perspective; it will also have important policy implications for patient care.

*Dissertation Outline*

In the next chapter, I provide the dissertation's theoretical overview and contributions. In chapter 3, I detail the methodology of this qualitative project. Chapters 4-7 are empirical chapters. In chapter 4, I examined the legislative and regulatory processes that led to the codification of EHR policy into the HITECH Act and its EHR Incentive program, Meaningful

Use. Chapter 5 then shifts our focus from law on the books to the law in action. This analysis provides a field level overview of the HITECH Act's impact on healthcare and the EHR industry. To examine this impact of the law on the ground, chapter 6 looks at its effects at one hospital system, Marlowe Health. Finally, in chapter 7, I then consider how these changes at Marlowe Health impact individuals' experiences and perceptions of the EHR. Drawing on my fieldwork, I focus on how the EHR impacts physician autonomy across three dimensions: time, interaction, and cognition. Finally, I conclude in chapter 8.

## Chapter 2: Theoretical Framing

In this dissertation, I argue that law plays a significant role in the innovation and adoption of disruptive technologies. In order to understand the implication of these legal processes – both for the materiality of the technology itself and for the experiences of its users, especially in regard to a profession's autonomy – we need to examine the codification of law on the books and the implementation of law in action. Usually, these two sides of law are analyzed separately. However, by employing a more holistic approach, I contribute to a more complicated/detailed understanding of the entanglement of law and technology, and that their iterative relationship has direct, yet varied, consequences for the professions who use it. Specifically, when law standardizes and supports the widespread adoption of a technology across an organizational field, the technology can positively or negatively impact a profession's autonomy. I argue that in the case of the EHR, it impacts the medical profession's autonomy across three dimensions: time, interaction, and cognition. But this impact varies by medical specialty, where generalists experience a negative impact to their autonomy across all three dimensions, while specialists experience negative autonomy on time but no effect on interaction and cognition.

I situate this dissertation in the organizational scholarship on innovation and technology, healthcare organizations, and professions, as well as sociolegal scholarship on the role of law. Together these literatures allow us to consider the iterative process by which technology and policy impact each other within the context of healthcare. By bringing these literatures together, it produces a more comprehensive understanding of how law/policy and technology interact and have the potential to generate/develop a disruptive technology. And importantly, the dissertation considers the subsequent consequences for the professions within the field as the technology alters workflows, routines, and relationships. While the dissertation focuses on and contributes to

an examination of this phenomenon in the field of healthcare, its contributions may extend to other organizational fields. Although the iterative interplay between technology and policy could vary by organizational field, that interaction still plays a critical role in how the innovation is developed, designed, and deployed. Finally, I also draw upon a sociotechnical approach in my analysis of the EHR as a technology, and therefore will briefly address this literature as well.

*Law and Technology in Healthcare Organizations*

Brennan and Suchman (2020) introduce a framework for considering the interplay between law and technology in healthcare organizations. Bringing together literature from organizational sociology, medical sociology, and sociolegal studies, they develop a 2x2 typology to suggest the different ways law could impact and be impacted by healthcare technologies. The first dimension of this typology considers whether a technology is consistent or disruptive to the workflows, practices, logics, and/or culture in the field of healthcare. The second dimension builds on a distinction in the medical sociology and organizational sociology literature and distinguishes whether a technology is clinical or administrative. A technology is clinical if it is used primarily in the diagnosis/treatment of patients, whereas administrative technology supports the delivery of patient care via scheduling, billing, and data management, etc. For each of the 2x2 components, they illustrate how the law could influence the technology.

This dissertation applies and extends the framework to the empirical case of the EHR. First, it considers the iterative relationship between the technology and policy cycles. Brennan and Suchman initially situate the analysis in the research tradition of technology cycles (Tushman and Anderson 1986; Anderson and Tushman 1990; Adner and Levinthal 2001), as this literature allows for the consideration of the social processes involved in the emergence, development, implementation, and diffusion or failure of a disruptive technology, including the

legal/policy processes. They suggest ways that the law can support/encourage, deter/block, and/or standardize/codify a healthcare technology into a consistent or disruptive innovation. I will extend this analysis by examining how this process plays out in the context of federal law making. Through an incorporation of neoinstitutional scholarship on the weak state and institutional/political entrepreneurs, I will show how law shapes and is shaped by the technology process.

Second, in addition to considering how technology may be consistent or disruptive of a field's norms, logics, workflows, etc., Brennan and Suchman (2020) analyze a technology as clinical or administrative. In their chapter, Brennan and Suchman hypothesize that the EHR is an *administrative* technology and that its different functionalities and degree of innovation determine whether it's a consistent or disruptive technology. By examining this within the context of my fieldwork, I will be able to elaborate upon this distinction. In addition, I will also show how the EHR impacts the medical profession's autonomy. However, I will further complicate this by suggesting that differences amongst medical specialties also result in the EHR technology having an uneven impact across clinicians. Therefore, certain medical specialties will experience greater disruption even though the translation of their work to an electronic format appears to be consistent across all specialties.

In the next section, I will describe the technology and policy cycle. This theoretical framing will help us understand how the law came to be on the books. Then I will draw on neoinstitutional scholarship on the weak state and the professions to consider how the law on the books translates to law in action. Finally, I conclude with a note on how a sociotechnical approach is also incorporated into the analysis, as it provides insight into the standardization and customization of EHRs.

*Technology and Policy Cycles*

In this section, I will first detail the technology cycle and then the policy cycle. Then I will highlight/hypothesize how this plays out within the context of the US federal government.

*Technology Cycle*

Research on technology cycles not only examines the processes of innovation and adoption of new technologies, but it also considers environmental impacts on these processes (Tushman and Anderson 1986; Anderson and Tushman 1990; Adner and Levinthal 2000). At its starting point, this research tradition recognizes that most industries experience routine incremental innovation all the time. Such incremental innovations make marginal improvements in quality or cost; but they don't significantly disrupt the industry's basic structure or practices. Occasionally, however, a more radical breakthrough will introduce a technological discontinuity, opening the industry to fundamental transformation. In these punctuated moments, the discontinuity has two potential pathways: competence-destroying or competence-enhancing (Tushman and Anderson1986). Competence-enhancing discontinuities are "order-of-magnitude improvements in price/performance that build on existing know-how within a product class" (Tushman and Anderson 1986:442). While these new technologies create a break or inflection from the previous incremental trajectory, they do not fundamentally challenge the status quo. Rather they build on the knowledge, practices, and processes that are already in place, strengthening or even exaggerating pre-existing relations and patterns of expertise and authority. In comparison, a competence-destroying discontinuity "require[s] new skills, abilities, and knowledge in both the development and production of the product" (Tushman and Anderson 1986:442). While this impacts the industry that is producing the technology, this disruptive

technology can have a larger impact, where it can "displace older technologies by developing new markets and disrupting existing markets" (Fennell et al 2014:206).

Technological discontinuities, whether competence-enhancing or competence-destroying, begin an "era of ferment," as firms experiment, compete, and collaborate on a variety of potential designs for putting the new technology into practice. During this period, feedback from users and organizations that will purchase/operate the new technology can influence the design. The era of ferment is also a time when standards and regulatory requirements can shape technological development. Early in the era of ferment, the relevant regulations and standards tend to reflect what was in place for the technology's prior iteration. This might shape assumptions and habits even if the technology requires a radical break. Later in the ferment, standards and regulations are often re-written to give a final push to the emerging dominant design.

The era of ferment ends when the industry converges on a dominant design, which is when the new innovation becomes industry standard. This lock-in moment sets the industry down a path of using a particular type of technology, even if there are alternative designs that are technologically superior (Arthur 1989). Importantly, it also reflects a series of social forces, such as accounting for the socio-historical context, the firms and actors involved, and market forces that contributed to the lock-in. Ultimately, the decision of which technology will win out as the dominant design is not decided solely by the innovators rather it's the culmination of other actors, including regulators, and organizations who invest in and see the potential of that particular technological strand. Following the convergence and lock-in on a dominant design, a new era of incremental change begins, where the dominant design continues to be elaborated upon based on feedback from organizations and users. Adjustments to the dominant design

continue until the next emergence of another technical discontinuity, which will start the technology cycle over again.

Drawing on the technology cycle literature is useful for two purposes. First, we can see how the healthcare sector influences the development of technology. For example, the close involvement of design and consultant physicians in the medical device industry could lead to innovations consistent with their current practices in the healthcare setting. Second, it also allows us to consider the role of law and how it influences the cycle. Regulations can encourage innovation by creating incentive programs; alter innovation by imposing standards that shift the direction of the innovation; or halt an innovation by banning it or restricting funding for research. Focusing on the social processes by which technology is developed, adopted, changed, or destroyed will allow us to consider the role of law more closely in this process.

*Policy Cycles*

Often sociolegal studies focus primarily on the implementation of a policy/law (Dobbin and Sutton 1998; Heimer 1999; Fuller, Edelman, and Matusik 2000; Gunningham, Thorton, and Kagan 2005; Edelman 2007). However, this dissertation considers both the legislative and regulatory processes that produce the law as well as its implementation. In the words of the sociolegal tradition, this dissertation studies both the law on the books and the law in action.

While the technology cycle allows us to consider law's influence on the innovation process, it is also equally important to consider how a disruptive technology impacts the law. Because not only does a disruptive technology trigger a technical discontinuity, it can trigger a legal discontinuity, where the current governance structure and jurisdiction is no longer suitable/appropriate for the new technology (Lewallan 2021). The law enters its own cycle of

change (Asquer and Krachkovskaya 2021). Therefore, we must also consider how new policy is identified, debated, and codified and how this interacts with the technology cycle.

A legal discontinuity first requires identifying a new policy solution. However, for the State, this solution isn't identified in a vacuum either. Research shows that interest groups and social movements play an important role in framing the policy problem, the debate, and potential solutions (Aplin and Hegarty 1980; Hacker 2002; Burstein and Hirsh 2007; Pettinicchio 2013; Moffitt 2014). In the case of healthcare, it's been documented how advocacy groups are influential in setting policy and allocating federal funding (Best 2012). And for a new technology, both the innovators and the users are active in the process as they seek to ensure that any resulting law supports their needs/interests.

Borrowing terminology from the technology literature, the law enters its own stage of ferment as the policy problem and solution are debated. It can take years, if ever, to converge on a proposed legislation that will pass and become codified as law. Often it is the work of political or institutional entrepreneurs, who identify an opportunity to push for the passage of a law (Patashnik, Gerber and Dowling 2017). These actors are able to mobilize resources to create and/or transform an institution that further serves their interests and values (Maguire, Hardy, and Lawrence 2004; Garud, Kumaraswamy, and Sambamurthy 2006; Greenwood and Suddaby 2006; Perkmann and Spicer 2007; Levy and Scully 2007). These political/institutional entrepreneurs can occupy core or periphery positions in the field and generate change through either heroic agency (e.g. a broad, systemic redesign for field-wide change) or through distributed agency (e.g. a more narrow and pragmatic approach to mundane problems, which nonetheless cumulates into field-wide change) (cf. Suchman and Brennan working paper).By recognizing the role of these

agents play in drafting and codifying a law, we can see who's interests and logics shape the understanding of the technology and its translation into policy.

In the case of the EHR, I will show how it's necessary to consider the iterative relationship between both the technology and policy cycle. While the EHR technology had the potential to be disruptive across the healthcare sector, its adoption rate remained low. However, for Congress and a variety of interest groups and policy advocates (i.e., our political/institutional entrepreneurs), the EHR was identified as a potential solution to two crises: the rapidly rising cost of healthcare and the decline in quality care. The law would ultimately standardize and incentivize EHR adoption, and it reflected the envisioned policy solution of legislators and stakeholders from across the healthcare sector.

*Policy Implementation*

However, legal processes do not stop at law on the books. Sociolegal scholars have focused on the other half of the legal process—the law's implementation. This analysis follows in the tradition of neoinstitutional scholarship on law and organizations, which adopts a cultural perspective to view law as a set of norms, rules, rituals, and symbols (Edelman and Suchman 1997). In this approach law operates largely through shared cultural understandings, a law's "content" is never fully exogenous to the regulated organizations; rather sensemaking processes within an organizational field produce endogenous meanings (Edelman 1990; Edelman 1992; Edelman, Abraham, and Erlanger 1992; Edelman, Uggen, and Erlanger 1999; Edelman 2016). Internal to the organization, employees interpret, and act based on the legal structure to address new regulations (Fuller et al. 2000). At this intraorganizational level, there is the opportunity to consider how this sensemaking moves beyond an examination of law on the book to one on law

in action. Instead of focusing on the legal texts and what they proclaim, this approach considers who is implementing the law as well as how they are implementing it.

Examining the implementation is important, since neoinstitutional sociologists have posed the paradox that the American state is "administratively weak but normatively strong" (Dobbin and Sutton 1998:443). Because of the administrative weakness of the federal government, laws and regulations are ambiguous and subsequently open to organizations' interpretation. To avoid the penalties associated with noncompliance, organizations dedicate resources, usually by hiring professionals, to create and implement a compliance program. The process of the weak state has been applied to Equal Opportunity law, to understand organizations' responses to the Civil Rights Act of 1964, which ordered the end of discrimination but did not outline specific requirements (Dobbin and Sutton 1998; Dobbin 2009). The corporate personnel experts translated the antidiscrimination legislation into policies and practices on the ground. Through professional networks (normative isomorphism) and reinforced by court rulings (coercive isomorphism), these policies and practices became best practices that all organizations needed in order to avoid enforcement penalties. Over time the organizations begin to rationalize the components of this program as part of the market and disassociate them from the original law. Subsequently the program becomes normative and in this way the state is strong because the original intent of the state is now normalized. In the case of equal opportunity law, the intent of the Civil Rights Act to end employment discrimination is fulfilled through the adoption of Human Resource practices even though they were not specifically outlined in the law itself.

While the HITECH Act is still in its infancy compared to the processes that played out with the Civil Rights Act, the paradox of the weak state offers a potential starting point for

analysis. Like many federal laws, the HITECH Act delegated regulatory work to federal agencies, including the Department of Health and Human Services' (DHHS) Office of the National Coordinator of Health Information Technology (ONC) and the Centers for Medicare and Medicaid (CMS). As chapter 4 will show, these federal agencies created a federal incentive program to encourage the adoption of EHRs. These programs introduced technical standards and system functionality requirements, which led to a convergence on a dominant design. In addition, the program also included penalties for noncompliance. As providers, healthcare organizations, and vendors configured their technology to meet these standards, it shifted the field to adopt commercial EHRs, thereby suggesting/reflecting the processes of normative and coercive isomorphism.

To build on this analysis, I also draw from science and technology studies (STS) and economic literature to consider the role of the standards introduced by the HITECH Act. Standards are the result of "…a process of constructing uniformities across time and space, through the generation of agreed-upon rules" (Timmermans and Epstein 2010). However, while standards are commonly thought of as neutral, technical specifications, STS argues for and demonstrates the social nature of standards. Therefore, standards are imbued with power (Busch 2011), aren't neutral (Timmermans and Epstein 2010), and can act as type of social regulation (Brunsson and Jacobson 2000).

The economic literature on standards also aids in understanding why markets adopt standards and the implications of these standards wars. Markets are more likely to adopt standards if there are network effects, which "…are complementary relationships in value creation among adopters of a common standard" (Stango 2004:3). In other words, the more people who adopt a technology and its corresponding standard, the more beneficial it'll be to

each individual user. In principle, this positive network externality is present in the case of the EHR—as more healthcare organizations and providers adopt and use an EHR, more patient records will be electronically available for access and review. However, converging on a standard can vary in the time it takes, and the initial indeterminacy of the standardization trajectory can lead to unpredictable, perhaps suboptimal outcomes: Before a likely standard emerges, purchaser hesitancy can lead to excess inertia and the under-adoption a potentially beneficial innovation; and after a likely standard emerges, bandwagon effects can lead to reinforcing feedback and the "lock in" of a potentially sub-optimal design(Farrell and Saloner 1985; Greenstein and Stango 2009). In the case of the EHR, the lack of industry standards was one of the primary barriers to EHR adoption. As documented in chapter 4, healthcare organizations and providers expressed concern that they would invest in an EHR that would not align with either de facto or de jure standards, thereby requiring a reinvestment in a new technology once the industry finally locked into a standard. While the economic literature primarily focuses on the market as the source and force in standard-setting, research has documented when standard-setting organizations and/or the government take a more active role in the process (Stango 2004; Cabral and Kretschmer 2007).

Taking these literatures together, standard setting as part of the regulatory process reflects not just the intent of the law, but also the ideas, logics, and positions of the people/groups involved in drafting and finalizing the standards. In the case of the HITECH Act and its federal incentive program, the technical standards were developed by a public-private partnership and then open to a public comment period. It is here that the participation of the EHR industry became more pronounced and impacted the standard specifications. This iterative standard setting process between policy and technology stakeholders reflects a continuation of the

interaction between the policy and technology cycles. In addition, while the weak state paradox identifies courts as the source of coercive isomorphism, the HITECH Act and the case of the EHR suggests that de jure standards can be an alternative source if sanctions, such as fines, are tied to compliance. Finally, by considering the standardization of organizations, we can see "how standards are adopted, diffused, implemented, avoided, and altered in the course of their implementation" (Brunsson, Rasche, and Seidl 2012). Chapters 5-7 will address how EHR standards and the use of certified EHR technology is adopted and its implications for EHR vendors and healthcare organizations.

By focusing on law in action, it allows us to consider variation in implementation and user experience with a technology. The adoption and implementation of new technology presents opportunities for adaptation and resistance. In the subsequent section, I will review technological changes in healthcare.

*Technological Change in Healthcare*

I now will address the literature on technological change in healthcare, as it aids the analysis of both a new technology and a new policy. First, the literature establishes that technological change can impact both the clinical and administrative sides of healthcare. Technological change not only alters patient care (diagnosis and treatment), but it also effects the delivery of care, where it challenges pre-existing organizational structures and relations between professions (Fennell et al. 2014). Of particular relevance to this dissertation, research has studied how new technologies change routines and work processes, professional relationships, and professions' sense of autonomy.

A major stream of research examines how technology alters work and routines, including CT imaging (Barley 1986) and MRI imaging (Joyce 2008). Research has also examined how the

introduction of EHRs altered routines and work, which in turn impacted physicians and nurses' sense of autonomy (Harris 1990; Winthereik, van Der Ploeg, and Berg 2007; Bar-Lev 2015). Complimenting this research on work and routines, is a rich tradition that examines whether and how a new technology deskills or upskills when incorporated into labor processes (Gallie 1991; Milkman and Pullman 1991; Gallie, Felstead, and Green 2004; Vallor 2015). Medical sociologists have considered the process of deskilling within the context of ancillary professions, (McKinlay and Arches 1985). By bringing in this literature from the sociology of work, we can see that technology itself plays an important role in determining whether a profession is deskilled or upskilled. We see this process unfold with the EHR. For example, many EHR systems shift billing responsibilities from professional coders to physicians, as the software allows the doctor to code while in the progress note. However, the physicians are not trained in the ICD-10 codes and in an interview, a physician shared her concerns that if she made a mistake in coding then she could be held liable for medical fraud. To avoid the risk, she acknowledges that she undercharges—losing money for herself and the hospital.

Research has also shown how technological change in healthcare alters interactions and relationships within and across professions. For instance, within genomic medicine, the pathologist began to play a more important role in the care team (Fennell et al 2014). Research on EHRs has also shown how the technology altered relationships between physicians and administrators, especially as the EHR became seen as a managerial tool of control (Bloomfield 1995; Reich 2012). Because the technology renders the clinicians' work visible, the administrators are able to respond to this information and use it to change behavior. Not only does this impact the relationship between clinicians and administrators, it may also contribute to their sense of autonomy. For instance, the administrators may feel empowered by the EHR and

therefore experience a greater sense of autonomy, while the clinician may feel a loss of autonomy.

I will contribute to the literature on technological change in healthcare by adding to how technology impacts work, routines, and relationships, which contribute to a profession's sense of autonomy. Unlike prior technologies, the EHR's scope is massive. It spans the clinical and administrative divide, altering not only treatment processes but also the delivery of care, where administrators are actively using the technology. This will allow us to see how a technological change not only impacts the clinicians, but also the administers. Further, the EHR also spans across all medical specialties. Usually, research on technological change has been confined to one specialty, or if interdisciplinary, across a specific illness/disease. However, the EHR is used by all medical professions, which will allow for a more in-depth look at technological change across medical specialties. In particular, I will show variation between generalists and specialists.

*The Professions*

To fully understand the implications of this technological change on the user, I also draw on the professions' literature. Specifically, the dissertation will consider the technology's impact on professional autonomy—the extent to which the individual is able to exercise discretion/work independently, free from supervision. Originally, the sociology of professions took autonomy as a given. However, recent scholarship has begun to acknowledge variation in autonomy and its implications for control over work and the organizational field (Gorman and Sandefur 2011). This project examines autonomy at both the level of the individual professional as well as the level of the profession itself. In this section, I will first provide an overview of the research on professions. Then I engage with the scholarship focused on the medical profession and the

jurisdictional challenges from administrators and ancillary clinicians. Finally, I will outline how this dissertation contributes to our understanding of professional autonomy.

A profession is defined by its possession of formal knowledge, obtained through training (Freidson 1988), and abstract knowledge used to diagnose, treat, and infer (Abbott 1988). This combination of formal and abstract knowledge enables the use of discretion when addressing a problem, which in turn grants the profession autonomy. Control over the knowledge and its associated work enables the profession to stake a jurisdictional claim. This dominant position in a particular jurisdiction is legitimized by public support and credentialing through the state. However, this is not a static system, rather, professions compete for jurisdictional control, which in turn creates a system of professions (Abbott 1988). Thus, professional dominance can change as a result of internal challenges by paraprofessionals and/or external challenges from regulations, technological innovations, and public demand.

Within their jurisdiction, and because of their autonomy, the profession exercises self-control and occupation-control (Simpson 1985). In his analysis of the medical profession, Freidson (1970) argued that due to technical autonomy physicians self-regulate, because they rely on their own clinical experiences to make care decisions. However, there is also occupational-control, where members within the same profession control each other (Simpson 1985). In the case of the medical profession, if a physician did something wrong, the review of work was performed by another physician (Freidson 1970).

In addition to expertise and autonomy, the literature on professions highlights two additional themes that define the profession: normative orientation to the service of others and high social status, income, and other rewards (Gorman and Sandefur 2011). A normative orientation reflects a view of the profession as providing a public service that puts their clients'

needs first (Goode 1957; Gorman and Sandefur 2011). This approach to the professions aligns with a view of the medical profession as the caretaker, whose main motivation is providing quality care. However, and perhaps in conflict with this normative assumption, is the other defining feature of the profession that emphasizes a profession's prestige and economic rewards (Freidson 1970; Larson 1977; Gorman and Sandefur 2011).

Recent literature on the professions incorporates an institutional approach, which views the profession as an institution unto itself (Suchman and Dimick 2010; Muzio, Brock and Suddaby 2013), as well as institutional agents (Scott 2008). Of particular use for the dissertation, is to consider the institutional agency of the professions. Scott (2008) argues "More so than any other social category, the professions function as institutional agents—as definers, interpreters, and appliers of institutional elements" (223). As institutional agents, a profession is able create new institutions or changing pre-existing ones. Within the case of the EHR, if we consider professions as institutional agents, then their work and understanding of the EHR will play an important role in its continued use and what types of functionalities are added or removed, especially as it relates to the profession's sense of autonomy. In addition, Scott's typology of institutional agents and roles also allows us to consider variation within a profession, and for comparison across the professions as well.

Finally, current research on the professions broadens what constitutes a profession. Originally the literature focused on traditional professions, such as physicians and lawyers, and devoted pages to defining the boundaries between a profession, a paraprofessional, and other occupations. However, subsequent research has pushed against these boundaries. For example, Leicht and Fennell (2001) show how administrators undertook their own professional project, thereby drawing our attention to how management became a profession of its own. And more

recently, scholars are suggesting a new definition of professions that makes the distinction between those with expert knowledge acquired through higher education and those who do not. In other words, a profession is a knowledge-based occupation (Gorman and Sandefur 2011; Susskind and Susskind 2015). This allows us to more broadly consider who constitutes a profession, and therefore has the potential to act as an institutional agent, but it also allows us to consider processes involved in each of these four themes and begin to look for more causal processes as well as variation across professions (Gorman and Sandefur 2011).

*Professions in Healthcare*

I will now turn to the work on the professions within the medical field, in order to provide background for the dissertation's context. Initially research focused primarily on the medical profession, i.e., physicians, and their domination of the medical jurisdiction. Subsequent work reflects the expanded notion of a profession and incorporated ancillary clinicians, such as nursing, and administrators. It also considers how these other professions challenge the physicians' jurisdictional claims, thereby altering their professional work and autonomy. Finally, I provide a brief overview of some organizational changes within healthcare that has impacted the professional experience.

Paul Starr (2008) provides a historical analysis that traces how the American medical profession claimed biomedical knowledge and consolidated its authority. First, the medical profession adopted and developed a biomedical paradigm that successfully treated disease and illness. Specialization in medical knowledge and standardized training created not only a more cohesive profession, culminating in the formation of the American Medical Association (AMA), but also in political support in licensure. These developments within the medical profession coincided with the industrialization, rising urban populations, and the rise of hospitals, which

resulted in patients seeking care from physicians as opposed to family and community members, thereby increasing physicians' cultural authority.

However, medical sociologists have documented challenges to the medical profession's jurisdictional claim following a series of changes to the organization of the US healthcare system. Internally, empirical research on deskilling has shown how ancillary clinicians, such as nurses, physician assistants, and technicians, have taken on more and more routinized tasks, thereby chipping away at the tasks that the medical profession can claim (McKinlay and Arches 1985). In addition, these paraprofessionals have seen advances in degrees and are fighting for more advance licensure and independent practice within the state. In addition, the administration has become more like its own professional group and are able to compete with the medical profession for control of healthcare organizations (Leicht and Fennell 2001; Numerato, Salvatore and Fattone 2012).

Externally, there has been significant changes to the organization of healthcare that has impacted the medical professions. In response to a cost crisis, changes in payment and organizational structure acted as countervailing power, which challenged the medical profession's domination (Light 2009). The emergence of health management organizations adds new tasks—provide quality care and cut costs—to the medical profession's jurisdiction, thereby demonstrating how the state can impact the profession (Casalino 2004). There have also been significant changes to the organizational field as it shifted from a logic dominated by the medical profession to a market logic, thereby altering the delivery of care at the organizational and environmental levels (Scott et al. 2000).

This literature on the professions, especially within the context of healthcare, has shown how the four themes of expertise, autonomy, normative assumption, and high status are

experienced by physicians. However, the broadening of what constitutes a profession allows us to continue to move beyond a focus on physicians and consider other key players in the field of healthcare including nurses, administrators, and the new health information technology (HIT) professionals. Therefore, this dissertation considers other key professional groups that also act as institutional agents. Not only do I consider how each of these professions experiences the EHR and their perceptions of the technology, but I also examine the interplay between these professions as they make sense of and use this disruptive technology.

Taken together, this dissertation will specifically contribute to the literature on profession's autonomy. Originally, the sociology of professions took autonomy as a given. However, recent scholarship has begun to acknowledge variation in autonomy and its implications for control over work and the organizational field (Gorman and Sandefur 2011). This project will examine autonomy at both the level of the individual professional as well as the level of the profession itself.

At the individual level of analysis, research focuses on the extent to which the professional is able to exercise discretion, free from supervision. This technical autonomy is a defining feature of early conceptions of the profession (Freidson 1970; Gorman and Sandefur 2011). However, subsequent research has shown that a professional's sense of autonomy is not universal; it varies across and within professions due to organizational structures, changes in the organizational field, and demographics (Stelling and Bucher 1972; Prechel and Gupman 1995; Lin 2013; Jenkins 2018; Bosk 2020). I will contribute to this literature by examining how a technology impacts a professional's sense of autonomy by examining variation both across and within professions. For instance, the incorporation of predictive analytics and evidence-based

medicine in the EHR moves decision-making from the physician to the technology itself. This shift negatively impacts a medical profession's sense of autonomy.

I develop a typology of the relationship between an individual's autonomy and technology, which will account for variation across and within professions. The typology looks at variation in a professional's autonomy across time, interaction, and cognition. *Autonomy over time* examines the extent to which a professional can organize their time. By analogy to the technical control of the manufacturing floor, technical autonomy provides the professional with the ability to structure time at their discretion. In the case of the EHR, this new technology introduces a documentation burden that significantly extends the amount of time medical professionals engage in the EHR. *Interactional autonomy* considers how a technology impacts a professional's interaction with other professionals (i.e. physicians, ancillary clinicians, administrators) and clients (i.e. patients). The EHR technology can support the professional's discretion in the interaction, or it can interfere/constrain the interaction. For instance, with the EHR, the physician-patient experience has changed due to the necessity of documenting in the system during a patient visit, as physicians report the EHR structures the interaction rather themselves. Finally, *cognitive autonomy* reflects the professional's discretion in how they use their knowledge and expertise. Use of knowledge to infer, diagnose, and treat is a defining feature of the professions. New technologies that incorporate decision-support features have the potential to infringe on a professional's cognitive autonomy. I illustrate this typology in Chapter 7. While this typology is the result of inductive categorization of the themes in the qualitative data, it can serve as a potential starting point for future research of other technologies, especially in the application of information technologies.

At the level of the profession, I consider the profession as an occupational group and how it maintains its boundaries and jurisdictional control (Abbott 1988). Changes to the organizational field of healthcare not only impact an individual's perception of autonomy; it also impacts the collective profession's autonomy. Research has documented how these changes, especially the rise in healthcare administrators, negatively impact the medical profession's jurisdictional claims, which also impacts their autonomy within the system of professions (McKinlay and Arches 1985; Scott et al. 2000; Leicht and Fennell 2008; Light 2010; Numerato et al. 2012). However, it is still unclear whether and to what extent the professions' autonomy, especially for physicians, has been negatively impacted (Prechel and Gupan 1995). In addition, the development of the EHR also marks the emergence of a new professional group, health information technologists. This profession designs, markets, trains, and supports the EHR, and they may play an important role in defining the EHR's capabilities and limitations. The health information technologists, along with administrators, can use the EHR in jurisdictional disputes. For example, prior research has shown how medical professionals were able to maintain jurisdictional control following the introduction of CT scans (Barley 1986) and MRIs (Joyce 2008). However, given the scope of the EHR, it is possible that administrators or the new health information technology profession will be able to gain more of a stake in the healthcare jurisdiction.

*Sociotechnical*

Finally, I will draw upon a sociotechnical approach to inform my understanding of the EHR and its place within my analysis. This approach considers the materiality of the technology as a physical artifact that is distinct from the social processes related to its use and meaning (Orlikowski 1992; Orlikowski & Barley 2001; Orlikowski 2010). While the prior work on

technological change will allow me to examine the sensemaking around the professions' perception of the EHR and their autonomy, the sociotechnical approach will allow for an additional layer of analysis as I consider the actual EHR itself—it's design, abilities, and limitations. There is already a series of empirical studies, especially in information systems, that makes the case for applying a sociotechnical or actor network approach to understand the implementation of information systems, including EHRs in a healthcare setting (Berg et al. 1998; Greenhalgh et al. 2009; Greenhalgh and Stones 2010; Cresswell, Worth and Sheikh 2010; Cresswell and Sheikh 2014; Cucciniello et al. 2015). By acknowledging and analyzing the EHR's materiality, these studies demonstrate how the EHR enables and constrains the users' experience, which in turn impacts the implementation process as well as how users perceived the EHR. Understanding the materiality of the EHR will also be helpful in reconciling differences between the promised EHR, the future EHR, and EHR in actual use.

In addition, by attending to the EHR's materiality, I also will be able to examine and elaborate on customization of these systems. While standardization emphasizes adherence to agreed upon rules, customization highlights the ability to adjust/alter a rule to fit the needs of the organization or individual user. This tension between standardization and customization introduces an interesting angle to this study of the EHR as a disruptive technology. To what degree does customization conform to a standard and to what degree does it act as a form of resistance? This dissertation examines the degree of customization at the organizational and individual level.

*Conclusion*

By drawing on the organizational scholarship on innovation and technology, healthcare organizations, and professions, as well as sociolegal scholarship on the role of law, this

dissertation provides a comprehensive analysis of the iterative relationship between law and technology. While most research in these areas focus on one side of the law—its formation or implementation—I first contribute by providing an overview of both sides of the process. Second, by considering how the punctuated cycles of technology and policy parallel and interact, I add to our understanding of how law and innovation shape each other. Finally, I show the implications of technology policy for professions by developing a new typology of how a disruptive technology impacts a profession's autonomy.

Using the case of the EHR, I will first look at the codification of federal EHR policy and then its subsequent implementation and implications for healthcare. However, before presenting the empirical findings in chapters 4-7, the next chapter presents a description of the multi-method qualitative project that was undertaken to examine the technology and policy cycles.

## Chapter 3: Methodology

To understand how the EHR impacted the field of healthcare, I employ a multi-method qualitative approach.

I conduct a historical analysis of federal EHR policy to examine the role of law in supporting, shaping, standardizing, and/or deterring a disruptive technology. The historical analysis focuses on the passage of the Health Information Technology for Economic and Clinical Health (HITECH) Act and the implementation of Meaningful Use—a federal incentive program that dramatically increased the adoption and implementation of EHRs from 2009-2014. Through an analysis of Congressional Hearings, legislation, trade publications, policy statements, and white papers from relevant professional associations, I analyze how policymakers and stakeholders understood the EHR as a solution to a dual crisis in healthcare (improve the quality of care while lowering costs), and how this conceptualization of the EHR propelled the incentive program forward.

I also conduct fieldwork to understand how the implementation of the HITECH Act and Meaningful Use subsequently impacted healthcare professionals and organizations. Through semi-structured interviews with physicians, administrators, and health information technologists at a hospital system as well as employees at Epic Systems Corporation and Cerner, I capture how these professionals perceive the EHR, how the technology affects their work processes, and subsequently how this contributes to or detracts from their sense of autonomy. In addition, I conduct observations at a variety of professional association events to see how the EHR was presented, perceived, and understood across professional audiences.

Together, these methods allow me to triangulate and understand how the EHR impacts the field of healthcare. This methods section will first outline the historical methods and then address the fieldwork.

**Historical Analysis**

The historical analysis focuses on two key federal processes that supported the widespread adoption and implementation of EHRs. The first is the legislative process that resulted in the passage of the HITECH Act as part of the American Recovery and Reinvestment Act on February 17, 2009. The second is the subsequent regulatory process that produced the "Medicare and Medicaid; EHR Incentive Program", more commonly known as Meaningful Use—a key component of implementing the HITECH Act.

The legislative process is scoped from January 2000 through February 2009. It was not until this period that a federal policy on EHRs came into focus and legislation supporting their adoption was introduced in Congress. There was one prior regulation that addressed health information technology, the Health Insurance Portability and Accountability Act (HIPAA). Passed in 1996 primarily as insurance reform, HIPAA, was the first law to address the electronic transactions for billing health insurance as well as set standards for protecting the privacy and security of health information in paper and electronic format. Despite its passage in 1996, the federal government did not finalize its rules till 2002 and HIPAA did not go into effect till 2003 and 2005. While HIPAA set precedents and provides important context for subsequent debates on health information technology (HIT) at large, the actual law did not address EHRs specifically. Therefore, my analysis accounts for the context created by HIPAA, but it does not focus on its legislative history. (For a full history of the passage of HIPAA see Suchman and Brennan working paper).

The regulatory process is scoped from March 2009-December 2016. This reflects the period in which the Center for Medicare and Medicaid Services' three stages of the Meaningful Use incentive program were proposed and finalized. The third stage was finalized on October 16, 2015 and reflects the regulatory context within which my fieldwork took place. Federal policy on EHRs shifted following the passage of the 21st Century Cures Act on December 13, 2016. While this new law focused on expediting medical innovations, it addressed EHRs, and health information technology (HIT) more broadly, by prohibiting information blocking[2] and promoting interoperability. However, the new regulation was just beginning to take effect towards the end of my fieldwork and therefore outside the scope of this project.

The historical analysis draws upon a series of primary documents including Congressional hearings; Proposed and finalized legislation; Congressional debates; Proposed, Comments, and Final Rules of Meaningful Use; and policy reports. Below I describe my process for collecting and analyzing these sources. With these documents, I trace how the EHR was conceptualized and how EHR policy was formalized/codified in the HITECH Act and then Meaningful Use.

*Congressional Hearings*

Congressional hearings are a key primary source for understanding the iterative interaction between the policy and technology cycle. First, Congressional hearings are where policy and proposed legislation is initially examined and debated by Congressional representatives as well as a variety of stakeholders. Senators and Representatives present proposed bills and express their initial assessment, support, and/or concern. However, these

[2] Per the regulations, information blocking is defined as a practice that "is likely to interfere with access, exchange, or use of electronic information" (21st Century Cures Act: Interoperability, Information Blocking, and the ONC Health IT Certification Program 2020). It applies to health IT developers of certified health IT, health information networks, health information exchanges, and health care providers.

policy debates do not occur in a vacuum. Congressional witnesses are invited to testify on the proposed bill and/or topic. These witnesses often serve as key experts, sharing experiences on behalf of their organization, professional association, or interest group. They speak to how the proposed policy could impact their experience—highlighting the benefits as well as the pitfalls. Representatives and Senators can question the witnesses as well, which provides insight into the thinking of government officials. In addition, professional associations, organizations, interest groups, and individuals, who do not participate in the hearing, are still able to submit written testimony for the Congressional committee's consideration. These discussions and submitted materials allow me to trace how the EHR is understood and constructed by government officials as well as the innovators and clinical users. Taken together, this analysis provides an opportunity to understand how stakeholders from the policy and technology cycle interact and inform each other's understanding of the law and the EHR.

To construct a list of relevant Congressional hearings, I first searched on Proquest Congressional using search terms of electronic health record, electronic medical record, and health information technology. I conducted a similar search on Congress.gov. These searches yielded a total of 81 hearings from 1981-2019. Once I applied the scope of my two periods, I had 55 hearings. I then reviewed the accompanying summaries of these hearings to confirm relevancy to the case, keeping only the hearings that directly addressed/focused on EHRs and HIT. This resulted in 51 hearings to analyze within the scope of 2000-2016. See Appendix A for table of all Congressional Hearings.

As a check on this search process, an undergraduate research assistant performed the same search. While her search focused on hearings prior to 2000, she crosschecked to confirm that my list of hearings was complete. In addition, I was able to cross-reference the hearings

associated with the HITECH Act with the Congressional Legislative History that is compiled by Congress. Therefore, I am confident that all relevant hearings were included in my analysis.

To analyze the hearings, I read and created a summary for each speaker, their submitted testimony, and any additional submitted documents by individuals and organizations that were not invited witnesses. I also took extensive notes on the questions and answers sessions as well as the discussions between Representatives or Senators on the committee. I reviewed my notes to see what themes emerged around EHRs including the perceived benefits of the EHR and the barriers to widespread adoption. I also noted when topics and/or different witness types were absent. Throughout the analysis, I used the hearings to construct a detailed timeline of EHR policy from 2000-2016.

Subsequently, to further my analysis, I coded 10 Congressional hearings in NVivo. I selected five hearings from prior to the passage of the HITECH Act and five following its passage that represented pivotal moments in federal EHR policy (see Table 3.1). This additional analysis allowed me to verify themes from my initial analysis as well as engage in closer reading of the text.

**Table 3.1:** Congressional Hearings Coded in NVivo

| **Date** | **Hearing Title** | **Summary**[3] |
|---|---|---|
| 6/17/04 | Health Care Information Technology | Hearing before the Subcom on Health to examine public and private sector initiatives to promote use of health information technology to reduce medical errors and improve quality and cost of patient health care (Subcom advisory, p. 2-3). |
| 9/29/05 | Last Frontier: Bringing the IT Revolution to Healthcare | Hearing to examine development and use of health information technology (IT) to reduce medical errors and improve the quality and cost of patient health care. |
| 6/4/08 | Discussion Draft of Health Information Technology and Privacy Legislation | Hearing before the Subcom on Health to consider draft bill, to institute various measures to promote use of health information technology (HIT) in the health care system to improve quality and efficiency of health care and protect patient electronic health records privacy. |

[3] Summaries taken from Congressional Records as provided by Congress.gov and Proquest Congressional.

| | | |
|---|---|---|
| 1/15/09 | Investing in Health IT: A Stimulus for a Healthier America | Hearing to examine development and use of health care information technology (IT) to improve quality and cost of patient health care, including role in the economic stimulus package. |
| 1/27/09 | Health Information Technology: Protecting Americans' Privacy in the Digital Age | Hearing to examine development and use of health information technology (IT) to reduce medical errors and improve quality and cost of patient health care, focusing on issues regarding patient privacy protection. |
| 7/27/10 | Implementation of the Health Information Technology for Economic and Clinical Health (HITECH) Act | Hearing before the Subcom on Health to examine implementation of the Health Information Technology for Economic and Clinical Health Act (HITECH Act), which contains funding to promote adoption of health information technology (IT) among hospitals, doctors, and health care providers through HHS Office of the National Coordinator initiatives and through Medicare and Medicaid incentives |
| 9/30/10 | Standards for Health IT: Meaningful Use and Beyond | Hearing before the Subcom on Technology and Innovation to examine development, use, and security of health care information technology (IT) to improve quality and cost of patient health care (Subcom witness list and hearing charter, p. 2-7). |
| 6/2/11 | Not What the Doctor Ordered: Barriers to Health IT for Small Medical Practices | Hearing before Subcom on Health Care and Tech of the Committee on Small Business |
| 3/17/15 | America's Health IT Transformation: Translating the Promise of Electronic Health Records into Better Care | Hearing to examine health information technology (IT) transformation, focusing on efforts to translate promise of electronic health records (EHRs) into better patient health care. |
| 6/16/15 | Achieving the Promise of Health Information Technology: What Can Providers and the U.S. Department of Health and Human Services Do To Improve the Electronic Health Record User Experience? | Hearing to examine developments in and use of health information technology, focusing on ways in which HHS and medical providers can improve electronic health record (EHR) user experience. BACKGROUND AND CONTEXT: There are claims that EHRs are a source of widespread dissatisfaction among providers. The increased user adoption of EHRs in clinical practice has not led to universally improved provider experience. Complaints of increased time burdens on the practitioner, loss of provider interactions with patients, and frustration with new requirements and changed workflows dominate discussions among providers even as the capability of EHRs to reduce errors and improve communications has grown. |

Finally, to examine who participated in Congressional hearings, I also documented all individuals who either spoke or submitted testimony to a Congressional hearing from 2004-2016[4]. I recorded the following information in a spreadsheet: name, degree, title, department, and

[4] Federal EHR policy became more focused on EHRs beginning in 2004 following President George W Bush's Executive Order to establish the Office of the National Coordinator of Health Information Therefore, I focused on the witness from 2004-2016.

organization. In total, there were 455 individuals, where 183 were Senators or Representatives, and 272 were witnesses or individuals/organizations that submitted materials. I then coded the organization each individual represented by organizational type to analyze whose interests they represented in their testimony. These codes included: education, federal agency; hospital association, healthcare association other (e.g., lab, pharmacy); Health Information Exchanges, Health Information Management associations, Individuals (e.g., representing themselves and not an organization), industry, insurance, interest groups, medical professional associations, patient advocates, standard setting organizations, State representatives, and think tanks. This analysis not only provided insight into who was participating in Congressional hearings and the frequency of their participation, but also who was absent.

*Legislative History*

To understand how federal EHR policy translated into a codified law, I analyzed proposed bills and constructed a legislative history.

I initially constructed a legislative history through my readings of the Congressional hearings. Often these hearings focused on a specific bill that had been introduced in the House or Senate. I then searched for the bill on Congress.gov. The entries would reference other relevant bills. I used this information to create a spreadsheet that included the year, date the bill was introduced, bill number, title, whether it was from the Senate (S) or House of Representatives (H), legislative action, Sponsor, and Number of co-sponsors, which was then further divided by political party. I then cross referenced my list of bills with the Congressional Legislative History for the American Recovery and Reinvestment Act. I was able to add a few more bills to my list and ensure that it was complete and accurate. In total, I identified 14 bills. See Table 3.2 below for all federal bills focused on EHRs and HIT.

**Table 3.2:** Legislative History of HITECH Act

| Year | Date Introduced | Bill # | S or H | Action | Title | Sponsor | # Cosponsors | Cosponsor-R | Cosponsor-D |
|---|---|---|---|---|---|---|---|---|---|
| 2003 | 7/25/03 | HR2915 | H | Introduced | National Health Information Infrastructure Act of 2003 | Johnson, Nancy Lee, R-CT | 15 | 13 | 2 |
| 2005 | 6/30/05 | S1355 | S | Introduced | Better Healthcare Through Information Technology Act | Enzi, Michael B R-WY | 20 | 11 | 8 |
| 2005 | 7/18/05 | S1418 | S | Passed Senate | Wired for Health Care Quality Act | Enzi, Michael B R-WY | 20 | 10 | 9 |
| 2005 | 12/18/05 | HR4642 | H | Introduced | Wired for Health Care Quality Act | Issa, Darrell E R-CA | 0 | 0 | 0 |
| 2006 | 2/8/06 | HR4726 | H | Introduced | Wired for Health Care Quality Act | Issa, Darrell E R-CA | 2 | 1 | 1 |
| 2006 | 7/26/06 | HR4157 | H | Passed House | Health Information Technology Promotion Act of 2006 | Johnson, Nancy Lee R-CT | 31 | 31 | 0 |
| 2007 | 5/17/07 | HR2377 | H | Introduced | Assisting Doctors to Obtain Proficient and Transmissible Health Information Technology (ADOPT HIT) Act of 2007 | Gingrey, Phil R-GA | 1 | 1 | 0 |
| 2007 | 6/26/07 | S1693 | S | Introduced | Wired for Health Care Quality Act | Kennedy, Edward D-MA | 16 | 12 | 4 |
| 2007 | 7/12/07 | S1783 | S | Introduced | Ten Steps to Transform Health Care in America | Enzi, Michael B R-WY | 0 | 0 | 0 |
| 2007 | 10/10/07 | HR3800 | H | Introduced | Promoting Health Information Technology Act | Eshoo, Anna D-CA | 13 | 6 | 7 |
| 2008 | 4/24/08 | HR5885 | H | Introduced | Health Information Technology Promotion Act of 2008 | Burgess, Michael R-TX | 0 | 0 | 0 |
| 2008 | 6/4/08 | HR6179 | H | Introduced | Promoting Health Information Technology Act of 2008 | Camp, David R-MI | 13 | 13 | 0 |
| 2008 | 6/24/08 | HR6357 | H | Introduced | PRO(TECH)T Act of 2008 Protecting Records, Optimizing Treatment, and Easing Communication through | Dingell, John D-MI | 12 | 7 | 5 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Healthcare Technology Act of 2008 | | | | |
| 2009 | 1/26/09 | HR1 | H | Became Law | American Recovery and Reinvestment Act of 2009 | Obey, David, WI-D | 9 | 0 | 9 |

To compare the components of the bills, I created a separate spreadsheet where I copied over each line of a bill's final summary as each line of the summary represents a provision in the bill. After reading through the bills, I identified seven types of common policy provisions and then color-coded them. The seven policy provisions are as follows:

- Codifying the Office of the National Coordinator for Health Information Technology (ONC) as a permanent agency in DHHS
- Public-private partnerships to work on HIT policy
- Grants to physicians/healthcare organizations for purchasing EHRs
- Privacy
- Technical standards
- Quality metrics/standards
- Technology Resource Center

This analysis allowed me to track the policy provisions that were consistent across all 14 bills and which parts appeared/disappeared over time, thereby tracing the evolution of federal EHR policy. I next compared the provisions within each code to analyze similarities and differences to determine which versions of the provision were incorporated into the HITECH Act.

*Additional Sources*

While the Congressional hearings and legislation were the primary documents analyzed for the legislative process, I also reviewed additional sources. First, this included policy reports and white papers produced by professional associations, researchers, think tanks, and interest groups. These reports and white papers provided insight into how different stakeholders framed the EHR, especially its promises and potential pitfalls. Information, statistics, and policy proposals/solutions from these reports and white papers were often picked up and cited in Congressional testimony.

Second, I reviewed the two Congressional floor debates on bills relating to EHRs. The first floor debate was in the Senate on The Wired for Health Care Quality Act on November 17, 2005 (151 Cong Rec S 13260). The second floor debate was in the House of Representatives on

the Health Information Technology Promotion Act of 2006 on July 27, 2006 (152 Cong Rec H 5978). For each debate, I identified key positions and themes.

*Meaningful Use Rules and Comments*

While the above set of documents were used to trace the legislative process, to understand the regulatory process I analyzed documents pertaining to the development and implementation of CMS's EHR Incentive Program, commonly known as Meaningful Use. CMS developed a three-stage incentive program. Each stage involved CMS issuing a Notice of Proposed Rule Making (NPRM), a Comment period[5], and a Final Action, where CMS responded to comments and issued the final rule. Each of these documents were found in the Federal Registrar. I read through the NPRM and the Final Action for each stage, taking notes, and paying special attention to how CMS summarized comments and justified decisions around components of the program. These documents not only provided the details of the incentive program, but also highlighted points of ambiguity and concerns raised by organizations and users who needed to comply with the incentive program.

*Conclusion*

Taken together, the historical analysis of these documents provides important insights into the interactions between the policy and technology cycles. First, I construct a narrative of federal EHR policy from 2000-2016 that captures both the legislative and regulatory processes associated with the HITECH Act. To my knowledge, this is the first comprehensive history of this period. Additionally, by identifying key actors and organizations, I show how they constructed the EHR and linked it as a solution to the dual crisis in healthcare—rising costs and a

[5] CMS recorded thousands of comments for each stage. For example, the initial NPRM yielded 1.97K comments. While I looked through comments to get an overall sense of perspectives, I did not perform a formal analysis. However, since CMS reviews and responds to comments in each of the Final Action, they provide an overview of key themes. Future research can analyze these comments (cf. Pye, Rai, and Dong 2021)

decline in quality care. This vision of the EHR was codified into the federal government's intervention via the HITECH Act and is detailed in Chapter 4.

## Fieldwork: Interviews and Observations

While the historical analysis focuses on how the law on the books came to be, I conducted fieldwork to examine the law in action. To understand how professionals experienced and perceived the EHR's impact on their autonomy, I conducted semi-structured interviews and observations of professional association meetings and webinars. The interviews allowed me to see how professionals perceived the EHR and how it affected their workflows, practice, and interactions. These interviews were then complemented by observations at professional events, where the discussion of the technology moved from the individual experience to its impact/meaning for the larger professional project. The observations also provided insight into similarities and differences across organizations, states, EHR systems, and patient populations.

In total, I conducted 32 in-depth semi-structured interviews with 25 healthcare professionals including physicians, nurse practitioners, administrators, and health information technologists from October 2018 to February 2022. Fourteen respondents worked at Marlowe Health, a hospital system in the Northeast United States. Four respondents practice/work outside of Marlowe Health. Six respondents are former or current employees of Epic Systems Corporation or Cerner—the two most prominent EHR companies in the US. To further complement these interviews, I conducted 130 hours of observation at a variety of professional association meetings and webinars both in person and virtually from October 2018 to January 2022.

### *Interviews*

#### *Case Selection*

Research has shown that organizational context matters, especially in healthcare (Scott et al. 2001; Zapka 2008; Kellogg 2011; Hoff 2014). Since the 1980s and continuing into the 1990s, there has been a move towards horizontal and vertical alignment of healthcare organizations (Fennell and Adams 2011) with consolidation into integrated healthcare systems becoming the norm. These hospital systems provide infrastructural support for the delivery of care by coordinating and allocating resources, negotiating insurance reimbursements, setting policies and procedures, responding to regulatory requirements, and providing other administrative services across its organizational members. The hospital system's corporate entity therefore plays an important role in organizing the delivery of patient care.

Additionally, a hospital system is composed of a variety of organizational types that range in size and type of patient care delivered. These organizations include ambulatory clinics that provide out-patient services, such as primary care, as well as tertiary hospitals that deliver in-patient care. Hospital systems also include specialty hospitals that focus on particular organ-systems or illnesses, such as orthopedics and cancer. Prior research has shown how each of these organizational types has their own sets of logics and approaches to patient care, and they serve different patient populations (Scott 1982; Scott et al. 2001; Hoff 2014). Due to these differences, the organizational context within a hospital system will also impact professionals' experiences of autonomy. By embedding my interviews within a particular hospital system, I can compare the professions' experiences and perceptions across organizational types, while holding the system's corporate overhead constant.

I selected Marlowe Health[6], a large non-profit hospital system as my primary case[7]. Located in Northeastern United States, Marlowe Health was founded by two tertiary hospitals, North Hospital and South Hospital. Over the years its membership expanded to include additional tertiary hospitals, specialty hospitals, and community health centers[8]. Therefore, Marlowe Health provides a variety of organizational types in which I can embed my interviews.

Although part of Marlowe Health, the North and South Hospitals maintained their own set of ambulatory practices as well as separate identities, organizational cultures, and workflows. These distinctive organizational identities were recognized and known within the local environment. Not only did the workforce identify first with their affiliated hospital over Marlowe Health but the patient population also saw and treated these organizations as distinct entities. I focused my interviews on North and South Hospitals and their affiliated ambulatory practices. This allows me to compare not only inpatient to outpatient settings, but also differences between North and South Hospital. Toward the end of this study, the corporate overhead of Marlowe Health began an effort to consolidate and harmonize the system. However, the success of this rebranding and restructuring is very much a work in progress.

Of additional importance to this study, Marlowe Health also has an extensive and varied experience with EHRs and was directly impacted by the HITECH Act. The founding members developed their own homegrown EHR systems between 1980-2000. These systems were designed by and for specific medical specialties including cardiology, emergency medicine, and ambulatory care. This was not a unified homegrown system. Interoperability between the

[6] A pseudonym.
[7] Originally, I planned to conduct fieldwork at a second hospital system to avoid results that could be singular to a particular hospital system. In addition, to avoid results that are singular to a particular EHR system, this second hospital system used Cerner. However, due to the COVID-19 pandemic, I was unable to enter this field site. In future research, I would replicate this study in the second hospital system and compare both organizational and technical differences.
[8] I do not include specific numbers of each organizational type to avoid re-identification of Marlowe Health

systems was limited and inpatient care remained largely a paper-based system. Following the passage of the HITECH Act, Marlowe Health moved to purchase and implement Epic Systems instead of adapting their homegrown systems. Therefore, this case also shows how subjects respond to the adoption and implementation of a new EHR system in the wake of the HITECH Act. In addition, I had the opportunity to interview subjects of an ambulatory practice recently purchased by South Hospital. Prior to the merger, Ambulatory 1 used an EHR system purchased from a vendor, AllScripts, but because of the merger they needed to switch to Epic. The transition to Epic took place in the summer 2018. My initial interviews with subjects from this ambulatory practice as well as follow up interviews in 2021 allow me to see how a more recent implementation of an EHR system plays out.

Finally, many of Marlowe Health's tertiary hospitals are also teaching hospitals affiliated with the local medical school, which allows me to consider how the EHR may impact the medical profession across years of experience. In addition, North Hospital has an affiliated Health Institute – a private graduate school for health professions focusing on ancillary clinical education – that also provides insight in how these clinicians use and educate on EHRs.

For these reasons, Marlowe Health provides a variety of opportunities to see how the professions experience EHRs across organizational types.

*Interviews*

To understand professionals' experiences and perceptions of EHRs, I conducted semi-structured interviews as it allowed for the research participants to explain in greater detail their thoughts, feelings, and experiences. It also allowed me to ask for clarification of any words or statements to better capture their intended meanings.

*Recruitment:*

Subjects were initially recruited through personal connections and then I employed snowball sampling. However, recruitment proved to be challenging. During my first year of field work (fall 2018 to fall 2019) interview requests went unanswered or potential respondents said they were too busy to talk. Everyone I interviewed was willing to send out my contact information and a blurb about my research to colleagues. But they refused to share their contacts' information so I could not follow up.

Interestingly, each generalist I interviewed referenced one or two other physicians who would be good subjects for this study as those physicians struggled with the incorporation of the EHR into their practice. But then the subject would quickly explain that those physicians were too busy and wouldn't have time, and therefore wouldn't provide the contact information. This interaction reinforces one of my findings about how the EHR negatively impacts physician's time, which is detailed in chapter seven.

Despite the challenges of recruitment, the subjects who participated in this study provided rich interviews about their experiences with EHRs. In addition, I conducted additional interviews with professionals at other hospital systems in different geographic locations to interrogate what findings were unique to Marlowe Health and which were consistent across organizational contexts. Commonality across themes suggest I reached saturation (Small 2009).

*The Sample*

I conducted 32 in-depth semi-structured interviews with 25 healthcare professionals including physicians, nurse practitioners, administrators, and health information technologists from October 2018 to February 2022. I first will describe the sample from Marlowe Health and then the sample from the EHR industry.

Fifteen respondents worked at Marlowe Health in the Northeast United States. Four respondents practice/work outside of Marlowe Health. Ten of the 15 are physicians, two are nurse practitioners, and three are health information technologists with two also occupying administrative positions. The demographics and location of practice are presented below in Table 3.3.

**Table 3.3:** Demographics of Interviewees in Marlowe Health

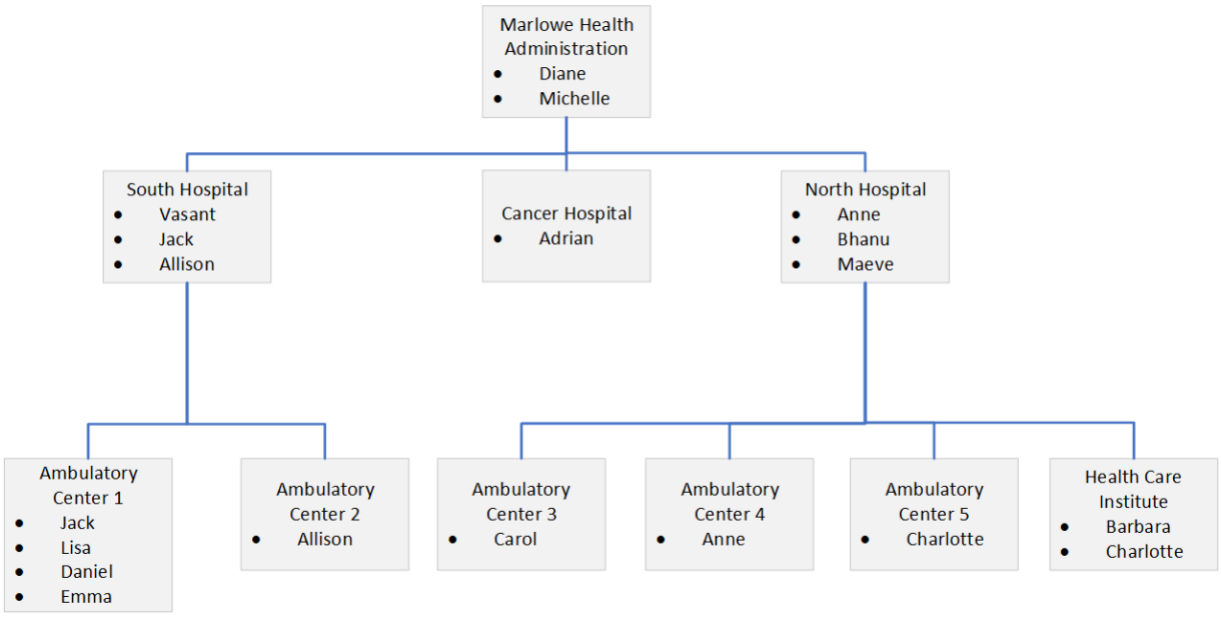
| Subject | Profession | Medical Specialty or Department | Race | Gender | Age | Practice Type |
|---|---|---|---|---|---|---|
| Jack | MD | Cardiology | White | Male | 47 | South Hospital, Ambulatory 1 |
| Lisa* | MD | Family Medicine | White | Female | 44 | Ambulatory 1 |
| Allison | MD | Radiation Oncology | White | Female | 35 | South Hospital, Ambulatory 2 |
| Carol* | MD | Primary Care | White | Female | 59 | Ambulatory 3 |
| Bhanu* | MD | Internal Medicine | Asian | Male | 32 | North Hospital |
| Anne* | MD | Primary Care | White | Female | 48 | North Hospital, Ambulatory 4 |
| Vasant | MD, Resident | Internal Medicine | Asian | Male | 29 | South Hospital |
| Adrian | MD | Oncology | N/A | Male | N/A | Cancer Hospital |
| Maeve | MD, Resident | Anesthesia | White | Female | 31 | North Hospital |
| Daniel | MD | Cardiology | White | Male | 73 | Ambulatory 1 |
| Charlotte* | DNP | Neurology | White | Female | 43 | Ambulatory 5, Health Institute |
| Barbara*** | DNP | Palliative Care | White | Female | 50 | Health Institute |
| Emma** | HIT | Ambulatory EHR support | White | Female | 32 | South Hospital, Ambulatory 1 |
| Diane | HIT, Administration | Health Information Management | White | Female | 64 | Marlowe Health |

| | | | | | | |
|---|---|---|---|---|---|---|
| Michelle | HIT, Administration | Health Information Management | Black | Female | 51 | Marlowe Health |

* Indicates subjects who participated in a follow up interview in 2021 to discuss the impact of the COVID-19 pandemic on their practice and use of the EHR.
**I conducted three formal interviews with Emma between 2018-2020. She also provided periodic updates on policy and technology changes pertaining to EHRs in Marlowe Health and South Hospital
*** This subject taught at the Health Institute affiliated with North Hospital. She practiced in a separate hospital system, which used Cerner. However, because she taught students who did clinical rotations in the Marlowe Health, she was experienced user in both Epic and Cerner.

To understand the subjects' place within the Marlowe Health, refer to Figure 3.1 below.

**Figure 3.1:** Setting Practice of Subjects




*Interviews*

Each interview lasted between 30 and 60 minutes. I conducted five interviews in person and the rest of the interviews were by phone or zoom[9]. For physicians and nurse practitioners,

[9] While it would have been ideal to conduct all interviews in person, subjects requested phone interviews to accommodate their schedules. These subjects spoke to me during their lunch breaks, their commute home, and after clinic hours. Four requested to conduct interviews by zoom because they took place during the COVID-19 pandemic.

questions focused on their experiences with the EHR including how they were trained on the EHR, how they use the EHR in their work, and how they navigate the EHR with patients. For health information technologists, the interviews focused on how they designed and supported the EHR. Because the interviews were semi-structured, I was able to use the "constant comparative method" (Glaser and Strauss 2009) adding and adjusting questions based on emerging themes from ongoing analysis of previous interviews' transcripts.

Beginning in spring 2021, I reached out to these subjects for follow up interviews. I conducted six follow up interviews[10]—four physicians (Lisa, Carol, Bhanu, and Anne), one nurse practitioner (Charlotte), and one health information technologist (Emma). These interviews provide an in-depth and longitudinal look at the implementation of EHRs. They captured not only how these respondents' experiences with EHRs may have changed since our initial interview, but also to understand the role of the EHR during the COVID-19 pandemic—how it was used to share information, facilitate virtual care, and whether it supported/hindered the medical profession's response to the crisis.

I also conducted interviews with professionals from other hospital systems, located in different states, as a check on my findings. These additional interviews allowed me to consider what findings were unique to Marlowe Health thereby reflecting its organizational context. But these interviews also provided insight into overarching themes related to EHR experiences and perceptions that persisted across organizational settings and state lines. These interviews included three physicians and 1 health information management professional:

- Richard, cardiologist – uses Epic
- Michael, oncologist – uses Epic, previous hospital had homegrown system[11]
- David, neurologist – uses Epic

[10] All follow up interviews were conducted by phone or zoom due the ongoing COVID-19 pandemic.
[11] Interestingly, Michael's previous hospital maintained its homegrown EHR system following Meaningful Use.

- Brenda, health information management – works on a state-level health information exchange

*EHR Vendor Sample*

I conducted six interviews with employees at Epic Systems and Cerner. These interviews focused on the innovation and design processes as well as how each company interacted with and responded to clinical users' questions and needs.

In April 2019, I conducted in person interviews with three Cerner employees from three departments.

- Kasey, Physician Solution Strategy
- Jennifer, Clinical Documentation Strategy
- Ben, Revenue Cycle

These interviews were not recorded at the request of the subjects. Instead, I jotted notes during the interview and wrote up a detailed fieldnotes following the interviews.

In summer 2020, I conducted interviews with three former employees from Epic Systems by zoom and phone.

- Will, Programmer, 1986-1989
- Ed, Programmer, 1996-2013
- Priya, Technical Support Analyst for the Anesthesia module, 2017-2018

For both the Cerner and Epic employees, the interviews focused on the innovation process; the go-live process (the implementation of the EHR in healthcare settings); their interactions with administrators, physicians, ancillary clinicians, and/or hospital-based health information technologists; their experiences working in their company; and their sense of a larger professional identity. Because the interviews were semi-structured, I was able asked follow up questions and adjust the interview protocol.

*Analysis*

Prior to analysis, the recorded interviews were professionally transcribed. I de-identified all interviews and interview fieldwork notes. I conducted line-by-line coding of the transcripts, using the computer-assisted qualitative data analysis software package NVivo. Initially, I drew on the professions and technological change literatures to create codes; however, I also adopted an inductive approach, to add themes that emerged during my review of the transcripts.

*Observations*

To complement the interviews, I also conducted 130 hours of observations from 2018-2021. These observations took place at 29 events focused on EHRs that include professional association meetings, Office of the National Coordinator of Health Information Technology (ONC) meetings, and webinars sponsored by the Massachusetts Health Data Consortium, STAT, and other professional associations (see Table 3.4 below for a full list of events).

Through these observations, I witnessed how physicians, ancillary clinicians, administrators, health information technologists, health information management professionals, vendors, health policymakers, and federal/state government officials discuss the EHR—how it worked, their experiences, the challenges of the technology, and their envisioned future. Many of these speakers and meeting participants also work in healthcare settings outside of the Marlowe Health, thereby allowing me to compare their experiences with my interview subjects. In my analysis, I could account for organizational and EHR system differences as well as see consistent themes across these spaces.

Prior to the COVID-19 pandemic, I attended most of these events in person, where I not only was able to listen to presentations but also engage with other participants between sessions and over meals during the day long events. However, beginning in March 2020, events shifted to a virtual platform due to the COVID-19 pandemic. Even in these virtual settings, I was still able

to observe the speakers' presentations as well as the audiences' questions and interactions in the chat. In fact, the presence of a virtual chatroom allowed for greater observation of participants' conversations and sharing of ideas. Therefore, these virtual events were comparable, and in some ways more advantageous, to the in-person observational experiences.

**Table 3.4:** Observations

| Event | Date | In Person | Virtual |
|---|---|---|---|
| Carl Dvorak, President of Epic, Lecture, Healthcare in America Lecture Series, Alpert Warren Medical School, Brown University | 1/29/18 | X | |
| New Jersey Academy of Family Physicians Annual Meeting and Gala | 6/15/18-6/17/18 | X | |
| Employing Medical Scribing to Increase Revenue and Decrease Physician Burnout webinar, Massachusetts Health Data Consortium | 10/2/18 | | X |
| Founder Friday with Dr. Jon Elion, Nelson Center for Entrepreneurship, Brown University | 11/2/18 | X | |
| Massachusetts Health Data Consortium Annual Meeting | 11/28/18 | X | |
| Afternoon at Cerner | 4/25/19 | X | |
| American Academy of Family Physicians Leadership Conference, Future of AI | 4/25/19 | X | |
| HIMSS Annual Spring Conference | 5/16/19 | X | |
| David Blumenthal MD, President of the Commonwealth Fund, Former National Coordinator of ONC (2009-2011), Lecture, Healthcare in America Lecture Series, Alpert Warren Medical School, Brown University | 10/17/19 | X | |
| Lessons From Pandemic Response webinar, Chilmark | 6/17/20 | | X |
| How Innovation Can Support a Safe Re-Opening Strategy, Post COVID-19, Massachusetts Health Data Consortium | 6/25/20 | | X |
| Exchanging Information to Transform Patient Care: the Healthix Story, The CIO Forum, Massachusetts Health Data Consortium | 7/22/20 | | X |
| Inside the Virtual Care Boom: What happens when the point of care becomes anywhere?, STAT | 7/29/20 | | X |
| STAT Health Tech Summit | 9/9/2020-9/10/20 | | X |
| STAT Summit | 11/16/20-11/19/20 | | X |
| Shifting Privacy Laws and Health Data, Massachusetts Health Data Consortium | 2/2/21 | | X |
| ONC Annual Meeting | 3/29/21-3/30/21 | | X |
| Interoperability: Going Beyond Compliance: a Consumer Centric Approach, Massachusetts Health Data Consortium | 3/31/21 | | X |
| Vantage Point Series with Micky Tripathi, current National Coordinator of ONC, Massachusetts Health Data Consortium | 6/3/21 | | X |
| 2021 Center for Digital Health Virtual Conference: Leveraging Digital Health for the Post-Pandemic World, Brown University | 6/22/21 | | X |

| | | | |
|---|---|---|---|
| Primary Care at a Critical Crossroads, Massachusetts Health Quality Partners | 6/29/21 | | X |
| STAT+ Conversations: A conversation on scrutiny facing Epic's health care algorithms, STAT | 7/27/21 | | X |
| ONC Tech Forum - Part 1 | 9/10/21 | | X |
| ONC Tech Forum - Part 2 | 9/17/21 | | X |
| A Comprehensive Approach to Health Care Transformation: A Framework for Success, Massachusetts Health Data Consortium | 10/7/21 | | X |
| AHRQ National Web Conference on Clinical Decision Support, AHRQ | 10/19/21 | | X |
| Moving Integrated Care Delivery Forward with FHIR, Massachusetts Health Data Consortium | 10/21/21 | | X |
| Code Red: The Urgency of the Clinician Burnout Crisis, National Academy of Medicine | 12/8/21 | | X |
| CDH Seminar with Dr. Leo Celi "Better than Humans: Building AI that is less prejudiced, more fair", Brown University | 1/19/22 | | X |

I wrote fieldnotes during and after each event. When the events were in person, I jotted notes during presentations and then wrote up detailed notes afterwards. For virtual events, I was able to take detailed notes on my laptop during the event and then elaborate on them afterwards. Many of the virtual events were recorded and provided to participants afterwards. This allowed me to relisten to these events.

All fieldnotes were uploaded to NVivo. I used the same coding schema developed for the interviews. Because of my inductive approach, I also added themes that emerged as I coded the fieldnotes that were then applied to additional fieldnotes as well as interview transcripts.

*Limitations*

While the interviews yielded rich data on the professionals' experiences and perceptions of EHRs, I acknowledge the limitations of this study. First, the interviews are embedded primarily in one hospital system and nearly all interviewees use Epic as their EHR. Therefore, my findings are limited to this organizational setting and this EHR system. However, to address this limitation and to disentangle findings from the organizational context, I interviewed professionals outside of Marlowe Health. Second, an N of 25 is small. However, the interviews

yielded rich data and I had repeated engagement with a third of subjects, which provided a more in-depth understanding of their experiences. Combined with findings from the observations, I was able to reach saturation, especially for physicians' experiences. However, in future research I would continue to interview within Marlowe Health.

*Secondary Sources*

Finally, from 2018-2022, I engaged with a variety of secondary sources to stay up to date on the field of healthcare and the EHR industry. Through this practice, I developed and maintained my fluency in key topics and technology, which facilitated my engagement with subjects in interviews and observations. First, to stay up to date on news in the sector, I received daily/weekly emails from Becker's Hospital Review, STAT, CommonHealth at WBUR, and Healthcare IT News. Second, I reviewed professional associations' newsletters and journals to track topics and issues that were relevant to larger professional projects. For example, these were produced by the American Medical Association (AMA), American Health Information Management Association (AHIMA), and Healthcare Information and Management Systems Society (HIMSS). Third, I read data briefs, blog posts, and reports produced by the Office of the National Coordinator for Health Information Technology (ONC) to gauge the government's perspective on EHR policy. Fourth, I also tracked topics, news, and opinions via blogs, such as KevinMD, as well as Twitter and online forums, such as Reddit.

*Conclusion*

Taken together, this multi-method qualitative project produced a rich set of data to examine the law on the books and the law in action, and how these two sides of law shape and are shaped by a technology. The historical analysis maps out federal EHR policy. The resulting narrative highlights how key stakeholders constructed the EHR as a solution to larger crises in

healthcare, and how this understanding of the technology became codified into law as the HITECH Act. The subsequent regulatory process that created the Meaningful Use incentive program standardized the technology and led to the rapid adoption of EHRs across the US healthcare system. The fieldwork shows the implementation of this policy—highlighting the implications of the policy and its impact on professionals at Marlowe Health. While focused on a single hospital system, the fieldwork demonstrates the ways in which EHRs altered workflows, practices, and relationships. In addition, the interviews allow for an in-depth analysis of the professionals' perceptions of EHR and how they impacted their sense of autonomy.

By triangulating across these methods, the subsequent empirical chapters detail the process of how a law on the books comes to be and then how the law in action plays out. It also shows us how this law and technology interact to inform each other and the subsequent unintended consequences for its users.

*A Note on the COVID-19 Pandemic*

Finally, I'd like to acknowledge the impact of the COVID-19 pandemic on this dissertation. Initially, this project was going to focus solely on how the EHR impacted the autonomy of physicians, administrators, and health information technologists. Fieldwork was to be conducted in two hospital systems, where one used Epic and one used Cerner. This original design would have allowed me to examine variation in autonomy by organizational context and by the materiality of EHR systems. Data collection at the first hospital system, Marlowe Health, began in the fall of 2018. I planned to begin my fieldwork at a second hospital system in spring 2020, as well as continue research at Marlowe Health. However, in March 2020, access to my field sites was cut off as the COVID-19 pandemic began. My informants were unable to participate as they were on the frontlines, risking their lives, to continue to provide direct patient

care or adapt the delivery of care. They barely had time for themselves, yet alone for an interview on EHRs.

As the first wave of the pandemic subsided, the healthcare workforce was exhausted and still catching up on delayed care. I decided to focus my energies on interviews at Marlowe Health. I am grateful to the informants who took the time to speak with me, and especially to the informants who participated in a follow up interview to share their experiences with the EHR during the COVID-19 pandemic.

Recognizing the limitations in data collection introduced by the pandemic, I decided to pivot. I added the historical analysis of the federal EHR policy to the project. While I had always planned to explore this topic via secondary sources, the pause in fieldwork provided an opportunity to conduct a more in-depth analysis of primary sources. It was not planned, but overall, I find this pivot greatly enriches the empirics and theoretical contributions of this dissertation.

## Chapter 4: Legislating the Blueprints: An examination of how federal law led to the rapid adoption and implementation of Electronic Health Records (EHRs)

The EHR not only translates the paper medical record into an electronic format, but additional functionalities, such as clinical decision support and streamlined billing, make it a disruptive technology. These advances in functionalities promise to improve patient care while addressing the rising costs of healthcare (Hillestad et al. 2005; Pagliari et al. 2007; DesRoches et al. 2008; Angst 2009). However, despite these promises of clinical and administrative improvement, adoption of EHRs was slow until the late 2010s.

In fact, healthcare lagged behind other industries in the move to information technology. Although the earliest iterations of the EHR date back to the 1960s, as of 2005, only 24% of physicians had access to a basic EHR and 9% had access to an EHRs with more advanced functionalities such as e-prescribing (Jha et al. 2006). Despite the slow adoption rate, the EHR was identified as a key policy solution to the twofold crisis in US healthcare—rapidly rising costs that didn't produce higher quality of care. After much debate, Congress passed the American Recovery and Reinvestment Act (ARRA), which included the Health Information Technology for Economic and Clinical Health (HITECH) Act in 2009. This incentive program, commonly known as Meaningful Use, allocated $18 billion to support the adoption of EHRs across the US healthcare system and establish a system of federal governance over "a nationwide health information network" (Burke 2010:14; Manos 2014). By 2016, 96% of hospitals eligible to participate in the incentive program certified they were using an EHR system and 90% of hospitals had completed the first stage of Meaningful Use (Office of the National Coordinator for Health Information Technology 2017c). Therefore, this one policy massively altered the

adoption and diffusion of EHRs, creating an exogenous shock through the healthcare system as organizations and professions responded.

This seemingly successful policy intervention presents an opportunity to examine the role of law in the development and diffusion of a technology. In this chapter, I trace the legislative and regulatory history of federal EHR policy that resulted in the passage of the HITECH Act and its Meaningful Use incentive program[12]. This legislation not only provided the financial incentives to spur the rapid adoption and implementation of the EHR, but it also played a pivotal role in defining and standardizing the technology. The implications of this standardization of EHR design not only shifted the field towards commercial EHR systems but also impacted organizational workflows and clinical users' experiences. These implications will be examined in chapters 5-7.

**Results**

Although EHR technology has been around since the 1970s, the healthcare sector had yet to converge on a dominant design. Federal policy focused on other areas of HIT governance but had not yet passed a law that mandated EHR adoption and specified the necessary functionalities of a compliant system. To explore and understand the technology's and policy's ferment and eventual convergence on a dominant design/law, I now present the historical narrative of the HITECH Act.

The legislative and regulatory history divides into four periods. First, I establish the technological and policy context for the development and refinement of EHR policy, which corresponds to 2000-2003. Next, I focus on how the Federal government identified and debated the EHR as a policy solution from 2004-2008. Then I show how the federal government

[12] Refer to Appendix B for a timeline of this period.

converged on its policy in 2009 with the inclusion of the HITECH Act within the American Recovery and Reinvestment Act. Finally, I present how the Centers for Medicare and Medicaid Services (CMS) and the Office of the National Coordinator for Health Information Technology shaped the EHR's dominant design through its Meaningful Use incentive program. In each period, I show how the two cycles intersected through interactions between the technical side (innovators and users) and the policy side (politicians and policy advocates).

**2000-2003: Technology and Policy Context**

*Technology Context:*

With the advent of computers, innovations in information technology within the healthcare sector began to lay the foundation for the EHR. This transition from a paper to electronic system marked the start of a technical discontinuity, as the computer and EHR became a new tool that altered approaches to patient health data as well as work processes. These early systems focused on transitioning features of the medical record as well as translating workflows into an electronic format. Most were developed within academic medical centers to reflect the needs and workflows of their clinicians. Often, each medical specialty/department had their own unique system[13]. In addition, administrative systems were developed for patient scheduling and tracking. Beginning in the late 1970s and early 1980s, several EHR companies were founded, including Epic Systems Corporation (1979) and Cerner (1979). Other computer companies, such as IBM and Microsoft, began to develop products for healthcare as well. However, it should be noted that the market for EHRs remained small.

[13] Marlowe Health, where I conducted my fieldwork, had multiple homegrown EHR systems in place before transitioning over to Epic following the passage of the HITECH Act. There were separate systems for emergency medicine, cardiology, and two distinct outpatient systems. Inpatient care remained on paper. Prior to the HITECH Act, Marlowe Health was working with a vendor to implement a separate inpatient system that would integrate into their homegrown systems.

Over time advances in technology allowed the EHR to incorporate more functionalities. This included computerized provider order entry (CPOE) system, which allows the attending physician to enter care instructions that are quickly shared with members of the care team. It also included e-prescribing, where a patient's prescription could be recorded electronically and sent to the pharmacy. The EHR also facilitated the incorporation of medical standards into the treatment of patients by drawing on evidence-based medicine, which "…strengthen[s] the scientific base of health care and determine[s] the effectiveness of care" (Timmermans and Kolker 2004:177). These were often simple protocols that could be distilled down to a checklist for the provider to complete. Finally, prompts with reminders for immunizations and screening or alerts to potential negative interactions between prescribed medications were incorporated. It is important to note that while these functionalities were developed, they were not standard features in all EHRs. Rather, which functionality and the extent of its action, varied across EHR systems as well as organizational settings. The inclusion of these functionalities into the EHR led to an important distinction between a "basic" EHR, which acted primarily as a data repository for patient data, and a "comprehensive" EHR, which acted an integrated system that incorporated these advanced functionalities. However, there was variation in what advanced functionalities were included in a comprehensive EHR. This distinction between a basic and comprehensive EHR, as well as the heterogeneity in comprehensive EHRs, also highlights that by the early 2000s, there was not a single definition of what constituted an EHR (Jha et al. 2006). In addition, not only were the functionalities of the EHR not standard, the field had yet to converge on a single set of standards for data formatting as well as medical terminology. While a series of public-private organizations formed to set HIT standards, the industry hadn't agreed on a single set. Therefore, the healthcare sector hadn't converged on a dominant design for the EHR.

With this long ferment, the adoption and implementation of the EHR remained slow. Because there was not a single definition of an EHR, it was a challenge for researchers and policy advocates to measure a clear adoption rate. A comprehensive review of studies reported that as of 2005, only 24% of physicians had access to a basic EHR, while 9% had access to an EHRs with more advanced functionalities such as e-prescribing (Jha et al. 2006). This is a remarkably low adoption rate, especially when we consider how other industries had fully transitioned to computerized systems during this same time period, such as financing (Guthrie 1999). This slow adoption was attributed to clinicians' negative perceptions of EHRs and refusal to use them (Holden 2009); clinicians' lack of technical skills, poor EHR design, high costs of purchasing computer equipment and record systems, and time-consuming data entry (Colleen and Greenes 2015). In addition, several studies documented failed adoptions of EHR systems (Brown and Jones 1998; Sicotte et al. ; Stoop, Bal, and Berg 2007).

*Policy Context*

Despite this long, slow ferment, the EHR technology became linked as a one solution to a series of crises in US healthcare—improving the quality of patient care while also lowering the costs. One of the key sources of this policy framing was the Institute of Medicine (IOM), now known as the National Academy of Medicine (NAM). As a member of the National Academies of Sciences, Engineer, and Medicine, the IOM was founded in 1970 to operate as a nonprofit to "work outside the government to provide objective advice on matters of science, technology, and health" (National Academy of Medicine n.d.). Beginning in 2000, the IOM released a series of reports on the status of the US healthcare system that became significant reference points in the EHR policy debates.

IOM's Committee on Quality in Health Care in America[14] published *To Err is Human: Building a Safer Health System* in 2000. The report focused on medical errors in hospital settings and highlighted the frequency and potential causes of medical errors in a more systemic approach. IOM identified workflows, processes, and information gaps as contributing factors to devastating mistakes for patients. Most notably, the report presented the startling statistic that 98,000 people[15] die a year due to medical errors and that medication errors contributed to 7,000 of these deaths (Institute of Medicine (US) Committee on Quality of Health Care in America 2000). Although EHRs were not a prominent part of the report, as solutions focused more on developing transparency around medical error reporting and patient safety programs, these statistics were repeatedly cited as justification for EHRs in subsequent Congressional hearings on EHR policy. Because EHRs could provide clear, up to date information on patients, the EHR came to be seen as a potential solution to the crisis of medical errors.

In the following year, 2001, IOM released *Crossing the Quality Chasm, A New Health System for the 21st Century*. As a follow up report, the Committee on Quality in Health Care expanded its analysis of what constituted a gap in quality care. Its description of multiple factors that contributed to poor and unequal quality of care was extensive and it offered a series of proposals on redesigning the US healthcare system. As a pivotal report, IOM focused health policy attention on the need for systemic reforms to improve care and the overall healthcare system. Significantly for EHR policy, an entire chapter of the report focused on information

[14] This committee is part of the IOM's project, Quality of Health Care in America, which began in June 1998. The overall goal was to develop a strategy for "a threshold improvement in quality over the next ten years" (Institute of Medicine (US) Committee on Quality of Health Care in America 2000: foreword). William Richardson, President and CEO of the WK Kellogg Foundation, served as Chair of the 19-person committee. The committee represented a variety of stakeholders from across the healthcare sector.

[15] It should be noted that this 98,000 comes from a single study. The IOM report acknowledges several alternative numbers from different studies. But the 98,000 deaths statistic became the statistic that is continually referenced in Congressional Hearings by Senators, Representatives, and witnesses.

technology and called for establishment of a national health information infrastructure. By directly linking information technology to improving the quality of care, the report strengthened the perceived promises of EHRs.

Following these reports, the Department of Health and Human Services (DHHS) contracted with IOM to examine the federal government's health quality enhancement processes. In 2003, IOM published its findings in *Leadership By Example: Coordinating Government Roles in Improving Health Care Quality.* Notably for EHR policy, the report found that Computerized Order Entry (COE) and EHRs have "been found to result in measurably improved health care and better outcomes for patients" (Institute of Medicine (US) 2003:110). These conclusions reiterated the importance of EHRs as one solution to addressing the continued quality gap in care.

Finally, in 2003, the IOM released a fourth report titled *Patient Safety, Achieving a New Standard of Care*. Building on its previous reports, IOM argued that to achieve a culture of safety in healthcare, a new health care delivery system is needed. Integral to this goal is the development of national health information infrastructure. The report outlines data standards necessary for health information exchange and analysis to support patient safety initiatives. These policy recommendations again reiterated the need for expanded HIT/EHR adoption and highlighted the need for standards to support information exchange/interoperability.

Overall, these four reports provided important context for the EHR policy debates in the early 2000s. They explicitly link HIT and EHRs as one solution to improving the quality of care and preventing medical errors. These reports are frequently cited in Congressional hearings by Representatives, Senators, and witnesses.

Finally, while federal law had not explicitly addressed EHRs, there were two laws that set important precedent and informed subsequent policy debates. The Health Insurance Portability and Accountability Act (HIPAA)[16] was the first law to address the electronic transactions for billing health insurance as well as set standards for protecting the privacy and security of health information in paper and electronic format. Despite its passage in 1996, the federal government did not finalize its rules till 2002 and HIPAA did not go into effect till 2003 and 2005. While the actual law did not address EHRs specifically, it did two important things. First, it set a precedent for federal involvement in setting HIT standards. Second, it set the privacy and security standards that would be applied to and expected of EHRs.

The other law was the Medicare Modernization Act (MMA) passed in 2003. While primarily focused on prescription drug benefits, it included two provisions relevant for EHR policy. First, a provision required DHHS to adopt final electronic prescribing standards by 2008. The lack of standards was seen as a barrier not just to e-prescribing, but also to the widespread adoption of EHRs. DHHS's role in standard adoption would come to be seen as a potential model for EHRs and other forms of HIT. The second provision provided grants to physician offices to purchase electronic prescribing systems. Financial costs of EHR systems were seen as another barrier to adoption and so this MMA grant program became an often-cited model for overcoming the cost burden of EHRs.

By 2003, the EHR technology cycle was still in ferment and adoption rates remained low. There was not a single definition of what constituted an EHR. However, federal policy began to increasingly recognize the promise of EHRs to prevent medical errors, improve quality of care, and lower costs, especially following the release of IOM's reports.

[16] For a full history of the passage of HIPAA see Suchman and Brennan working paper.

**2004-2008: Federal Activity**

The federal government's focus on health information technology, and especially EHRs, began in earnest in 2004. On April 27, 2004, after addressing a crowd about the future of healthcare at the VA Medical Center in Baltimore, MD, George W Bush signed Executive Order 13335, which outlined his "policy vision for nationwide interoperable HIT infrastructure that:

> (a) Ensures that appropriate information to guide medical decisions is available at the time and place of care;
> (b) Improves health care quality, reduces medical errors, and advances the delivery of appropriate, evidence-based medical care;
> (c) Reduces health care costs resulting from inefficiency, medical errors, inappropriate care, and incomplete information;
> (d) Promotes a more effective marketplace, greater competition, and increased choice through the wider availability of accurate information on health care costs, quality, and outcomes;
> (e) Improves the coordination of care and information among hospitals, laboratories, physician offices, and other ambulatory care providers through an effective infrastructure for the secure and authorized exchange of health care information; and
> (f) Ensures that patients' individually identifiable health information is secure and protected" (Executive Order 13335, 2004).

This framework reflects many of the promises of EHR technology that had been percolating within policy circles and notably within the IOM reports. To accomplish this vision, Executive Order 13335 also established the Office of the National Coordinator for Health Information Technology (ONC) in the DHHS. This position was tasked with leading the development of a nationwide interoperable health information technology infrastructure and its subsequent implementation with the goal of all Americans having an EHR by 2014. It was an ambitious 10-year goal considering the state of the technology and healthcare in 2004, but a goal that was ultimately accomplished. This section examines the legislative process that produced the bill that would make this goal a reality.

*The ONC*

Following the Executive Order, Dr. David Brailer was appointed the first National Coordinator of HIT on May 6, 2004. Brailer was an internal medicine physician and an entrepreneur who founded CareScience—an application service provider that focused on improving efficiency and preventing errors within hospitals. He played a key role in establishing the position of ONC and was a frequent witness at Congressional hearings, where he provided reports and updates on the status of HIT adoption.

On July 21, 2004, the ONC hosted a Health IT Summit. Brailer and DHHS Secretary Tommy Thompson released a framework, *The Decade of Health Information Technology: Delivering Consumer-centric and Information-rich Health Care.* Per Secretary Thompson, this served as new strategic information technology framework to "guide discussion, investigation and experimentation to accelerate widespread adoption of HIT in both public and private sectors" (Health Information Technology: Improving Quality and Value of Patient Care, 2004). The four overarching goals included: the use of HIT to inform clinical practice, interconnect clinicians via HIT, provide personalized care via the information in HIT, and improve population health. This framework set expectations as well as the strategic vision for HIT governance under the Bush administration.

During this period, ONC also coordinated with a series of public-private organizations to examine and address HIT policy and standards. These organizations primarily focused on questions of data formatting, data integrity, and data harmonization in order to formalize standards that were considered foundational for interoperable EHR systems. In addition, these partnerships set an important precedent for the ONC. Its role would be to facilitate the standard setting process while still allowing stakeholders within the industry to make and review key standard setting decisions. These four organizations included the National Health Information

Network (NHIN), Healthcare Information Technology Standards Panel (HITSP), the Certification Commission for Health Information Technology (CCHIT), and American Health Information Community (AHIC) Their work would serve as models for the HITECH Act. However, it must be noted that the standard setting process continued to be slow during this period.

One organization was the National Health Information Network (NHIN), which was created by ONC in 2004. Its goal was to "improve the quality and efficiency of care by creating the mechanism that would allow for a nationwide health information exchange" (Office of the National Coordinator for Health Information Technology n.d.). As a public-private entity, it worked to set the standards for secure data interchange—essentially establishing the possibility of interoperability.

A second organization was the Healthcare Information Technology Standards Panel (HITSP), which was founded on October 6, 2005. ONC selected the American National Standards Institute (ANSI), Health Information and Management Systems Society (HIMSS), ATI, and Booz Allen Hamilton to conduct a standards harmonization initiative.

A third organization was the Certification Commission for Health Information Technology (CCHIT)—a voluntary, private sector organization founded in 2004 by the American Health Information Management Association (AHIMA), the Healthcare Information and Management Systems Society (HIMSS), and the National Alliance for Health Information Technology (NAHIT)[17]. CCHIT developed the first comprehensive definition of capabilities needed in EHRs for providers and healthcare organizations. In 2005, CCHIT was awarded a three-year contract from DHHS to "assess the certification method and examination process for electronic health

[17] The founding members represent the main professional associations in the field of health information management. For an overview of the HIM profession see Suchman and Dimick 2010.

record vendors and find ways to help streamline the process and make the information more readily available for everyone" (CCHIT 2015). By 2006, CCHIT created EHR certification programs with ONC, to certify whether the EHR was in compliance with the harmonized standards set by HITSP. Per CCHIT, they certified over 200 EHR programs that made up 75% of the marketplace by mid 2009 (CCHIT 2015). This certification process would be incorporated into the HITECH Act as criteria for receiving incentive payments.

Finally, to coordinate across these organizations and set priorities, DHHS Secretary Levitt established the American Health Information Community (AHIC). As another private-public partnership, it advised DHHS on policies and standards that would contribute to achieving the goal laid out in Bush's Executive Order 13335.

Together these organizations worked to set the standards and policies that would be adopted/used by the EHR industry. Their work and reports were presented at Congressional hearings throughout this period, thereby informing not just on the status of the slow push towards standardization but also offering a model of how to accomplish this work in a fragmented industry. Overall, these public-private organizations provided space for innovators, clinical users, healthcare administrators, and policymakers to interact and influence both the technology and policy cycles.

*Congressional Activity*

While the ONC was coordinating with stakeholders in the healthcare industry, Congress also began to consider their role in supporting the widespread adoption and implementation of EHRs. From 2004-2008, Congress held 23 hearings on EHRs and introduced 12 bills (four in the Senate and eight in the House—see Table 4.1). These documents show an envisioned future where interoperable EHRs would improve the quality of care while reducing costs—a twofold

solution to the crisis in US healthcare, e.g., a policy discontinuity. Surprisingly, there was bipartisan support for the President's vision of a nationwide EHR system. Both Democrats and Republicans drew on the same policy reports, statistics, and research studies to argue in favor of the need for widespread adoption and implementation of EHRs. While partisan divergence focused on funding mechanisms to support EHR adoption, there continued to be overwhelming bipartisan support for the EHR.

The EHR became linked to healthcare policy as a solution and a necessary step for additional healthcare reform, because of its perceived ability to accomplish three tasks: reduce medical errors, improve the quality of patient care, and reduce the cost of healthcare. These tasks echoed the promises outlined in the IOM reports and were repeated throughout the Congressional hearings. The EHR would reduce medical errors by ensuring that clinicians had access to accurate patient information on which they based their clinical decision-making, which in turn would also improve the quality of patient care. Advanced functionalities would also improve the quality of patient care by incorporating evidence-based medicine guidelines. Finally, the EHR would reduce the costs of healthcare. Both a 2005 RAND study and a Center for Information Technology Leadership (CITL) study suggested that the widespread adoption of EHRs would result in $80 billion in savings a year (Girosi, Meili, and Scoville 2005; Walker et al. 2005). While a 2008 CBO report challenged these studies' estimates (Congressional Budget Office 2008), their conclusions of significant cost savings became strongly associated with the EHR and frequently cited in Congressional hearings. Overall, the promise of whether EHRs would accomplish these tasks was never questioned by policy makers. Rather, the Congressional hearings sought to understand why healthcare lagged so far behind in IT adoption compared to

other industries and what role the federal government could play in making the envisioned technological promises of an interoperable EHR a reality.

The promise of EHRs were reinforced by witnesses at Congressional hearings including physicians, administrators, industry representatives, and patient advocates. During this period, 182 witnesses either spoke or submitted testimony across 23 hearings (see Appendix B for the numbers of each organizational type a witness represented between 2004-2008). The most frequent type of witness came from federal agencies. These 36 representatives spoke on behalf of the ONC, DHHS, CMS, Veterans Affairs, and the General Accountability Office. A close second is industry representatives at 22 with a mix of EHR and HIT vendors and larger IT companies, such as IBM and Microsoft. Interestingly, the two major EHR companies, Epic and Cerner, that would come to dominate the market following the passage of HITECH Act did not participate. Representatives from healthcare organizations/hospitals and medical professional associations also each had 22 representatives speak at hearings. The frequency of these four witness types suggest that their perspectives and experiences played an important role in framing Congress' understanding of EHRs during the policy ferment.

Across the hearings, witnesses also echoed support for EHR adoption. Early adopters of EHRs, (physicians, researchers, and hospital systems) touted the technology's ability to facilitate access to patient information, which in turn improved quality of care and cut costs by avoiding duplicate testing. For example, Dr. Andrew Wiesenthal, Associate Executive Director of Kaiser Permanente testified before the House Subcommittee on Health:

> Why did we decide to implement a comprehensive electronic medical record at this time? It was a strategic imperative. To make a major leap forward in terms of quality improvement, service, patient safety, care coordination, efficiency, effectiveness, and job satisfaction, we needed to take the risk. The overriding goal of Kaiser Permanente HealthConnect is quality improvement. Once fully implemented, patient medical information and clinical decision support will be

> available on a 24 hours-a-day, 7 days-a-week, 365 days a-year basis, and more than one clinician will be able to use a single patient's information simultaneously. Having the complete medical record available makes it possible for physicians to be aware immediately of all patient issues, test results, history, and concerns, as well as recommendations the patient has received from other clinicians. Clinicians will always be able to work with the most current information and provide the best care and service possible" (Health Care Information Technology 2004:51)

Dr. Wiesenthal continues in his testimony to explain that Kaiser Permanente had been an early adopter of EHR. As a large, multistate hospital system, they saw the technology as clinically and administratively necessary. Despite the challenges of adopting a new system, Dr. Wiesenthal continued to emphasize the improvements to quality care—sharing examples of how the EHR transformed his ability to provide faster and more accurate care. While other early adopters of EHRs acknowledged initial challenges to adoption, they reiterated that these were temporary and pointed to the overall benefits of the systems.

There were several barriers to adoption that were repeatedly cited by witnesses across the hearings. The first was cost. Investing in an EHR system –whether purchasing from a vendor or developing in house— was expensive. In addition to the system itself, providers had to factor in the costs of computer hardware, HIT/IT employees to support the system, training, and yearly maintenance and upgrades. Several witnesses cited Miller's 2005 study that estimated the cost of an EHR system to be $44,000.00 on average per physician and $8500.00 per physician for annual maintenance fees (Hearing on Promoting the Adoption and Use of Health Information Technology 2008). Early adopters also pointed out the learning curve associated with adopting a new system. During the initial adoption period, they would have to cut back on patient visits. Because of the fee-for-service model of reimbursement, this meant a loss of revenue, which compounded the costs associated with purchasing a system. Therefore, witnesses called for federal support in the forms of grants or tax credits that could help offset the costs of an EHR

system. This was seen as especially critical for independent practices and rural healthcare organizations.

A second barrier was the lack of standards in the EHR industry. Keep in mind that while the ONC was coordinating across the four standard setting organizations during this time period, they had yet to converge on a single set of standards. Witnesses recounted concerns from physicians and healthcare organizations that they would purchase an EHR system that would be incompatible with another EHR system, thus making interoperability impossible. In addition, witnesses were concerned that the federal government would eventually set standards that were incompatible with products on the market. Again, this would force physicians and healthcare organizations to purchase new systems, which reiterates the concern for costs. Witnesses called for the federal government to step in and assist with standard setting.

A third barrier was continued concerns over patient privacy. Although the new HIPAA regulations introduced standards for protecting the confidentiality of health information, it had just gone into effect in 2003 and implementation was still underway. Also, the Security Rule wouldn't go into effect until 2005. There were still questions over the effectiveness of HIPAA as a framework for privacy. Some witnesses felt that HIPAA did not go far enough and advocated for tweaks to improve the rules. Others argued that HIPAA needed to be overhauled and replaced with new regulations.

These three barriers came to represent the challenges that the federal government needed to address in order to help the healthcare sector adopt EHRs. Once identified, legislators and various stakeholders were able to focus on proposed solutions that could be translated into law.

*Proposed Legislation*

While the hearings addressed general questions about HIT and EHRs, they also focused on a series of proposed legislation that would foster the widespread adoption of EHRs. From 2005-2008, 12 bills were introduced – four in the Senate and 8 in the House (See Table 4.1[18]). Half of the bills had bipartisan co-sponsors.

**Table 4.1:** Congressional Bills on EHR/HIT 2005-2008

| Date | Bill # | Action | Title | Sponsor | Co-Sponsors | R | D | I |
|---|---|---|---|---|---|---|---|---|
| 6/30/05 | S1355 | Introduced | Better Healthcare Through Information Technology Act | Enzi, Michael B R-WY | 20 | 11 | 8 | 0 |
| 7/18/05 | S1418 | Passed Senate, 11/18/05 | Wired for Health Care Quality Act | Enzi, Michael B R-WY | 20 | 10 | 9 | 1 |
| 10/27/05 | HR4157 | Passed House, 7/26/06 | Health Information Technology Promotion Act of 2006 | Johnson, Nancy Lee R-CT | 31 | 31 | 0 | 0 |
| 12/18/05 | HR4642 | Introduced | Wired for Health Care Quality Act | Issa, Darrell E R-CA | 0 | 0 | 0 | 0 |
| 2/8/06 | HR4726 | Introduced | Wired for Health Care Quality Act | Issa, Darrell E R-CA | 2 | 1 | 1 | 0 |
| 5/17/07 | HR2377 | Introduced | Assisting Doctors to Obtain Proficient and Transmissible Health Information Technology (ADOPT HIT) Act of 2007 | Gingrey, Phil R-GA | 1 | 1 | 0 | 0 |
| 6/26/07 | S1693 | Introduced | Wired for Health Care Quality Act | Kennedy, Edward D-MA | 16 | 12 | 4 | 0 |
| 7/12/07 | S1783 | Introduced | Ten Steps to Transform Health Care in America | Enzi, Michael B R-WY | 0 | 0 | 0 | 0 |
| 10/10/07 | HR3800 | Introduced | Promoting Health Information Technology Act | Eshoo, Anna D-CA | 13 | 6 | 7 | 0 |
| 4/24/08 | HR5885 | Introduced | Health Information Technology Promotion Act of 2008 | Burgess, Michael R-TX | 0 | 0 | 0 | 0 |
| 6/4/08 | HR6179 | Introduced | Promoting Health Information Technology Act of 2008 | Camp, David R-MI | 13 | 13 | 0 | 0 |

[18] Table 4.1 replicates data from Chapter 3's Table 3.2 on page 43. However, it is scoped to include the bills that were introduced and considered from 2005-2008. I include this table here again as a reference for readers.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 6/24/08 | HR6357 | Introduced | PRO(TECH)T Act of 2008<br>Protecting Records, Optimizing Treatment, and Easing Communication through Healthcare Technology Act of 2008 | Dingell, John D-MI | 12 | 7 | 5 | 0 |

There were key components that were shared across the bills. These include:

- Codifying the ONC as a permanent office within DHHS. The National Coordinator is charged with leading/overseeing the implementation of HIT and the development of a nationwide HIT infrastructure
- Creating a public-private stakeholder organization, most frequently referred to as the American Health Information Collaborative or Partnership for Health Care Improvement, to advice DHHS on HIT policies and standards
- Supporting the development of standards for HIT
- Creating grant programs to facilitate the purchasing and enhancement of HIT systems
- Creating a Health Information Technology Resource Center to provide technical assistance and best practices
- Developing quality metrics to measure quality and effectiveness of health care
- Adding new privacy provisions to address gaps and strengthen HIPAA

Table 4.2 shows the frequency of these policy components across the twelve bills.

**Table 4.2**: Key EHR Policy Components by Congressional Bill on EHR/HIT 2005-2008

| | S1355 | S1418 | HR4157 | HR4642 | HR4726 | HR2377 | S1693 | S1783 | HR3800 | HR5885 | HR6179 | HR6357 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Codifying the ONC as a permanent office within DHHS. The National Coordinator is charged with leading/overseeing the implementation of HIT and the development of a nationwide HIT infrastructure | X | X | X | X | X | | X | X | X | | X | X | 10 |
| Creating a public-private stakeholder organization, most frequently referred to as the American Health Information Collaborative or Partnership for Health Care Improvement, to advice DHHS on HIT policies and standards | X | X | X | X | X | | X | | X | | | X | 8 |
| Supporting the development of standards for HIT | X | X | X | X | | X | | | | | X | X | 7 |
| Creating grant programs to facilitate the purchasing and enhancement of HIT systems | X | X | X | X | X | X | X | X | X | | X | X | 11 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Creating a Health Information Technology Resource Center to provide technical assistance and best practices | | X | | | X | | X | X | X | | X | X | 7 |
| Developing quality metrics to measure quality and effectiveness of health care | X | X | | X | X | | X | | X | | | | 6 |
| Adding new privacy provisions to address gaps and strengthen HIPAA | | X | * | | X | | X | | X | | X | X | 6 |

* HR4157's privacy component stated that it would alter the scope of HIPAA.

Across the twelves bills, the most common policy components focused on creating grant programs to facilitate the purchase of EHRs (11 out of 12) and the codification of the ONC (10 out of 12). The involvement of a public-private stakeholder organization was also frequently included (8 out of 12). The other components appeared in at least half of the bills. One bill, HR5885, did not contain any of these common policy provisions. Instead, it focused on creating safe harbors from criminal and civil penalties associated with anti-kickback laws, which had been identified as a potential barrier to EHR adoption. The bill also promoted telehealth. While these two policy components were found in a couple of the other bills (anti-kickback safe harbor HR4157; telehealth HR4157, S1693, HR6179), they were not frequent policy features.

Overall, these shared provisions suggest that policy was beginning to converge on a dominant legal design. These provisions reflected a vision of a federal agency, the ONC, facilitating a public-private endeavor to standardize the EHR technology and encourage their adoption through financial incentives. It's important to note that the involvement of key stakeholders in these public-private entities suggested that innovators and users of EHRs would have an important role in advising and shaping the standards.

Yet despite bipartisan support and similar provisions, most of these bills didn't gain traction to move through the policy cycle. Only two bills in the 109th Congress passed their respective chambers. In 2005, the Senate was able to reach a bipartisan consensus on EHRs and passed the Wired for Health Care Quality Act with unanimous consent. Meanwhile, House Republicans introduced and passed the Health Information Technology Promotion Act of 2006 as an alternative to the Wired for Health Care Quality Act on July 27, 2006 (270 R-148 D). While the two bills shared many of the same provisions outlined above, the key difference that emerged during the Congressional floor debates was whether and the extent to which the federal

government should offer financial assistance to offset the costs of EHR systems. The Senate bill offered grants to healthcare organizations, while the House bill limited grants to small physician practices in medically underserved areas. During the House debate on its bill, prior to its passage, Democrats argued that the Senate's bill should be picked up instead. Both bills were sent to the other chamber, but no further action was taken. In the following years, iterations of these bills were introduced but they never moved out of committee.

During this period, the federal government identified EHRs as a policy solution to larger healthcare crises. Witnesses from Congressional hearings highlighted the barriers to EHR adoption, which allowed policy to converge on a set of policy challenges and potential policy solutions. Yet despite bipartisan enthusiasm, which was grounded in evidence presented by Congressional witnesses, Congress was unable to pass a bill. Thus, the policy ferment continued.

**2009: The passage of the HITECH Act**

Despite the legislative activity from 2004-2008, the proposed bills failed to gain enough traction to pass in both chambers and become law. By January 2009, Washington DC was preparing for the inauguration of Barack Obama as the 44th president and facing the continued crisis of the Great Recession. Representatives in both the House and Senate saw this as an opportunity to finally pass HIT legislation. Especially for Democrats, who now controlled Congress, the EHR was considered a necessary foundational step to support the Obama administration's plans for healthcare reform. Provisions to support the adoption of EHRs soon became linked to the stimulus package.

Within the first weeks of the 111th Congress, two hearings were held on EHRs. The first hearing was held by the Senate Committee on Health, Education, Labor, and Pensions on January 15, 2009, the week prior to President Obama's inauguration and on the day that Senators

Biden and Clinton gave their farewell speeches on the Senate floor. Senator Mikulski (D-MD) opened the hearing by connecting it to a Working Group on "Quality Healthcare: The Means for Saving Lives and Saving Money", which was established by Senator Ted Kennedy (D-MA). Senator Mikulski made it clear that HIT not only has the potential to improve healthcare but tied to healthcare reform and the stimulus. She said,

> The purpose today is to talk about health IT, and everybody sees it as a silver bullet. Well, we believe it is one of the major tools and that we cannot do healthcare reform without it. It is also being discussed in the stimulus. So we want to get the best views and the best thinking. (Investing in Health IT: a Stimulus for a Healthier America 2009: 2)

The witnesses, and the hearing itself, focused on the potential of HIT and how to overcome barriers to adoption. Much of the same themes from the prior period were repeated here.

The second hearing on January 27, 2009, Health Information Technology: Protecting America's Privacy in the Digital Age, was held the day after the House introduced HR 1: The American Recovery and Reinvestment Act, i.e., the federal stimulus package. While the hearing focused on the gaps and challenges to patient privacy, it also focused on whether EHRs should be included in the stimulus bill or kept as a separate bill. While the Democratic senators saw this connection as an opportunity, Republican senators saw them as two separate legislative issues. Senator Orrin Hatch (R-UT), stated,

> Unfortunately, we might not have a chance to reintroduce this bipartisan legislation again in this Congress since health IT is now being addressed through the stimulus legislation. Now, regretfully, this language was crafted without the input of Republican offices, including mine, who have demonstrated longstanding interest in this important bipartisan issue (Health Information Technology: Protecting Americans' Privacy in the Digital Age 2009:3).

While EHR policy was long recognized as a bipartisan issue, the approach to including it in the stimulus package was considered partisan maneuvering by Republicans.

Overall, these two hearings echoed the promises of EHRs that had been discussed in the previous four years of hearings. They highlighted the potential to improve the quality of care by having accurate patient information readily available to clinicians within and across organizations to support clinical decision-making. This in turn would lower costs by eliminating duplicate testing and procedures. However, concerns over standard setting and patient privacy persisted. While the standards organizations were making progress, witnesses still raised the concern that these standards would be set too late and contradict what providers had already purchased/developed. In addition, privacy advocates emphasized the implications for patient privacy by expanding HIT and access to this information. Advocates, such as the Center for Democracy and Technology, questioned the adequacy of HIPAA's framework to protect patient's privacy. Debate emerged as to whether HIPAA's governance could be improved upon or whether it should be scratched in favor of new regulations that would overcome its weaknesses.

Congress attempted to address these policy challenges by including Title XIII: The Health Information Technology for Economic and Clinical Health (HITECH) Act within HR 1: The American Recovery and Reinvestment Act. The proposed bill included provisions to permanently establish the Office of the National Coordinator for Health Information Technology and create "incentive payments for certain eligible physicians and hospitals that adopt and use certified EHR technology meaningfully" (H.R.1). These provisions reflected similar proposals from prior bills – primarily the Senate's bipartisan Wired for American Health Act –suggesting that federal policy finally converged on dominant policy plan.

Within 23 days of its introduction, the American Recovery and Reinvestment Act became law on February 17, 2009. The HITECH Act officially codified the Office of the National

Coordinator for Health Information Technology (ONC); created the public-private Health Information Technology Policy Committee (HITPC) and Health Information Technology Standards Committee (HITSC); enhanced HIPAA enforcement and privacy protections; and established an incentive program to encourage the adoption and implementation of certified EHRs for "meaningful use". These provisions would not only expedite the adoption of EHRs by pumping $18 billion into the healthcare sector, but they would inform the standardization and design of the EHR so that it would fulfill the promises as outlined in policy reports and Congressional hearings. The next section will focus on how this happened.

**2010-2017: CMS EHR Incentive Program, Meaningful Use**

While the HITECH Act introduced a series of provisions to encourage the adoption and implementation of EHRs, the most significant was the creation of the "Medicare and Medicaid Programs; Electronic Health Record Incentive Program", commonly known as Meaningful Use. Developed by the Centers for Medicare and Medicaid (CMS), Meaningful Use created a multi-stage process by which eligible providers and eligible hospitals could receive financial incentives if they adopted and certified the use of an EHR that met specific standards. The program also introduced financial penalties by reducing Medicaid/Medicare reimbursements for those who refused to use an EHR. Taken together, this carrot and stick approach proved to be an effective strategy for encouraging the widespread adoption and implementation of EHRs. Recall that in 2005, only 25% of hospitals had a basic EHR (Jha et al. 2006) but by 2015, 96% of hospitals had an EHR (Office of the National Coordinator for Health Information Technology 2017c). This is a truly remarkable result for a 4-year program.

However, Meaningful Use did more than funnel $18 billion into the healthcare sector to support the purchasing and upgrading of EHR systems. The program also played a critical role in

shaping the innovation and trajectory of EHRs. By setting core objectives that eligible recipients must attest to/demonstrate use; the program set, framed, and prioritized EHR functionalities. In addition, CMS drafted its program in close consultation with the newly codified ONC and its HIT Policy Committee (HITPC) and HIT Standard Committee (HITSC). These three organizations played a critical role in the formulation of the Meaningful Use program. Both the HITPC and HITSC were public-private partnerships, thereby providing a space for not only clinicians and healthcare administrators to weigh in but also private industry and patient advocate groups as well. Refer to Appendix D for a table of HITPC and HITSC members. Thus, Meaningful Use not only helped to offset the financial costs associated with EHR adoption, but it also drove standard setting and framed what constituted the "meaningful use" of EHRs, especially at an accelerated pace of innovation and adoption. Thus, now that the law had converged on a dominant policy design, it led to the convergence on a dominant EHR design.

*Drafting the EHR Incentive Program and the Rulemaking Process*

While the HITECH Act provided provisions for a federal incentive program to encourage the adoption of EHRs, it left the specifics of that program to be determined by the Secretary of DHHS. Since the incentive payments were tied to Medicare reimbursement, the development of the program was delegated to CMS. To ensure that this federal money would go towards accomplishing the goal of an interoperable nationwide EHR system, the law stated that eligible professionals (EPs)[19], eligible hospitals[20] and Critical Access Hospitals[21] (CAHs) "must

[19] An Eligible Professional (EP) is a non-hospital-based physician/provider who receives money under Medicare's FFS program or is employed/contracted with a qualifying MA organization. This is the largest category.
[20] An Eligible hospital receives money under Medicare FFS program or is employed/contracted with a qualifying MA organization.
[21] A Critical Access Hospital or Children's Hospital is certified participant of the Critical Access Hospital Program. These hospitals are located in and serve rural communities that are a long distance from emergency care. This program was created by the 1997 Balanced Budget Act.

demonstrate meaningful use of certified EHR technology (CEHRT)" (Centers for Medicare & Medicaid 2022).

The HITECH Act identified three components of Meaningful Use "1. Use of certified EHR in a meaningful manner (e.g., e-prescribing); 2. Use of certified EHR technology for electronic exchanged of health information to improve quality of health care; 3. Use of certified EHR technology to submit clinical quality measures (CQM) and other such measures by the Secretary" (H.R. 1). Each of these components of meaningful use reflect the themes/promises of the technology presented in the Congressional hearings. First, use refers to the functionalities of the EHR system, such as e-prescribing, CPOE, etc., that providers would use in their everyday work. In addition, HITECH required that the EHR be certified that it meets the federally issued standards. Second, exchanging information via interoperable systems would allow providers to have a patient's most accurate, up to date information. Third, the inclusion of clinical quality measures in EHRs allows the federal government, as well as the EHR vendors and their users, to use the data within the EHR to evaluate the quality of care provided and then use it to improve their work.

Both the ONC and CMS worked closely to develop a program that would meet the requirements laid out in the HITECH Act. However, the recommendations from ONC via the HITPC and HITSC were integral in defining both the incentive program and the standards for the certified EHR program.

The newly codified ONC began to put its provisions into action. Dr. David Blumenthal became the new Coordinator on April 20, 2009, replacing Dr. Robert Kolodner who had served in this role since 2006. Dr. Blumenthal was a practicing primary care physician at the Massachusetts General Hospital and professor at Harvard Medical School. ONC first established

the HITPC[22] and HITSC[23]. Each committee represented a variety of key stakeholders that "represent a balance among various sectors of the health care system so that no single sector unduly influences the recommendations of [either] Committee" (H.R. 1). Interestingly, it is here in these committees that we see more direct participation from the EHR industry. For example, Judy Faulkner, founder and CEO of Epic Systems Corporation, was on HITPC. While the committees' focus was different (policy vs. standards), each one formed working group, held hearings, and created additional space to receive stakeholder feedback. Through this iterative, public process, HITPC and HITSC wrote recommendations that were sent to the National Coordinator. The HITPC recommendations were influential in establishing the Meaningful Use program, while the HITSC's work on data integration, data exchange, and data standardization informed the EHR certification program.

Following the regulatory process, CMS released a Notice of Proposed Rule Making (NPRM) for the Medicare and Medicaid Programs; Electronic Health Record Incentive Program on January 3, 2010. The proposed regulations were pursuant to the section in ARRA that called for the development of incentive payments for eligible groups that use certified EHRs and would allow for the program to meet HITECH's dates for when incentive payments could begin to be released: October 1, 2010 for eligible hospitals and January 1, 2011 for eligible professionals

[22] HITECH designated HITPC membership included: 3 appointed by the Secretary of DHHS (and 1 is a public official; 4 appointed by the Senate Majority Leader, Senate Minority Leader, Speaker of the House of Representatives and Minority Leader of the House of Representatives; and other members appointed by the President to represent relevant federal agencies. In addition, 13 members are appointed by the Comptroller General to represent different stakeholders including: 3 patient/consumer advocates; 2 healthcare providers (1 must be a physician); 1 labor organization for healthcare workers; 1 expert in health information privacy and security; 1 expert in "improving the health of vulnerable populations"; 1 researcher; 1 health plan or third party payer; 1 information technology vendor; 1 purchaser or employer; and 1 expert in health care quality and reporting (H.R. 1)

[23] The HITSC membership was not as specifically listed compared to the HITPC. Instead, the HITECH Act simply said it'll "at least reflect providers, ancillary healthcare workers, consumers, purchasers, health plans, technology vendors, researchers, relevant Federal agencies, and individuals with technical expertise on health care quality, privacy and security, and on the electronic exchange and use of health information" (H.R.1).

(EPs). The comment period ended on March 15, 2010. CMS recorded over 2,000 comments (CMS.gov 2010). This rule also referenced two separate yet related proposals that were issued by the ONC. This included an interim rule to specify the initial set of standards, implementation, specifications, and certification for EHRs, as well as a proposed process for organizations to certify their EHR technology. This reiterates the close coordination between CMS, ONC, HITPC, and HITSC.

On August 2, 2010, CMS issued its Final Action on the Medicare and Medicaid Programs; Electronic Health Record Incentive Program, commonly known as Meaningful Use. The Final Rule went into effect on September 27, 2010. In the Final Rule, CMS addressed the public comments and explained whether/how they adjusted the proposed rule in response to feedback. Ultimately, CMS decided to create a graduated program with three stages. Therefore, for each stage, CMS in conjunction with ONC would follow the regulatory process and release a proposed rule, solicit comments, and then issue a final rule for that specific stage. This allowed CMS and ONC to adjust program requirements based on speed of technological innovation as well as from experiential feedback from eligible participants.

*The EHR Incentive Program, Meaningful Use*

For Meaningful Use, CMS decided to create a graduated program with three stages. They justified this decision because:

> Such a phased approach encompasses reasonable criteria for meaningful use based on currently available technology capabilities and provider practice experience, and builds up to a more robust definition of meaningful use, based on anticipated technology and capabilities development. The HITECH Act acknowledges the need for this balance by granting the Secretary the discretion to require more stringent measures of meaningful use over time. Ultimately, consistent with other provisions of law, meaningful use of certified EHR technology should result in health care that is patient centered, evidence-based, prevention-oriented, efficient, and equitable (Office of Federal Register 2010).

Acknowledging the state of EHR technology in 2009-2010, CMS and ONC viewed a 3-stage program as necessary to allow for innovation to catch up with its goals. The first stage (2011-2012) focused on data capture associated with a basic EHR, the second stage (2014) focused on using the data in the EHR to improve clinical processes and begin information exchange. The third stage (2015) focused on interoperability and improving health outcomes. Each stage's requirements shifted the EHR from a basic data repository toward the envisioned EHR from earlier policy debates.

For each stage, there was a set of core objectives and menu objectives. The core set of objectives were functionalities that the EHR must contain and perform at a certain threshold. For example, in Meaningful Use stage 1, a core objective was "maintain an up-to date problem list of current and active diagnoses" and to be in compliance, eligible providers and organizations needed to certify that "more than 80% of all unique patients" had a problem list created and updated (Office of Federal Register 2010). Thus, to receive incentive payment, the eligible provider, hospital, or CAH needed to certify that they were maintaining a problem list in the EHR for majority of their patients. Each core objective's measure was adjusted to reflect the ease of implementing a particular functionality.

Meanwhile, the menu set of objectives was optional. These functionalities were considered more advanced and therefore more challenging to implement, as the technology and standards were still in the developmental stage However, CMS stated that these menu objectives would become core objectives in the next stage of Meaningful Use. Therefore, this gave healthcare organizations and vendors additional time to work on incorporating these menu objectives into their EHRs to be ready for the next stage.

Finally, each stage had a series of quality measures that the EHR would need to be able to report to DHHS. These quality measures would allow the federal government, as well as healthcare organizations and vendors, to evaluate the quality of care provided. It should be noted that due to technological limitations of sharing data, this measure was delayed until 2012.

Taken together, the three stages of Meaningful Use advanced EHR technology to fulfill the envisioned promise outlined during the policy ferment. Recall that in 2004, there was not an agreed upon definition of an EHR; instead, there was a distinction between a basic and comprehensive EHR. And there was heterogeneity in these comprehensive EHRs. By creating an incentive program that clearly outlined the required functionalities, it guided the EHR industry and field of healthcare towards a dominant design that reflected its standards. While clinical users, healthcare organizations, and innovators could use any EHR technology, if they wanted to receive incentives and avoid penalties, then they would need to use an EHR that met the law's requirements.

*Certified Electronic Health Record Technology*

Thus, the EHR Incentive program required participants to not only attest to the meaningful use of an EHR, but that the EHR needed to be a certified EHR technology (CEHRT). Developed in conjunction with Meaningful Use, ONC also released technical standards that supported and reinforced each stage of the incentive program. Following the regulatory process, ONC released a NPRM and responded to public comments to generate three editions of CEHRT—2011, 2014, and 2015.

The certification process built on the work of CCHIT, which had developed an EHR certification for ONC in 2006. It reviewed EHR technology to ensure that it "meets the technical capability, functionality, and security requirements adopted by DHHS" (Charles, Gabriel, and

Searcy 2015). This standardization was necessary to lay the technical foundation to support interoperability. The HITECH Act also required ONC to develop and maintain a Health IT Product List (CHPL), which is the "single authoritative, comprehensive listing of all CEHRT products that have been tested and certified for use by providers participating in Meaningful Use" (Charles et al. 2012). This publicly available list tracks a technology's certification status, its certification edition and criteria, and any compliance activity. By making this information publicly available, EPs and eligible hospitals could more easily identify and select certified vendors. Thus, not only did the CEHRT program institute specific technical standards for the EHR, but its CHPL also further legitimized these EHR systems. The next chapter addresses how the CEHRT and CHPL contributed to a shift away from homegrown EHRs to out of the box commercial EHRs as the dominant form of technology.

*Penalties*

Meaningful Use also introduced financial penalties for failure to demonstrate meaningful use of certified EHR technology. These penalties took effect in 2015, four years after the program started. For EPs, this involved an annual adjustment to their fee schedule for professional services (FSS): 99% of FFS in 2015; 98% of FFS in 2016, and 97% FFS for 2017 and each subsequent year that they failed to certify use of an EHR. In other words, they would lose 1% to 3% of their Medicare and Medicaid payments. Eligible hospitals would receive a reduced payment for inpatient services and CAHs would have downward adjustment of payments.

**Discussion**

Through this historical analysis, I consider the interplay between the technology and policy cycles. For the EHR, it entered a long period of ferment. Although the industry continued

to innovate, it had not converged on a dominant design by the early 2000s. Yet policy advocates, politicians, and healthcare stakeholders recognized the potential of this technology as a way to address the quality and cost crises in healthcare. Once identified as a policy solution, Congress entered its own period of ferment as it debated legislation to address the barriers that seemed to be stalling the technology from being widely adopted. The 2009 stimulus package offered a political opportunity for Democrats to converge on dominant policy by incorporating previous bipartisan EHR policy provisions into legislation. Through this political maneuvering the HITECH Act was finally passed, thereby introducing a series of provisions designed to encourage the widespread adoption of interoperable EHRs.

However, because EHR technology had not yet converged on a dominant design, this policy reflected more of an envisioned future. Therefore, the HITECH Act's Meaningful Use incentive program not only provided financial incentives, but they were linked to specific design features. Each stage of the Meaningful Use program mandated new core functionalities and the CEHRT mandated technical standards. Together these policies pushed the EHR towards a dominant design—moving the EHR from its basic document repository status to include components, such as clinical quality measures, checklists, and early-stage predictive analytics, that aligned the technology with the envisioned future of the EHR from 2004. Recognizing that policy was at times ahead of the technology, the second stage of Meaningful Use was delayed thereby providing additional time for vendors and heath care organizations to innovate and catch up on the core requirements.

Across this period, stakeholders were actively involved—not just in providing witness testimony but also participating in public-private organizations. Because the ONC facilitated policy and standard recommendations from a diverse set of stakeholders (such as industry,

clinicians, patient advocates), Meaningful Use and HITECH reflected the iterative input from stakeholders, with a more "gentle" push from the federal government to expediate the EHR's development.

Overall, the HITECH Act and Meaningful Use appear to be a successful policy intervention. It accomplished its intent of encouraging the widespread adoption and implementation of the EHRs. However, as the law on the books translated to law on the ground, there were important unintended consequences for healthcare organizations, EHR vendors, and clinical users. In the next chapter, I detail how Meaningful Use's standardization–both in functionality requirements and technical standards—resulted in healthcare organizations shifting away from homegrown systems to primarily adopting commercial EHRs. Thus, instead of using homegrown systems designed specifically for the organization, which was the case of most early adopters/proponents of EHRs, healthcare organizations purchased commercial EHRs, which in turn introduced new standardized approaches to documentation and workflows

## Chapter 5: Field Level Changes Following the HITECH Act

While the previous chapter examined the codification of federal EHR policy, this chapter examines the impact of the HITECH Act on the US healthcare system and the EHR industry. Two of its programs, Meaningful Use and the Office of the National Coordinator's (ONC) Health IT Certification program, led to the rapid adoption and implementation of EHRs across the US healthcare system. While this successfully accomplished the law's goal of universal EHR adoption and use, these programs also standardized the technology and changed the EHR landscape. Significantly, commercial EHRs replaced homegrown EHRs as the dominant technology. This shift has important implications for the EHR industry as well as healthcare organizations and clinicians.

Drawing on secondary data as well as interviews with EHR employees from Epic Systems Corporation and Cerner, I first illustrate these field level changes and then highlight their implications. Overall, this chapter shows the law in action and provides the context for the subsequent chapters that examine how the EHR changed workflows and practices at one hospital system, Marlowe Health, and how these changes impacted physicians' autonomy.

### *A Brief Recap*

Recall from the previous chapter that EHR adoption was slow. As of 2005, only 25% of hospitals had adopted an EHR (Jha et al. 2005). In addition, the EHR industry had yet to converge on a dominant design. However, Congress and other key stakeholders recognized the EHR as a potential solution to the dual crises in healthcare—rising costs and declining quality care. Throughout the 2000s, witnesses at Congressional hearings lauded their EHR systems. These early adopters were frequently from academic medical centers and the VA, where they developed and used homegrown systems, which reflected the workflows, processes, logics, and

culture of the organization in its design and interface. While commercial EHRs existed at the time, most vendors worked with a small set of clients. Even these commercial EHR vendors, including Epic Systems Corporation and Cerner, tailored their system's design to their client's organizational needs.

Therefore, Congress' understanding of EHRs, and the positive perceptions of the technology, were shaped by a small set of organizations' experiences with homegrown or customizable commercial systems. As detailed in the prior chapter, Congress' intention was to translate this success to healthcare organizations across the country when Congress passed the HITECH Act as part of the American Recovery and Reinvestment Act in 2009. Two of its key policies, Meaningful Use and the ONC Certification Program, drove the rapid adoption and implementation of EHRs. However, to understand the implications of this successful policy, we need to consider what type of EHR technology came to dominate the field. Therefore, I will now show how this nudge towards adoption resulted in a widescale transition to off the shelf, commercial EHRs as the primary form of EHR technology, and, importantly, that many early adopters would transition to commercial EHRs as well.

*HITECH Act in Action*

*EHR Adoption:*

The Meaningful Use Program appears to be a widely successful policy in accomplishing its goal of increasing the adoption and implementation of EHRs. There were significant increases in EHR adoption for office-based physicians and non-federal acute hospitals[24]. In 2004, 20.8% of

[24] This is a distinction made in ONC's tracking and reporting of data. Office-based physicians provide ambulatory service. They are often small or private practices. Non-federal acute hospitals provide in-patient services and as non-federal, they do not include the VA. This distinction matters, because it reflects not only different care settings but also differences in resources and access to technology. For instance, hospitals, especially hospital systems, may have an easier time offsetting costs and providing consistent IT support compared to a private or small, independent practice.

office-based physicians reported having any type of EHR, which included fully electronic systems or partial systems that were a mix of electronic and paper (Office of the National Coordinator for Health Information Technology 2019). This type of EHR use amongst office-based physicians rose to 48.3% in 2009, the year that the HITECH Act was passed (Office of the National Coordinator for Health Information Technology 2019). Within seven years, 85.9% of office-based physicians had adopted any type of EHR. Significantly, 79.9% of office-based physicians had a certified EHR, which meant they were in compliance with the Meaningful Use program and that their EHR technology had advanced to meet the standards set by ONC (Office of the National Coordinator for Health Information Technology 2019). As you can see in Figure 5.1, EHR adoption increased steadily and then began to accelerate between 2011 and 2012, which corresponds to the first stage of Meaningful Use.

**Figure 5.1:** Percentage of Office-based Physician Electronic Health Record Adoption

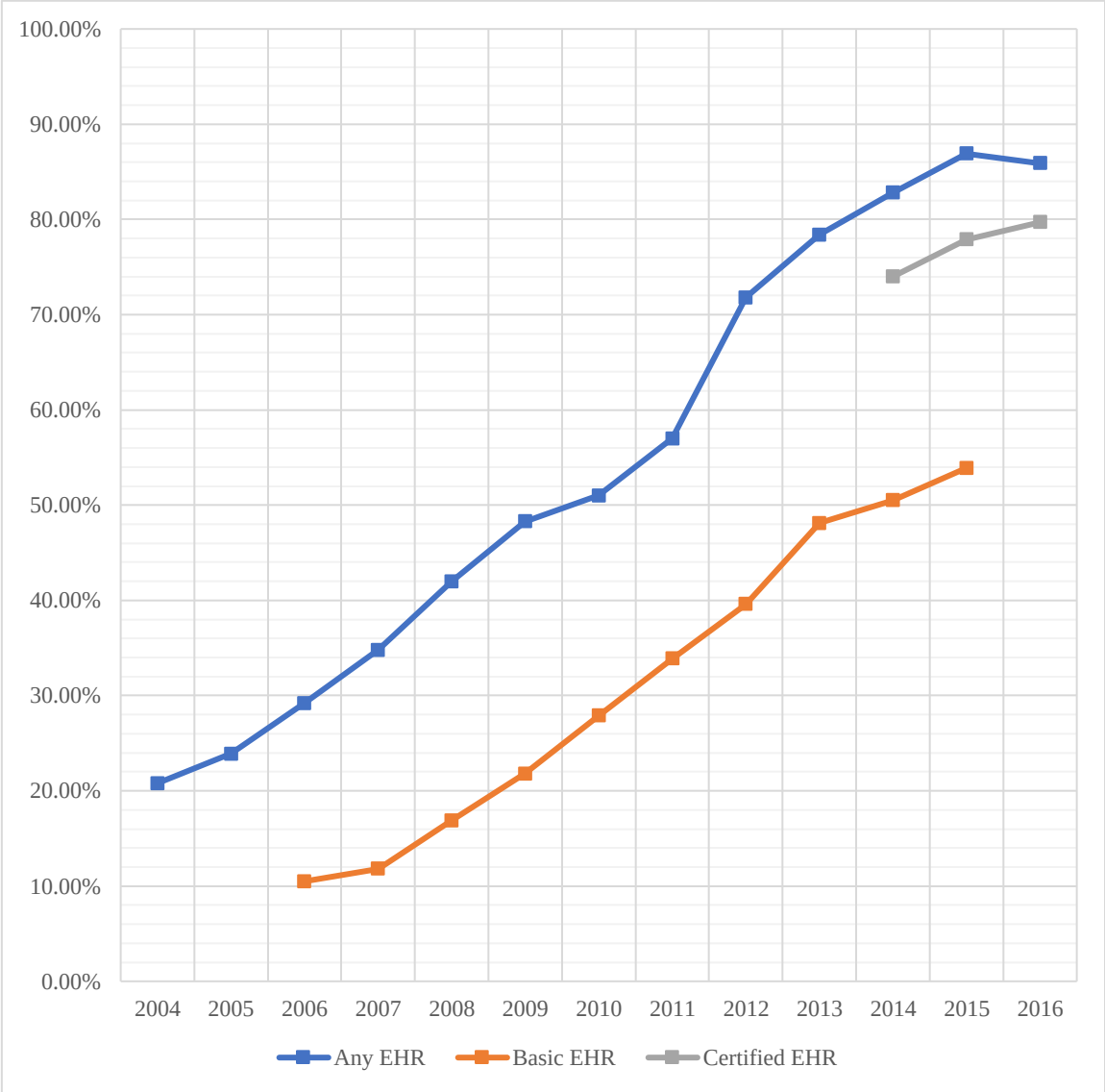



**Table 5.1** Percentage of Office-based Physician Electronic Health Record Adoption

| | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Any EHR | 20.8 | 23.9 | 29.2 | 34.8 | 42 | 48.3 | 51 | 57 | 71.8 | 78.4 | 82.8 | 86.9 | 85.9 |
| Basic EHR | | | 10.5 | 11.8 | 16.9 | 21.8 | 27.9 | 33.9 | 39.6 | 48.1 | 50.5 | 53.9 | |
| Certified EHR | | | | | | | | | | | 74 | 77.9 | 79.7 |

(Data Source: Office of the National Coordinator for Health Information Technology 2019)

Meanwhile, at non-federal acute hospitals, EHR adoption rates also grew rapidly following the passage of the HITECH Act[25]. In 2008, 9% of hospitals had a basic EHR and by 2015 that number increased to 84% of hospitals. Per ONC, this meant that "4 in 5 of all non-federal acute care hospitals had adopted a basic EHR" (Office of the National Coordinator for Health Information Technology 2017c). More significantly, two years later in 2017, 96% of non-federal acute care hospitals had a certified EHR, which met compliance with Meaningful Use (Office of the National Coordinator for Health Information Technology 2017c).

[25] The ONC tracked adoption rates of both basic EHRs and certified EHRs due to measurement differences. Per the ONC, "Basic EHRs, a historical measure of EHR adoption, includes functionalities, such as viewing imaging results, which are not included in certified EHRs…Although EHR adoption rates differ depending upon the specific measure, both key measures of EHR adoption—certified EHRs and Basic EHRs—consistently show widespread adoption of EHRs" (Henry et al. 2016).

**Figure 5.2:** Percentage of Non-federal Acute Care Hospital Electronic Health Record Adoption

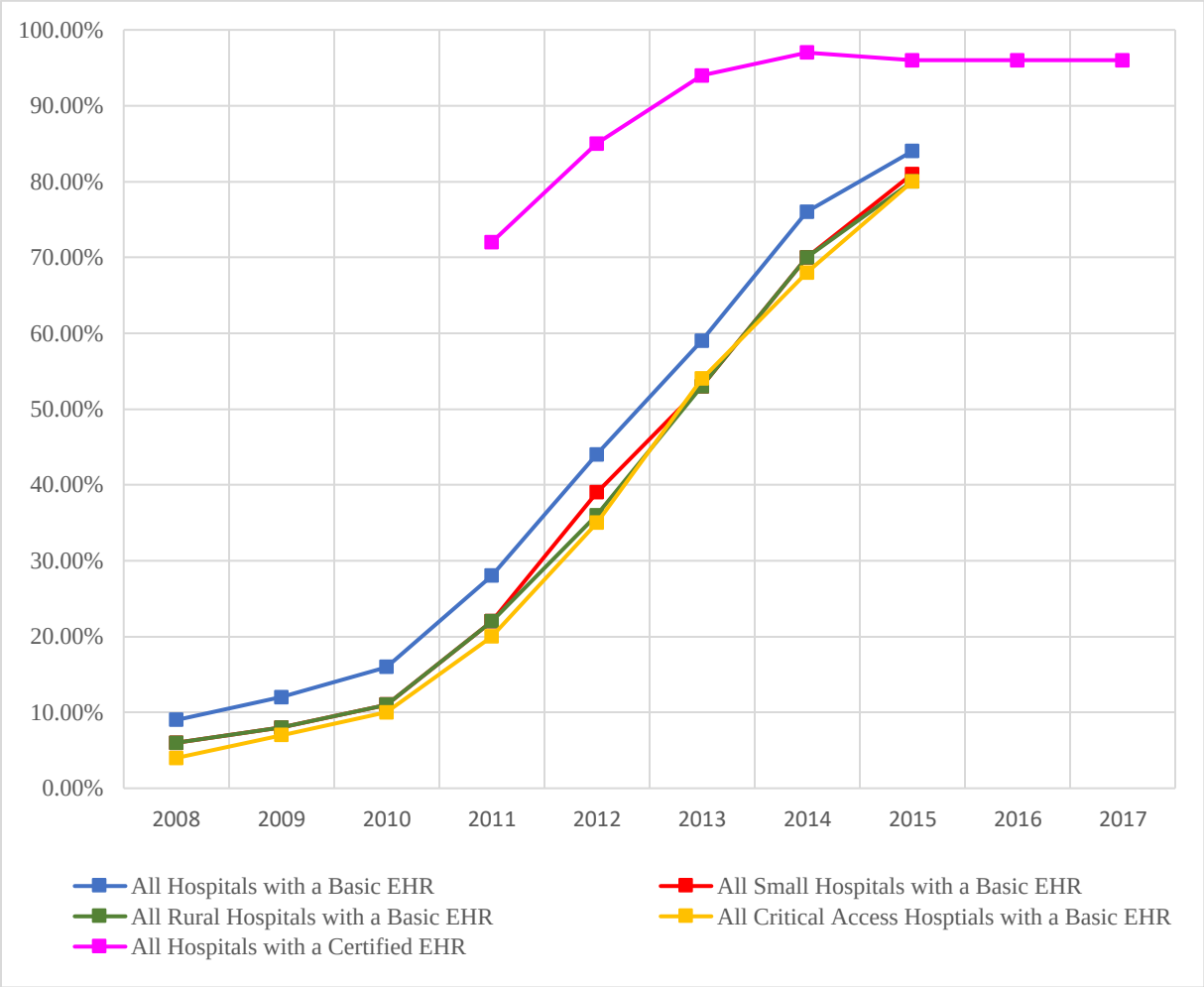



**Table 5.2:** Percentage of Non-federal Acute Care Hospital Electronic Health Record Adoption

| Hospital EHR Adoption | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|---|---|---|---|
| All Hospitals with a Basic EHR* | 9 | 12 | 16 | 28 | 44 | 59 | 76 | 84 | | |
| All Small Hospitals with a Basic EHR* | 6 | 8 | 11 | 22 | 39 | 53 | 70 | 81 | | |
| All Rural Hospitals with a Basic EHR* | 6 | 8 | 11 | 22 | 36 | 53 | 70 | 80 | | |
| All Critical Access Hospitals with a Basic EHR* | 4 | 7 | 10 | 20 | 35 | 54 | 68 | 80 | | |
| All Hospitals with a Certified EHR | | | | 72 | 85 | 94 | 97 | 96 | 96 | 96 |

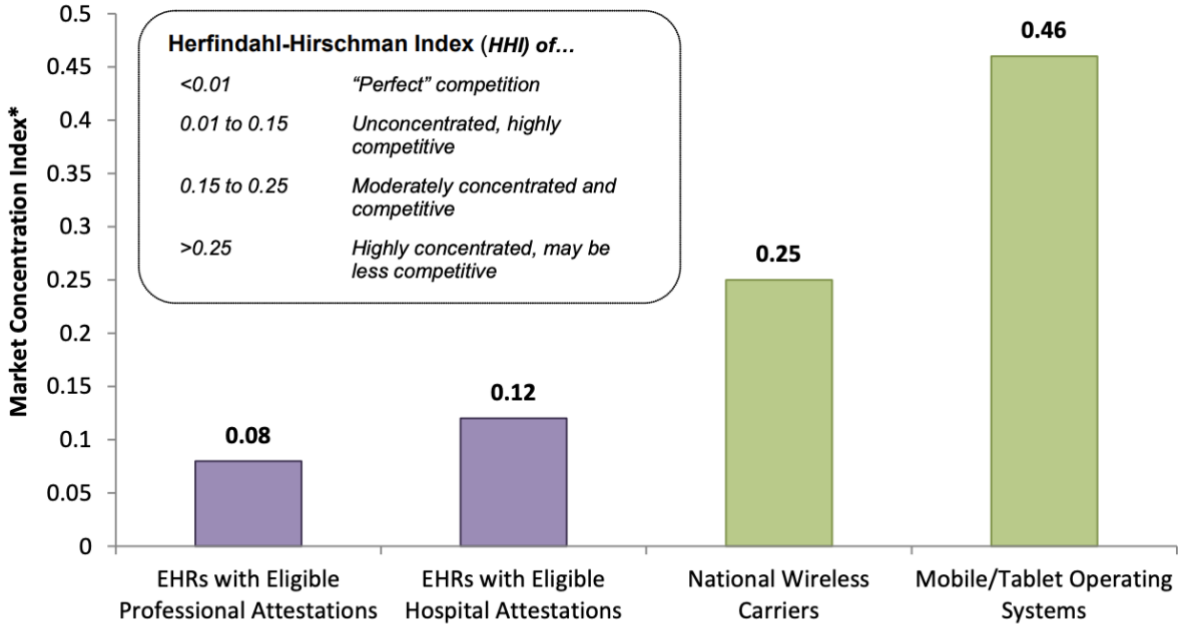
*Basic EHRs had clinician notes
(Data Source: Office of the National Coordinator for Health Information Technology 2017c)

As we can see in Figure 5.2, EHR adoption across hospital types began to accelerate between 2011 and 2012, as that was the year that Meaningful Use first went into effect.

Significantly, within the first year of Meaningful Use, 72% of hospitals had a certified EHR, which highlights the speed of their adoption.

This rapid growth in EHR adoption is impressive. But we need to look closer at the type of EHR technology being put in place. Recall that in order to receive their incentive payment, eligible professionals (EPs) and eligible hospitals needed to attest that the EHR not only possessed the core and menu objectives from a Meaningful Use stage, but the EHR was also a certified EHR technology (CEHRT). As of October 2012, ONC reported that "470 vendors provided CEHRT products used for [Meaningful Use] MU attestation" (Charles et al. 2012). This shows that the number of available vendor options for EHR was quite extensive in 2012. In fact, ONC's analysis of market concentration for EHRs showed that it is "unconcentrated and highly competitive" as documented in Figure 3 (Charles et al 2012). This low level of concentration in the EHR market reflects how EHR technology initially developed, as vendor EHRs focused on operating in a particular care setting (e.g. ambulatory vs. inpatient vs. skilled nursing home vs. dental office) or a particular medical specialty.

**Figure 5.3:** Competitiveness of CEHRT market among MU attestations, relative to other IT industries




SOURCES: ONC analysis of data from Certified Health IT Product List (CHPL) & CMS EHR Incentive Program, as of October 31, 2012
Wireless – US Dept Justice (2011)
Mobile OS – Netmarketshare (2012)
NOTE: Modular EHR systems were excluded from this analysis because neither data source accurately indicates which products providers use as their primary CEHRT in such systems.
*Herfindahl-Hirschman Index – a measure of the size of individual firms in relation to the industry. It is an indicator of the amount of competition among firms within an industry.

(Charles et al. 2012)

In addition, as of October 2012, most participants in Meaningful Use preferred a "complete" EHR over a "modular" EHR. A complete EHR has all 34 criteria from Meaningful Use Stage 1 for either ambulatory or inpatient care, whereas a modular EHR has less than the 34 criteria for Stage 1. Therefore, when attesting with a modular EHR, the participant needed to use multiple systems to meet the requirements of Stage 1. Ninety four percent of EPs (100,907 out of 107,883) of office-based physicians attested with a complete EHR, while 67% of eligible hospitals (1563 out of 2322) attested with a complete EHR (Charles et al. 2012). Notably, one third of hospitals attested with a modular EHR. The preference for a complete EHR also has important implications. By having a complete EHR, the EP or eligible hospital is able to meet all

Meaningful Use requirements on a single certified system. A modular approach requires balancing multiple systems to ensure that each system is in compliance with the part of Meaningful Use it represents, and that the combination of systems will be enough to meet full Meaningful Use compliance. The modular EHR approach therefore required more effort and coordination. Because a modular EHR was more commonly found in hospitals, this could suggest that some hospitals initially kept their homegrown systems in place –either supplementing with commercial EHRs or integrating their homegrown systems.

However, by 2016, commercial EHRs dominated the market. The ONC tracked Health Care Professional HIT Developers that EPs and eligible hospitals reported in their Meaningful Use attestations. This data shows the prevalence of EHR systems as well as the vast number of certified EHR systems in use. Per the ONC, and as we can see in Figure 4, "684 health IT developers suppl[ied] certified health IT to 354,395 ambulatory primary care physicians, medical and surgical specialists, podiatrists, optometrists, dentists, and chiropractors" as of 2016 (Office of the National Coordinator for Health Information Technology 2017a).

**Figure 5.4**: Number of Ambulatory Providers Reporting Vendors' Certified Technology

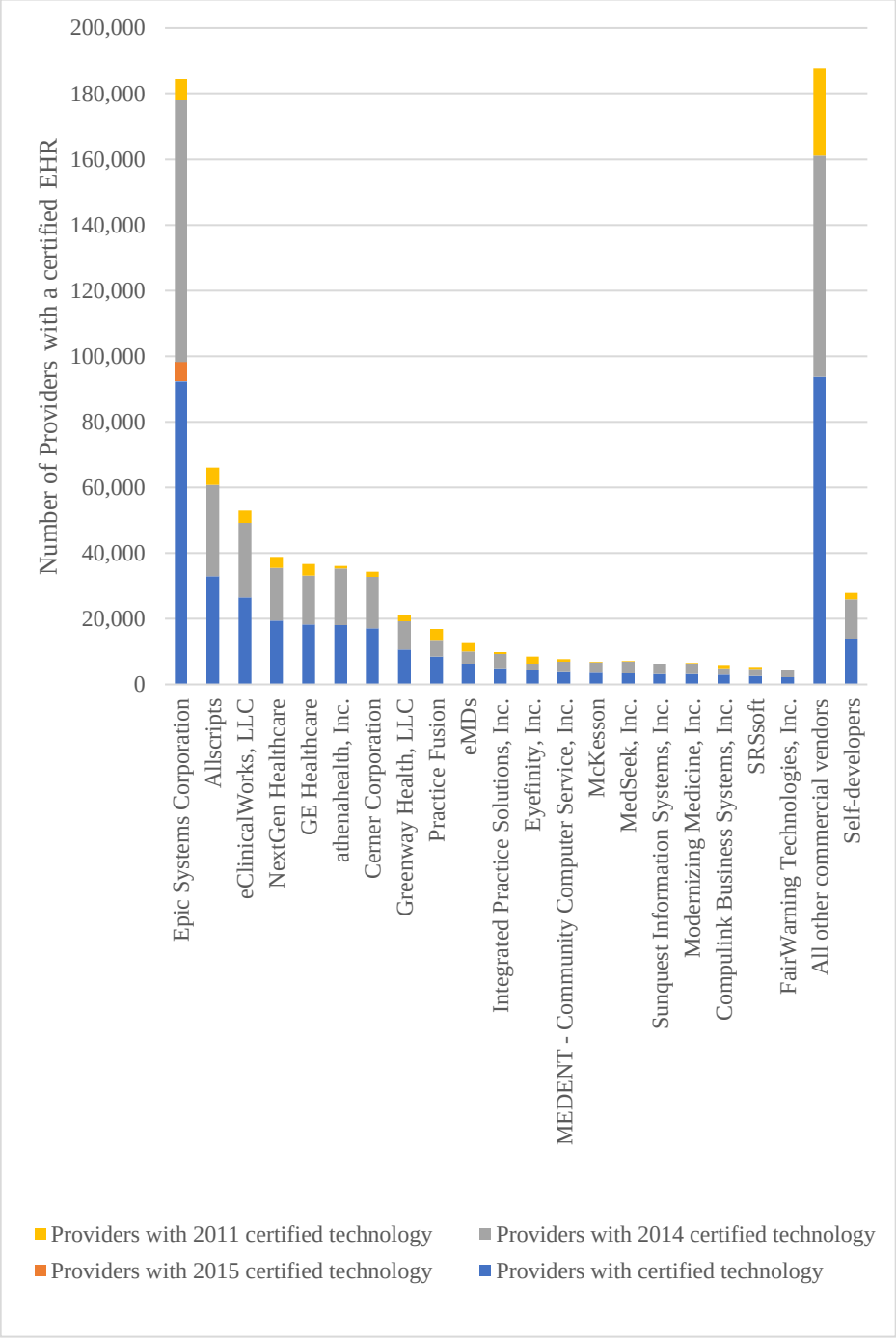


**Table 5.3**: Number of Ambulatory Providers Reporting Vendors' Certified Technology

| Developer | Providers with certified technology | Providers with 2015 certified technology | Providers with 2014 certified technology | Providers with 2011 certified technology | Technology type |
|---|---|---|---|---|---|
| Epic Systems Corporation | 92,241 | 5,875 | 79,831 | 6,535 | Commercial |
| Allscripts | 33,044 | 0 | 27,796 | 5,248 | Commercial |
| eClinicalWorks, LLC | 26,498 | 0 | 22,761 | 3,737 | Commercial |
| NextGen Healthcare | 19,414 | 0 | 16,007 | 3,407 | Commercial |
| GE Healthcare | 18,310 | 0 | 14,834 | 3,476 | Commercial |
| athenahealth, Inc. | 18,018 | 0 | 17,280 | 738 | Commercial |
| Cerner Corporation | 17,132 | 0 | 15,631 | 1,501 | Commercial |
| Greenway Health, LLC | 10,605 | 0 | 8,733 | 1,872 | Commercial |
| Practice Fusion | 8,440 | 0 | 5,107 | 3,333 | Commercial |
| eMDs | 6,333 | 0 | 3,756 | 2,577 | Commercial |
| Integrated Practice Solutions, Inc. | 4,919 | 0 | 4,367 | 552 | Commercial |
| Eyefinity, Inc. | 4,287 | 0 | 2,025 | 2,262 | Commercial |
| MEDENT - Community Computer Service, Inc. | 3,835 | 0 | 3,126 | 709 | Commercial |
| McKesson | 3,504 | 0 | 3,235 | 269 | Commercial |
| MedSeek, Inc. | 3,477 | 0 | 3,347 | 130 | Commercial |
| Sunquest Information Systems, Inc. | 3,208 | 0 | 3,208 | 0 | Commercial |
| Modernizing Medicine, Inc. | 3,202 | 0 | 3,060 | 142 | Commercial |
| Compulink Business Systems, Inc. | 2,957 | 0 | 2,075 | 882 | Commercial |
| SRSsoft | 2,672 | 0 | 2,138 | 534 | Commercial |
| FairWarning Technologies, Inc. | 2,304 | 0 | 2,304 | 0 | Commercial |
| All other commercial vendors[26] | 93,737 | 0 | 67,406 | 26,331 | Commercial |
| Self-developers[27] | 13,870 | 0 | 12,090 | 1,870 | Self-developed |

(Data Source: Office of the National Coordinator for Health Information Technology 2017a)

The number of certified vendors increased from 2012 to 2016 –rising from 470 to 684. Epic Systems Corporation is the most frequently attested system and appears to be outperforming its competitors amongst physicians. Of note, there are 46 self-developers[28], i.e.,

[26] Includes 619 developers
[27] Includes 46 self-developers
[28] "Self-developed technology is health IT developed by a health care organization or system to be used only by providers within that organization or system. Self-developed technology is not marketed and sold to providers

homegrown systems, that are used by 13,960 physicians. While it seems like a sizeable number of physicians, it accounts for only 4% of physicians and is stretched across 46 organizations. This suggests that commercial EHR systems are dominant form of technology adopted by physicians.

For the non-federal acute hospitals, the same trend applies. The majority of hospitals had adopted and implemented a commercial system by 2016. ONC found that "through program year 2016 of the Medicare EHR Incentive Program, 186 certified health IT developers suppl[ied] health IT to the 4,520 non-federal acute care hospitals, including Critical Access" (Office of the National Coordinator for Health Information Technology 2017b).

outside of the organization or system" (Office of the National Coordinator for Health Information Technology 2017a).

**Figure 5.5:** Number of Hospitals Reporting Vendors' Certified Technology

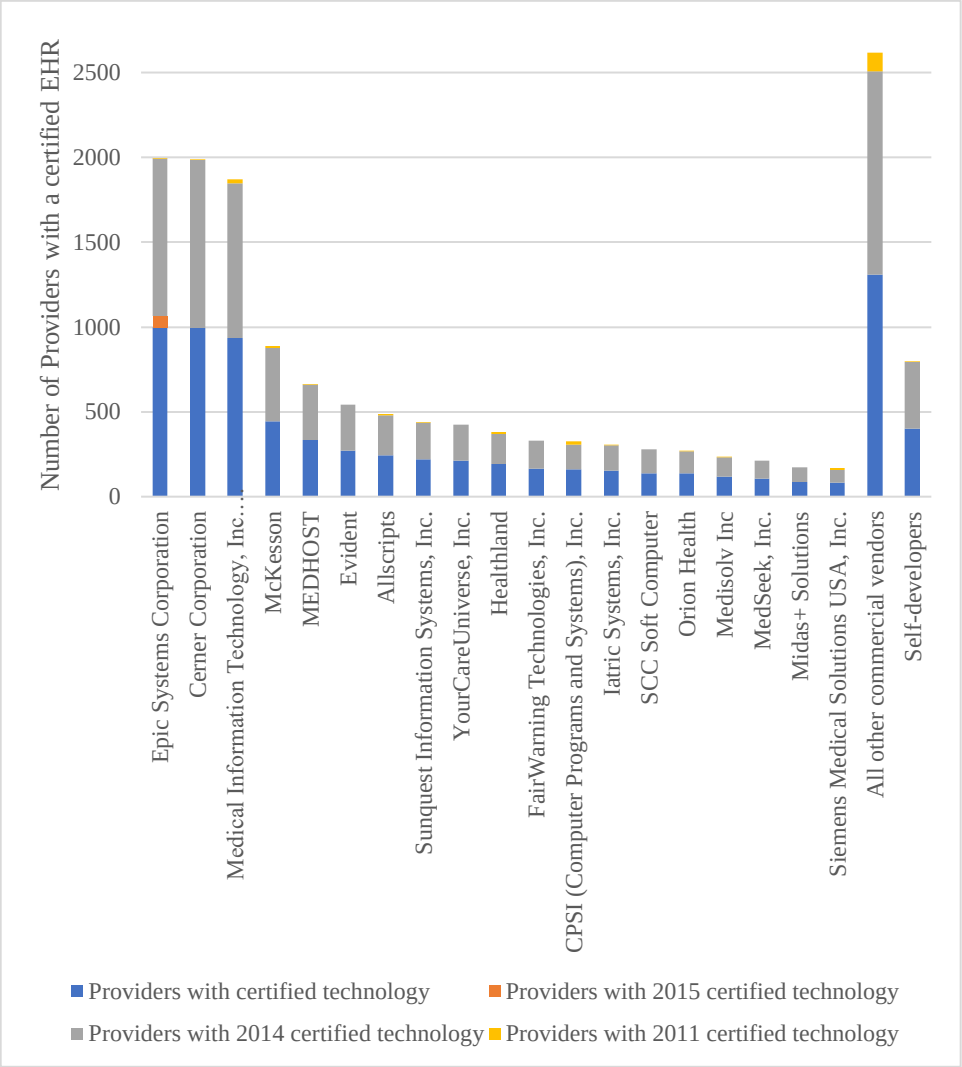



**Table 5.4:** Number of Hospitals Reporting Vendors' Certified Technology

| Developer | Providers with certified technology | Providers with 2015 certified technology | Providers with 2014 certified technology | Providers with 2011 certified technology | Technology type |
|---|---|---|---|---|---|
| Epic Systems Corporation | 997 | 68 | 928 | 1 | Commercial |
| Cerner Corporation | 994 | 0 | 991 | 3 | Commercial |
| Medical Information Technology, Inc. (MEDITECH) | 935 | 0 | 911 | 24 | Commercial |
| McKesson | 444 | 0 | 431 | 13 | Commercial |
| MEDHOST | 333 | 0 | 329 | 4 | Commercial |
| Evident | 272 | 0 | 272 | 0 | Commercial |
| Allscripts | 243 | 0 | 236 | 7 | Commercial |
| Sunquest Information Systems, Inc. | 219 | 0 | 218 | 1 | Commercial |

| | | | | | |
|---|---|---|---|---|---|
| YourCareUniverse, Inc. | 212 | 0 | 212 | 0 | Commercial |
| Healthland | 191 | 0 | 178 | 13 | Commercial |
| FairWarning Technologies, Inc. | 166 | 0 | 166 | 0 | Commercial |
| CPSI (Computer Programs and Systems), Inc. | 163 | 0 | 143 | 20 | Commercial |
| Iatric Systems, Inc. | 152 | 0 | 149 | 3 | Commercial |
| SCC Soft Computer | 139 | 0 | 139 | 0 | Commercial |
| Orion Health | 136 | 0 | 132 | 4 | Commercial |
| Medisolv Inc | 117 | 0 | 116 | 1 | Commercial |
| MedSeek, Inc. | 107 | 0 | 107 | 0 | Commercial |
| Midas+ Solutions | 86 | 0 | 86 | 0 | Commercial |
| Siemens Medical Solutions USA, Inc. | 84 | 0 | 73 | 11 | Commercial |
| All other commercial vendors[29] | 1308 | 0 | 1198 | 110 | Commercial |
| Self-developers[30] | 399 | 0 | 393 | 6 | Self-developed |

Epic Systems Corporation is once again the leading vendor, followed by Cerner Corporation, MEDITECH, McKesson, and MEDHOST. There are 27 self-developers, i.e., homegrown systems, used by hospitals, which accounts for 0.6% of hospitals. Therefore, it's important to note that 99% of hospitals were using a commercial EHR by 2016.

Overall, the data from ONC not only shows the rapid adoption of EHR systems, but also that commercial EHRs dominated both the market for physicians and hospitals participating in Meaningful Use. This also marks a shift in what EHR technology had previously been used. Recall, that the majority of EHR technology that existed prior to HITECH Act, or at least was showcased at Congressional Hearings, was homegrown/self-developed technologies. Although some physicians and hospitals were able to maintain their homegrown systems, they are in the minority.

*Why did healthcare organizations transition to commercial systems?*

[29] Includes 138 developers
[30] Includes 28 self-developers

For EPs and hospitals that did not possess an EHR prior to the HITECH Act, a commercial EHR was appealing. These new adopters were constrained by both time and the costs of developing a homegrown system that met the requirements of Meaningful Use and the Certified Health IT program. Selecting a commercial product would allow for timely participation with the Meaningful Use program. In addition, as part of the HITECH Act, ONC also provided a publicly available list of certified EHR systems, the Certified Health IT Product List (CHPL). The availability of a list of technology that was already in compliance with Meaningful Use also simplified the selection process and legitimized these commercial offerings. In fact, the American Medical Association (AMA), recommended that its members consult the CHPL when selecting an EHR (AMA n.d.).

Meanwhile, many early adopters also began to transition from their homegrown EHRs to commercial systems. A study surveyed six hospitals systems on their decisions to switch (Coliccho and Cimino 2020). These hospitals, described as the "pioneers" of EHRs, included: Columbia University, Intermountain Healthcare, Partners Healthcare[31], Regenstrief Institute, University of Alabama Birmingham, and Vanderbilt University. Five of the six hospitals were Congressional witnesses in the years prior to the passage of the HITECH Act, including: Columbia University, Intermountain Healthcare, Partners Healthcare, Regenstrief Institute, and Vanderbilt University. As witnesses, representatives from these healthcare organizations described and lauded their homegrown systems. In addition, research conducted on these early EHR systems was further used to justify and shape federal EHR policy (Colicchio and Cimino 2020). However, following the HITECH Act and the start of the Meaningful Use program, all six

[31] Renamed as Mass General Brigham in 2019.

hospital systems transitioned to a commercial vendor[32]. Five of the six hospital systems cited the cost to comply with Meaningful Use as primary motivator[33]. Four of the six hospital systems also transitioned to a commercial vendor due to the challenges of consolidating multiple systems. One hospital system, Columbia University, decided to switch to a commercial system as part of its merger with another hospital system. Reflecting on these findings, the study authors conclude:

> However, as consistently reported by our survey participants, M[eaningful] U[se]'s requirements and constrained time frame seem to have played in important role on their decision to adopt a commercial system, since vendors can amortize the cost to adapt their products to such regulations in a way that health care organizations cannot. As a result, homegrown systems that frequently produced positive clinical outcomes were replaced with commercial system adopted without a much needed redesign to fix widely known problems such as suboptimal interfaces, bloated notes, and overzealous alerts (Colicchio and Cimino 2020:362).

Early adopters needed to comply with Meaningful Use—not just to receive incentive payments, but also avoid penalties to Medicare and Medicaid reimbursements beginning in 2015. Because the Meaningful Use program was designed to also advance the innovation of EHR technology and provide the foundation for a nationwide interoperable system, early adopters would also need to update and advance their systems to meet the envisioned promises of EHR technology. But as we can see from these pioneers, it was less expensive and easier to manage a commercial system than upgrade a homegrown system.

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[32] Although these hospitals transitioned to a commercial EHR, all six hospitals maintained their homegrown systems. Columbia and the University of Alabama keep their homegrown systems to serve as backup during downtimes of the commercial system. The other four hospital systems maintained their homegrown systems for historical data. Each hospital also continues to develop local interfaces and applications to meet needs that the commercial vendor cannot address. Thus, these early adopters have found some ways to keep the spirit of/elements of a homegrown system within the confines of a commercial system. However, their primary EHR system is a commercial one.

[33] Initially Intermountain certified its homegrown system for Meaningful Use Stage 1. They identified 47 gaps in functionality that took two years to close and cost $17.3 million (Bowes 2014). Intermountain expected to receive $46.3 million in incentive payments (Bowes 2014). However, the study also acknowledged that the process to meet certification requirements delayed other important projects. Ultimately, Intermountain transitioned to Cerner (Colicchio and Cimino 2020). This suggests that organizations not only needed to consider cost but also resources and time when deciding whether to upgrade and certify their homegrown EHR.

Even the VA announced a transition to a commercial EHR, Cerner, in 2018. The VA was an early pioneer with its EHR system, VistA, that was frequently discussed and demonstrated at Congressional hearings. VistA was held up as an example of what an EHR could be. However, like other non-federal healthcare organizations, the difficulties of developing and upgrading VistA, as well as the challenges of integrating with the Department of Defense's (DoD) separate EHR system, led the VA to undertake an EHR Modernization project. Therefore, the VA decided to transition to the DoD's EHR system, MHS Genesis, which is based on Cerner's system (Office of Public and Intergovernmental Affairs 2017) Although not a participant of Meaningful Use, the challenges of maintaining their homegrown system and their transition further illustrates the isomorphism in the field towards the adoption of commercial systems.

*Implications*

The HITECH Act's Meaningful Use Incentive Program and Health IT Certification Program not only led to the rapid adoption and implementation of EHRs, but they also changed the type of commonly used technology. The vast majority of EPs and hospitals purchased commercial EHR systems. This trend towards off the shelf, commercial EHRs has important implications for the EHR industry and the healthcare system. I will now explore the implications of this trend in both sectors.

*EHR Industry*

In the years following the passage of the HITECH Act, the EHR industry experienced tremendous growth. Industry reports show an expanding, yet fragmented industry. In 2014, the year that the second stage of Meaningful Use began, the EHR's industry revenue was $8.8 billion and had experienced 9.3% growth between 2009-2013 (Phillips 2014). Overall industry profits were $1.8 billion (Phillips 2014). Between 2014 and 2021, the number of EHR

organizations increased from 1,227 to 2,181. The EHR industry generated $13.0 billion in revenue in 2021, which reflected a 3.3% annual growth from 2016 to 2021 (Kennedy 2021). Overall industry profit was $1.6 billion (Kennedy 2021). Despite the myriad of companies, several grew to dominant market share. Epic Systems Corporation and Cerner are the two companies with the highest market share. In 2014, Epic had 22% and Cerner had 8.8% of the market share (Phillips 2014). In 2021, Epic had 23.6% and Cerner had 16.6% of market share (Kennedy 2021), thereby accounting for 40.2% of the entire EHR market. Note that market share here reflects the "industry-specific revenue measured as a percentage of the industry's total revenue" (The IBISWorld Team 2019). Recall that in Figures 5.4 and 5.5 that Epic was the most used CEHRT for both office-based providers and hospitals. Epic's dominance in the market is apparent. However, in these same Figures Cerner is the 7th most used EHR for office-based providers and second most used for hospitals. Because hospital EHRs generate greater revenue than office-based EHRs, Cerner is able to dominant the market despite not appearing to be the most popular EHR.

But beyond growth, the increase in customers also impacted how these EHR companies approached their work. Interviews with Epic and Cerner employees revealed a move away from a customizable to a standardized approach. For example, a retired Epic employee, Ed, witnessed how Epic changed from 1996 to 2013. He said,

> Certainly, in the initial period of my time with Epic, even early on in my return to interfaces[34], there was this attitude, okay, we do what the customer needs and if it means doing a lot of code, we do that. As I got toward the end [of my career], Epic had more and more customers. We had to get a little pushy back and so we'd have to say, "No, we are not going in that direction." So, it was hard for me to give them [the customer] that note.

[34] A division within Epic that supports the system's software

When Ed initially started at Epic in 1996, it was a small company of 100 employees that worked directly to develop codes, interfaces, etc., for their customers. Ed shared examples of adjusting codes to fit the customer's technology needs, even if it differed from Epic's. However, as the company expanded in size and expanded its customer base in the wake of the HITECH Act, it began to take a more standardized approach. Ed could no longer customize code based on a client's request. It now needed to go through a new design review documentation process, which further standardized the coding process. This new standardized approach made it easier for Epic employees to support clients, especially when taking over for another coder.

Meanwhile, Cerner continued to take a more customizable approach to building EHR systems to reflect their clients' needs, workflows, etc. However, recently, Cerner began recommending standardized best practices to clients. For example, Jennifer, from Clinical Documentation Strategy, explained that initially in her career Cerner would make recommendations to clients on how to configure the system. However, if a client wanted to preserve a workflow or wanted the system configured a certain way then Cerner would do that. However, Jennifer reported that it became clear that clients weren't aware of how the decisions they were making would impact the use of the EHR system. Further, this customizable approach made the integration of a new configuration complicated as Cerner employees would have to shift through the client's system to figure out what decisions were made and how they'd impact and be impacted by the customization. To address these issues, Jennifer shared that Cerner is making stronger recommendations on what the client should do to standardize the system and facilitate updates and upgrades. Through these recommended best practices, it would help standardize the clients' EHR systems and prepare them for future upgrades and advancements in predictive analytics.

While Meaningful Use spurred tremendous growth in the EHR industry, it also changed the product. Meaningful Use's three stages and the CEHRT created standards that the commercial EHR vendors needed to incorporate into their products. But the rapid adoption of EHRs also introduced new pressures of managing more clients that then pushed EHR companies to be more standardized in the options offered to clients. Thus, these out of the box commercial EHR appear to have become more boxed in and standardized. This in turn has important implication for the healthcare system.

*Healthcare Organizations*

For healthcare organizations the adoption of EHRs, and the transition to commercial EHRs had important implications. In the years following the passage of the HITECH Act, clinicians and hospitals systems transitioned from paper medical records to an EHR, or from a homegrown to commercial EHR system. Both transitions altered workflows and processes and required new approaches to patient care, patient interaction, and documentation. Research studies, media accounts, and testimony at Congressional hearings highlighted both the successes and challenges of this rapid adoption and implementation of technology. I will provide a brief overview of several of these challenges below, but see chapter 6 for a more in-depth discussion.

One significant focus was on the impact to the clinician-patient interaction. Physicians now spend more time engaging with the EHR than interacting with patients (Young et al. 2018) and physicians criticize the EHR as interfering with their ability to interact and treat their patients based on their training and experience (Reich 2012; Levinson et al. 2017). Clinicians reported focusing more on documenting in the EHR and making less eye contact with their patients (Shachak and Reis 2009; Montague and Asan 2014; Dhand 2019). Patients also

complained/raised concern that their clinicians were more focused on the computer or laptop than them (Lee et al. 2016; Rose et al. 2016).

In addition, the amount of documentation increased dramatically. Research shows physicians spend long hours documenting in the EHR—5.9 hours of an 11.4-hour day workday (Arndt et al. 2017). Clinicians increasingly document outside their clinic hours, which has become known as "pajama time" (Saag et al. 2019; Schulte and Fry 2019). However, beyond the amount of time dedicated to documentation, the documentation itself has been questioned. Known as "note bloat", the amount of information now recorded in a patient's note is vast but not necessarily relevant (Shoolin et al. 2013). The EHR makes it easier to carry forward information from prior notes and checklists auto populate additional information into the note. These longer notes make it challenging to quickly identify key, relevant information for patient care. In addition, research highlights an increased documentation burden for physicians and a loss of autonomy, which are contributing factors to physician burnout (Shanafelt et al. 2015; Shanafelt et al 2016; Southwick and Southwick 2018).

The EHR also altered workflows and processes, as the EHR technology was incorporated into the healthcare organization's practice. The EHR added new tasks or required more task switching, especially in the transition from a homegrown to commercial system, which could have negative implications for patient care (Benda et al. 2016). Pop up alerts for medication interactions created a sense of alarm fatigue and can be ignored by clinicians (Carspecken et al. 2013; Phansalkar et al. 2013; Ancker et al. 2017; Smith et al. 2019; Howard 2019). The transition to EHRs is associated with a short-term decline in quality of care as clinicians learned to use a new EHR (Thirukumonon et al. 2014).

Clinicians' perceptions of the EHR are also mixed. For the basic functionalities associated with the first stage of Meaningful Use, physicians reported clinical benefits associated with overall care to patients, access to information, and alerts to critical labs and/or potential medication errors (King et al 2013). These positive perceptions were more likely if the EHR was certified for Meaningful Use, and/or the physicians had been using the EHR for two or more years. However, another study found that after two years of transitioning from a homegrown system to a commercial system, physicians' perception of the commercial EHR's functionalities remained negative compared to their perceptions of their original homegrown system. (Hanauer et al 2017). This study highlights the challenges of a second transition from one EHR system to another, especially a shift from a homegrown system to a commercial EHR. It also suggests how differences in EHR designs and workflows can impact physicians' experiences and perceptions of the technology.

Finally, the transition to EHR yielded mixed results in accomplishing its goal of lowering healthcare costs. Recall that the price of an EHR system, as well as costs associated with maintenance, was a major barrier to EHR adoption in the early 2000s. Although the Meaningful Use program provided incentives to offset the cost of adopting and implementing an EHR system, the actual cost of these systems ended up being much higher than anticipated. Costs were drive by the software, new equipment[35], training, and maintenance. For example, Partners HealthCare[36], a large Boston-based healthcare system including Massachusetts General Hospital and the Brigham and Women's Hospital, spent $1.2 billion in their transition from a mix of homegrown systems to Epic and "[e]ven Partners has acknowledged the expense of Epic will

[35] Epic requires a 24-inch screens so that all information is viewable. Partners Healthcare replaced thousands of monitors at the start of their transition to Epic (McClusky 2016).
[36] Now known as Mass General Brigham.

reduce its earnings over three years" (McClusky 2016). Other hospital systems reported high costs of purchasing Epic Systems, including Duke University Health System, which spent $700 million, University of California, San Francisco, which spent $150 million, and Dartmouth-Hitchcock Medical Center,[37] which spent $80 million (Moukheiber 2012). In addition, research on cost improvement associated with EHR implementation remained mixed. For instance, one study found that billing costs for clinicians and the hospital remained high, even with a certified EHR (Tseng et al 2018). While another study found modest increases in payment billed but was unable to distill whether the increased in billing was because of improvement to the quality of care following EHR implementation, or because the improved charting allowed the physicians and hospitals to charge more (Edwardson et al 2017).

*Conclusion*

While the Meaningful Use program was successful in accelerating the adoption and implementation of EHRs, the transition was not smooth. The policy had been predicated around the experiences of healthcare organizations and clinicians who primarily used homegrown systems. However, the need to use certified EHR technology in order to be in compliance with Meaningful Use, resulted in a shift to commercial EHR systems. While these commercial systems included many of the functionalities found in homegrown systems and were required by Meaningful Use, these out of the box, standardized systems introduced new workflows and processes that required changes to clinicians' practices.

[37] This is a small hospital in New Hampshire, especially compared to the other hospitals listed in this article.

## Chapter 6: Epic EHR at Marlowe Health

The previous chapters focused on the policy environment that accelerated EHR adoption through the HITECH Act and its EHR Incentive Program, Meaningful Use. The chapters highlighted how this federal policy intervention created field level changes in healthcare as organizations adopted off the shelf commercial EHR systems to comply with the program's standards, which in turn introduced new workflows and processes that required changes to clinicians' practices. The following chapters now shift our focus to what happened on the ground as certified EHRs are implemented.

My field work began at Ambulatory 1. Initially an independent physician practice, they were acquired by South Hospital of Marlowe Health in 2015. Ambulatory 1 had originally purchased the EHR system, AllScripts, in 2009 in response to the HITECH Act. However, because South Hospital used Epic Systems, Ambulatory 1 began transitioning over to Epic in summer 2018. I began interviewing Ambulatory 1 physicians, two months into their transition to Epic.

My interviews expanded to clinicians and administrators at South Hospital and North Hospital. As part of Marlowe Health, these two hospitals had their own EHR transition. Prior to HITECH Act, Marlowe Health had several homegrown systems for a variety of ambulatory practices. However, their inpatient services remained on paper. Following the HITECH Act, Marlowe Health decided that they would be unable to expand their homegrown systems to meet the requirements of Meaningful Use and needed to switch to a commercial system. They ultimately decided on Epic Systems. Michelle, a Health Information Management administrator, who was present for this decision explained,

> It really was truly a business decision in the sense of it is very difficult to support a bunch of different applications that are kind of stitched together. It was a classic grandma's patchwork quilt of applications with interfaces and things you need to talk to each other. I think Marlowe Health at the time was very thoughtful about, "We knew that we couldn't keep doing this whole patchwork quilt. We knew we had to get everything at least on one backbone so there was one foundational thing [EHR system] to go off of". And I think [Marlowe Health] took a look at what it would take to be able to do that in and of itself versus what it would take to actually go out and buy a piece of software that did this. When you think about it at a high level, Epic does just this. They just make EHR software. You think about the number of employees they have and you think about the number of employees we had at Marlowe Health in IS [Information Systems] that were actually doing this. I think in order to do this we probably would have had to buy a small software company to just make that software. It was really a business decision that if we really wanted to remain agile, remain best in class, we really needed to invest a little in making software something that didn't work. That we were always trying to make it work as opposed to something that worked seamlessly underneath the clinician.

Like the EHR pioneers in the prior study (Colicchio and Cimino 2020), Marlowe Health did not have the employees or resources to upgrade their homegrown system for Meaningful Use. The cost was too much. Rather, they viewed the transition to a commercial EHR as a necessary business decision in order to comply with Meaningful Use, as well as have an EHR system that would worked better from a technical perspective. However, Michelle acknowledged that this transition introduced new changes to workflows and practices that required adjustments in practice from clinical users. Thus, this field site is a good place to examine how the transition to a commercial EHR impacts clinicians' experiences

Theoretically, this chapter also marks a shift in focus from the macro law-in-action effects of HITECH on the organizational field to the micro law-in-action effects of HITECH on situated work practices. Both the literatures from Law and Society and Science and Technology Studies emphasize the importance of sensemaking in the implementation process. Tight coupling between technology, law, and practice is not guaranteed, and in fact, these literatures often find decoupling (Brennan and Suchman 2020). This chapter further builds on this literature by

examining the tension between standardization and customization in the EHR at both the individual and organizational levels. Finally, this chapter also employs a sociotechnical approach to consider the materiality of the EHR as a physical artifact that is distinct from the social processes related to its use and meaning (Orlikowski 1992; Orlikowski and Barley 2001; Orlikowski 2009). As previously stated in the Theory Chapter, there is already a series of empirical studies, especially in Information Systems, that makes the case for applying a sociotechnical or actor network approach to the implementation of information systems, including EHRs in a healthcare setting (Berg et al. 1998; Greenhalgh et al. 2009; Greenhalgh and Stones 2010; Cresswell, Worth and Sheikh 2010; Cresswell and Sheikh 2014; Cucciniello et al. 2015). By acknowledging and analyzing the EHR's materiality, these studies demonstrate how the EHR enables and constrains the user's experience, which in turn impacts the implementation process as well as how users perceived the EHR. This analysis of the EHR's materiality will also allow for an extension of Brennan and Suchman's (2020) framework and a more detailed examination of their categorization of the EHR as an administrative technology.

Drawing on fieldwork conducted at Marlowe Health, this chapter provides a detailed overview of how this hospital system and its workforce adopted and adjusted to the EHR system developed by Epic Systems Corporation. Through in-depth semi-structured interviews with clinicians and administrators, as well as EHR vendor employees, this chapter focuses on the materiality of Epic and its incorporation into clinicians' practice.

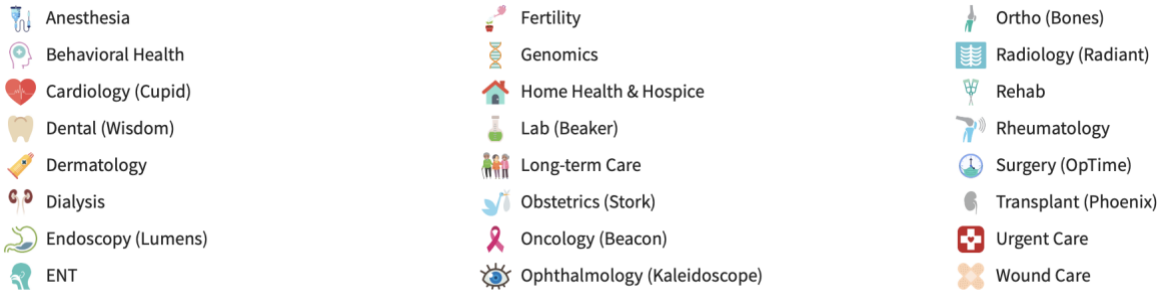
This chapter will first provide a brief overview of Epic Systems Corporation – both the company and its EHR. Next, it will examine the tension between standardization and customization as Epic's EHR is adopted and implemented at Marlowe Health. The chapter will

then explore Documentation, Clinical Support, and Interoperability in the EHR and their subsequent impact on the workflows, practices, and experiences of clinicians.

*Epic: The Foundations*

Epic Systems is an integrated platform that brings together a series of modules to create its EHR. These modules are designed to incorporate specific workflows and information based on care settings (ambulatory vs. inpatient) and medical specialties. Figure 6.1 presents the 24 clinical modules and their names. Notably, several modules have unique Epic names, which are designated in parentheses. These names reflect the organization's flair for creativity and whimsy. Epic has developed its own jargon that extends to features in the EHR system itself and its own internal processes[38]. Both users on the clinical side as well as on the Epic side refer to the module by its Epic name. While patient information is visible across these modules, clinical users are trained to document in their respective module[39].

**Figure 6.1:** Epic System's Clinical Modules




Source: (Epic Systems Corporation 2021)

While these modules are used to document patient care, the Epic EHR is more than just an EHR data repository. Computerized Provider Order Entry (CPOE) is built into the modules to

[38] For example, internally, Epic refers to questions from clients as "Sherlocks", instead of the more commonly used term of help desk ticket.

[39] This created challenges for Marlowe Health during the COVID-19 pandemic when ambulatory clinicians and EHR technologists were brought in to assist on the inpatient floors during the first and second surges. Both set of users were unfamiliar with the inpatient module and had to learn how to document in this part of the system.

facilitate the communication of clinicians' treatment directions to the care team. Clinical decision-support is increasingly being incorporated into the system, moving beyond checklists and pop-up alerts to the implementation of algorithms. To connect patients with their health information and providers, Epic has a patient portal called MyChart. The portal allows the patient to view the problem list (i.e., all current diagnoses), provider notes, test results, and prescriptions[40]. Patients are also able to send messages to their providers. These are all functionalities that were required by Meaningful Use. In addition, Epic offers a revenue cycle and a care management module to support the financial side of health care delivery. Taken together, these modules create Epic's EHR, and this baseline system is referred to as Foundations.

*Standardization vs. Customization*

Compared to other EHR companies, Epic is known as being a more standardized and tightly controlled system. Recall from the previous chapter, that Epic moved towards a more standardized approach as its number of clients expanded following the passage of the HITECH Act. Epic also earned this reputation due to its tight control over its proprietary information[41] (Jennings 2021; Ross 2021). This reputation of standardization was also well known to the administration of Marlowe Health. Diane, a Director in Health Information Management, referenced it as she explained Marlowe Health's decision to transition from a homegrown system to Epic:

> It was narrowed down to about three vendors. And I think this was a huge change for us because we realized that we probably had less control over what we could change with Epic than other vendors, the flexibility, a lot of things we can't change with Epic. But all in all, we decided they did have more functionality and

[40] I will address these components of the record in more detail in the Documentation section of this chapter.
[41] Due to this tight control, it was difficult to find images to include in this chapter. Emma, a health information technologist at Marlowe Health, explained that Epic wouldn't even allow her organization to include screenshots of the system in tip sheets for the patient portal, MyChart.

> the different modules. And the fact that there were so many other users, like large health centers that had gone with Epic and the way that they were going to support us, that we felt, "Let's let go of the self-created developed software and we need to go with this." And even if we use it, not forever, it was time for a change.

Although Marlowe Health's administration recognized the limited flexibility compared to their homegrown EHR, Epic's modules, capabilities, and system support offset their concerns. This statement is similar to reasons provided by the early EHR adopters regarding their shift from their homegrown system to Epic, which was outlined in the previous chapter. Marlowe Health's decision to switch to Epic, despite its reputation as a more standardized system, also suggests a mimetic isomorphism as other health centers also implemented Epic's EHR.

However, at the organizational level of the client and at the individual level of the clinical user, Epic allows for a certain degree of customization. Often seeming to offer more customization than its initial reputation would suggest. This next section highlights the tension between standardization and customization in Epic's EHR.

*Organizational Customization:*

All healthcare organizations begin with Epic's Foundations. Epic assigns a designated Implementation Services (IS) analyst team to work with the client. Per Priya, a former Epic Technical Support (TS) analyst,

> IS is really there to build the foundation of the system for a hospital, to implement it. It takes a couple years, depends on the size of the hospital system, et cetera. And then there's some modifications and customizations and stuff that can happen, but really not much at that level.

While IS builds the Foundation system for the healthcare organization to include the needed modules, IS has the ability to make modifications. These customizations can incorporate specific workflows, documentation requirements, quality metrics, etc., within a particular module or across all of them. Through this initial decision-making process, healthcare organizations can

determine if they would like an "out of the box" Epic EHR or if they would like to make some adjustments.

Customization at the organizational level increases as the "Go Live" date becomes closer. The organization/client then transitions the work to its Technical Support (TS) analysts. Priya shared,

> TS are the long-term support for the system. So, from there, we work with the [Epic] analysts, and they can basically take requests from users and see what customization they want to make, how can they optimize the system to work best for their hospital, healthcare facility, and then TS help [Epic] analysts build that. So, they take that foundation system that the IS had helped build, and then they tailor it more to the hospital.

Once TS takes over the project, this is when most customization occurs. There is a TS analyst assigned to every module, who then coordinates with representatives from the healthcare organization's respective department/division to further customize/design the module to replicate and/or incorporate workflows, note templates, and other unique features that either clinicians or administrators want to include in their organization's EHR. The TS analyst is present at the "Go Live" and will continue to adjust the modules to address concerns and challenges that arise as the hospital system's clinicians begin to use the EHR. Even after the implementation, the TS analyst continues to support the module and will add customizations as requested by users. However, recall Epic's design review process described in the previous chapter. Not all client customization requests will be granted.

Overall, these customizations allow healthcare organizations to preserve some of their workflows, metrics, and other important features of their organizations Despite beginning with the same Foundations system, these customizations at the organizational level create real differences that clinical users noted. Maeve, an anesthesiology resident, commented,

> So, all three of my Epics have been [different]…I would say if you, on the outside, someone who's a non-doctor might think they're really, really similar between my three Epics for medical school, intern year, and here [at North Hospital]. I think there are quite large differences in my day-to-day work.

Maeve's experiences suggest the subtlety and impact of healthcare organizations' ability to customize within Epic. While much of the EHR system appears to be the same, the customizations are more evident in actual everyday use. Thus, while Epic as a brand appears to be more standardized than other commercial EHR systems, the extent of its customization at the organizational level is more extensive. This is also important to note from an analytical perspective. At times, it was challenging to determine whether a component of the Epic EHR originated in Foundations or reflected a customization based on a healthcare organization's decision/policy. In interviews, several respondents shared their belief that Marlowe Health had a more customized Epic system compared to other healthcare organizations. These respondents would try to parse out whether a challenge they encountered within the EHR originated in Epic or reflected their organization's decision[42]. Other respondents were unaware or did not connect Marlowe Health to these challenges, rather they blamed Epic.

Finally, while the customizations allowed healthcare organizations to preserve some workflows and logics, these customizations also created challenges. From a technical perspective, Priya, pointed out that new system upgrades would often break the customization features in an organization's Epic EHR. The TS analysts and the client/healthcare organization's IT support staff would need to the go in and fix the errors. From a user perspective, because of this organizational based customization, users who switched from one healthcare organization to

[42] When possible, I would consult with a key informant, Emma, a health information technologist at Marlowe Health, to determine whether it was an Epic or Marlowe Health decision.

another, such as Maeve, commented on the challenges of adjusting to differences between the two organizations' Epic systems.

*Clinical Users' Customizations*

Epic also provides users with the ability to create their own customizations. First, users can create note templates that structure the visit note. Some clinical departments will create a template that they then share with everyone. Other departments allow users to create their own templates. Thus, users can create custom note templates at either the department or individual user level. For instance, Lisa, a family medicine physician, remarks on how Epic's approach to custom templates differs from the previous EHR system her ambulatory practice used.

> We noticed we couldn't find a template for how to do a physical. In Allscripts, they're basically two kinds of notes. There's a preventive note, and a non-preventive note, and there are a few different ones for different age ranges. But every single one of us, if we open a note for an adult physical age 19 to 49, it's the same note. But with Epic, we were told "Well, what everybody does is, they just find somebody else's that they like and they use that one." So, it requires every single one of us to find this stuff. So, eventually, I happened upon a template that I like well enough, and I kept customizing it, but I still keep having to add things to it.

The transition between the two EHR systems illustrates how Epic allows customization in its product. While this customization of note templates provides clinicians with the ability to create a template that works for their documentation needs and styles, this customization of note templates also raises important questions about standardization. For instance, if users have unique note templates, this has implications for data management including challenges of locating relevant/important information as well as analyzing the content for predictive analytics.

Other clinicians described how the customizations in note templates help to lighten the documentation burden associated with the EHR. Allison, a radiation oncologist, said

> The average case that I see, I see 80% breast cancer, I have templates for most everything in terms of the breast cancer world, so that documentation burden is

> significantly less than if I see a cancer type that I don't often see, because then everything, in terms of the final part of the note the impression and plan portion, that part is all new.

This quote illustrates another way in which Epic EHR's customization also reinforces practitioner specialization. While Allison's customized template increases her efficiency in documenting her breast cancer patients, it cannot be used to document rare cancers. Instead, there is a documentation burden for these unique cases. It's possible that this may then pressure some clinicians to develop additional templates to try and further standardize care and save time.

A cardiologist, Jack, uses a custom template not only to ease the documentation burden but also to bypass his department's template that involves checking off boxes. He shares,

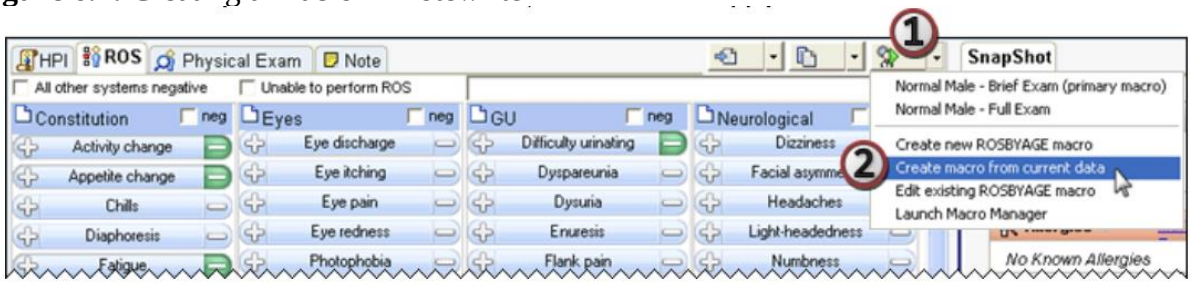
> People that are slow at these things [documenting in the EHR], pull up, for instance, a review of systems, where they have to find the check box and click negative, negative, negative, or find the check box, just click all negatives, reviewed. Whereas what I do, is I just have a whole note template, that already says review of systems is negative. You change the positives and delete the ones that say negative and turn them positive. Again, you can do that all in a Microsoft Word format rather than a point and click format. Same thing for physical exam, I just had an entire physical exam that's all normal. I just go in there, switch the abnormals, rather than clicking every single time throughout the whole physical exam.

For Jack, pointing and clicking, to answer system generated questions took too much time. Instead, he described using his own templates that allowed him to document as if he was in a Word document, as a more efficient use of his time. However, as I'll discuss below, these check boxes often served as the first step in decision support features. Therefore, bypassing these checklists also meant that Jack avoided engaging in Epic's decision support features.

Alternatively, some clinicians prefer to incorporate these customized "point and click" features in their template. These clinicians use the customization feature known as "macros" that are available in Epic's NoteWriter. A macro sets the default selections in a point and click template usually for routine exams and procedures. These can be customized to highlight

"common signs, symptoms, and pertinent negatives" (UVA Health). For example, in an office visit, the clinician can designate common elements that they want to incorporate in the visit note. Figure 6.2 is an example of a Review of Symptoms (ROS) macro for a "normal male".

**Figure 6.2:** Creating a Macro in Notewrite




Source: (UVA Health 2015)

By selecting certain elements as negative in green, when the clinician employs this macro in their note, the ROS will automatically display them as negative. The clinician can then go in and change any to positive if necessary. This feature allows the clinician to expedite documentation and avoid pointing and clicking through checklists. However, again, this is customized to reflect what the clinician considers to be common elements for a patient visit, which could vary by clinician. In addition, the incorporation of these macros has also been identified as a contributing factor to note bloat, which I'll address later on in this chapter.

Clinical users can further customize their documentation by programing SmartTools, which are shortcuts to facilitate documentation. The most commonly used are "SmartPhrases" also known as "dot phrases". A dot phase is a type of command that can pull information from within the EHR, such as lab results, and include it in a note; place commonly used phrases or descriptions, such as discharge instructions, in the note that the user can edit; pull up a different section of the note to edit/document in, etc. By employing these dot phrases into their documentation practices, clinicians report that they can more quickly document and avoid repetitive typing of standard information included in notes. However, creating these .dot phrases

takes time and depends on the user's skill-level in Epic. Many informants reported that setting up these SmartPhrases was challenging and time consuming.

While Epic allows for these customizations in documentation at the individual level, physicians did highlight that the customization produced non-standardized notes, which created challenges in finding information about a patient. In addition, because the dot phrases made it easier to pull information from other parts of the EHR into the note, the note became long and repetitive. Again, making it challenging to parse out new information and a clinician's treatment plan. In this way, the challenges of customization contributed to larger challenges of managing the overall documentation of patient information. The next section will address these documentation challenges.

*Documentation*

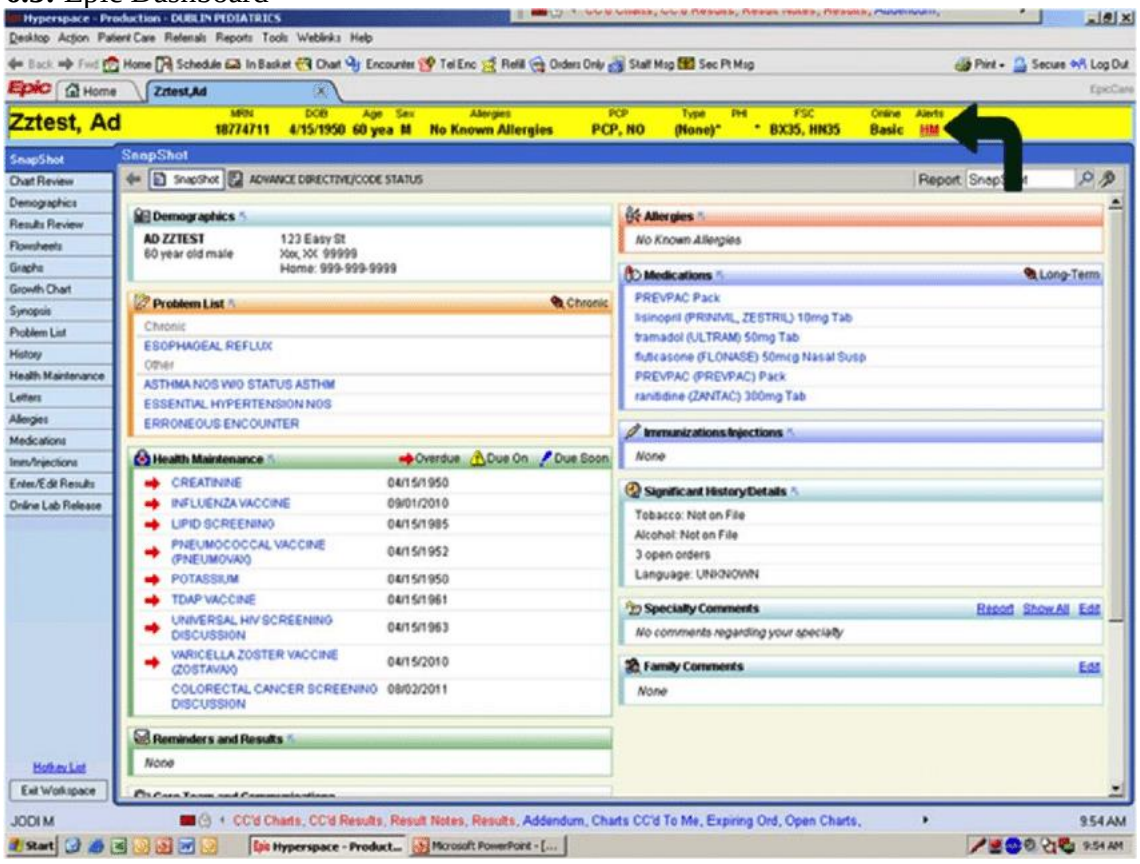
The initial purpose of medical record is to document patient care. The EHR transitioned that process from paper to an electronic format; however, the translation was not always clear or direct. Where and how information was stored and presented in the EHR reflects some of the unique features of the EHR systems. Although Meaningful Use and the EHR certification process required functionalities and technical standards, how the patient information is documented and presented can vary. This section will now explain how Epic presents patient information and its documentation requirements.

When a clinical user first opens a patient's chart in Epic, the main screen, i.e. the dashboard, displays three features that are designed to provide an overview of the patient's health status. First, there is the problem list that contains all current and ongoing diagnoses, such as diabetes, hypertension, skin cancer, etc. A clinician can click on each problem and see additional information about this diagnosis. Next, the medication list includes current

medications and dosages. Finally, the health maintenance module includes reminders for vaccinations and health screenings that are due. All clinicians have access to these modules and should be updating them at each patient visit to ensure that the information is current and accurate.

Initially, clinicians could navigate to different areas of the patient record by clicking on series of tabs either at the top of the screen or on the left-hand side. These tabs include Demographics, Results, History, Letters, Labs, Imaging, Notes, and Allergies. Refer to Figure 6.3.

**Figure 6.3:** Epic Dashboard



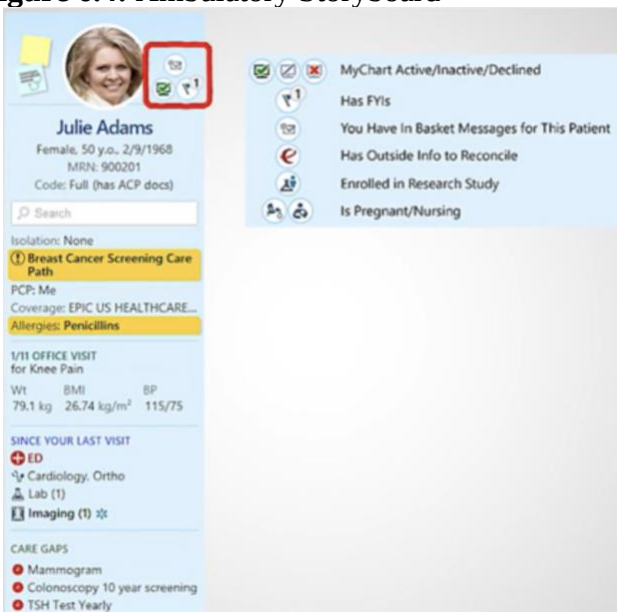

Source: Nelson 2017

The Dashboard for the Test Patient in Figure 6.3 provides an overview of the patient and their health. This is how Epic looked for respondents interviewed between 2018-2020. By displaying the information in this way, Epic is highlighting what it has designated as key clinical

information. The tabs available on the left navigation allow the clinician to click into other parts of the record for additional information. While this design incorporates all elements of a paper medical record, its organization, especially what is featured on the dashboard, reflects a different organizing logic. For respondents, this presentation of information was actually overwhelming. Richard, a cardiologist at a different hospital system, provided this simile: “Epic is like being in the cockpit of a 747. So many boxes of information. It’s a lot to take in”. This opinion was also heard at professional association meetings and in newsletters, blogs, and on social media. While the EHR facilitated displaying patient information, how it was displayed became a contributing factor to a sense of information overload, which will be explored later in the chapter.

Beginning in 2020 Epic rolled out a new upgrade called “Storyboard” that replaces the tabs on the left-hand side of the screen. The Storyboard allows clinicians to see an overview of the patient. This includes a patient’s picture, name, date of birth, gender identity, medical record number (MRN), insurance coverage, alerts for needed screenings/tests as well as if they are pregnant or a fall risk, allergies, purpose of visit, vitals, updates on care provided by other clinicians since last encounter, and Care Gaps, which is another name for Health Maintenance. Refer to Figure 6.4 for an example of a Storyboard for an ambulatory visit.

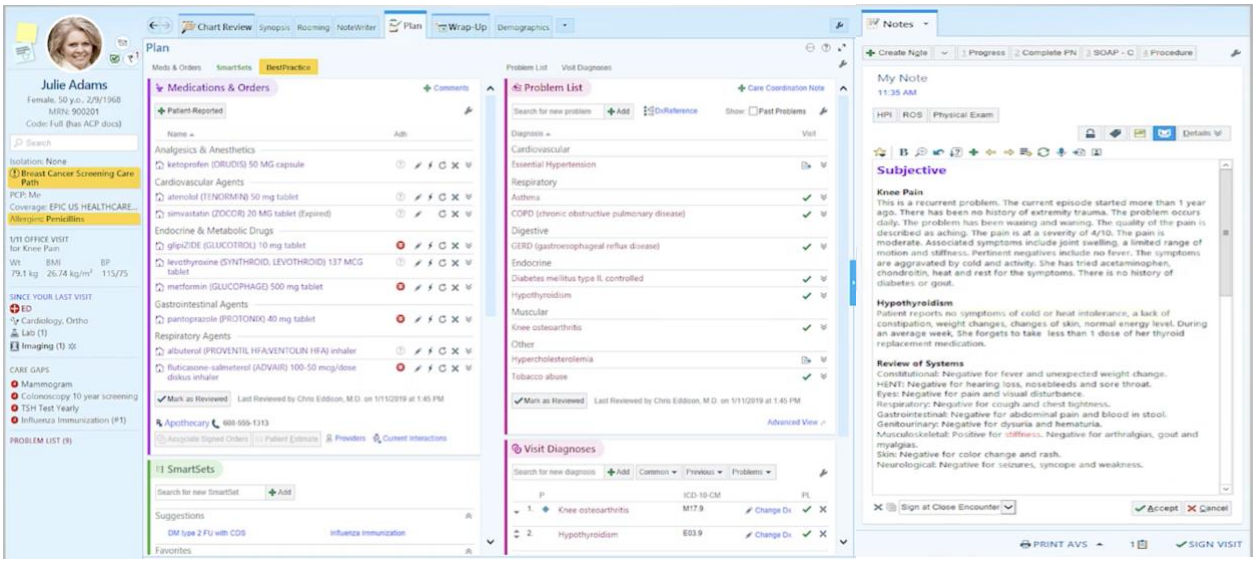
**Figure 6.4:** Ambulatory Storyboard




Source: (Houston Methodist 2020)

In addition to providing this snapshot of the patient, clinicians can hover over the icons by the patient's picture (in the red box on Figure 6.4) and see additional information. Epic refers to this process as "hover to discover". Overall, this feature was designed to address some of the challenges of documenting and reconciling information within Epic System by consolidating and reorganizing key patient data. The data on the storyboard is no longer categorized by type of data but is structured to convey an overview of the patient's status, recent care, and action items for the clinician to address. In other words, this snapshot tells the patient's health "story". Below in Figure 6.5, is an example of a patient's chart in the Ambulatory module. The patient's storyboard remains visible as the clinician views other parts of the record, which may ease some of the previous challenges of toggling and trying to locate information while reviewing and documenting in the record.

**Figure 6.5:** Overview of Patient Record in Ambulatory Module

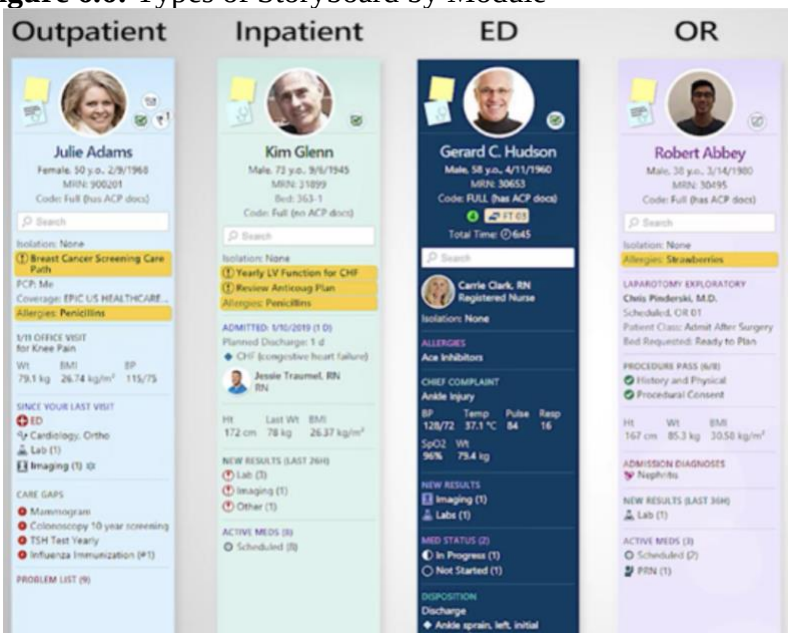



Source: (Houston Methodist 2020)[43]

Finally, it should be noted that the Storyboard feature has been designed to reflect different care settings including outpatient/ambulatory, inpatient, Emergency Medicine, and the OR. Figure 6.6 includes examples of each of the four storyboards. By tailoring the storyboard to the care setting, it highlights the information that is considered the most important/vital for the particular specialty.

[43] An Epic training video that walks through each of these features is available for viewing at the following link: https://players.brightcove.net/993020718001/default_default/index.html?videoId=6050334168001

**Figure 6.6:** Types of Storyboard by Module




Source: (Houston Methodist 2020)

Marlowe Health began to roll out the Storyboard upgrade in June 2020 to any clinician who wanted to begin using it. However, the official go-live of Storyboard was August 2020.

*Problem Based Charting*

One of the key features of Epic's documentation is the problem list. In the Dashboard, the problem list was prominently displayed (see Figure 6.3). In the storyboard, information from the problem list is incorporated and is prominently displayed in the full chart view (see Figure 6.5). While the prior sections focused on how patient information is displayed in Epic, this section focuses on Epic's approach to problem-based charting, which connects the diagnosis to the plan and assessment. Historically, especially in a paper-based record, a patient's health information was organized by patient visit. However, with problem-based charting, the information is categorized by a diagnosis, i.e., a problem, and so relevant information from across visits are linked to it (Li et al. 2018). When a clinician clicks on a particular problem in the problem list, they see details about the diagnosis as well as the plans and assessments. This approach to

documenting in the record is supposed to create a comprehensive overview of the patient's health plan[44].

However, in practice the problem list is not always up to date, nor are they clearly organized, according to interviews and secondary research (Li et al. 2018; Wang and Wright 2020; Poulos, Zhu, and Shah 2021). For example, a diagnosis could be added to the problem list by a clinician, but it is not marked resolved when it is no longer a current "problem", or a clinician does not update the problem to reflect changes in the assessment and plan. In addition, not all clinicians have adopted this approach to charting. Some clinicians continue to document everything in a visit note and do not update the problem list. These competing documentation styles make it difficult to locate information. In addition, since problem-based charting is a new way to document care, the workflows on who documents, updates, and is ultimately responsible for the problem list is still in flux. For instance, there is debate as to whether and who determines when a diagnosis is truly resolved and whether it should remain on the list as pertinent medical history. Anne, a primary care physician, explains

> It becomes the primary care physician's responsibility. I'm like a chart manager. I'm like an Epic keeper. Like the dashboard is my job. Specialists go in and do whatever they want. They put two more knee related diagnoses. I'm the one who tries to consolidate it to one. It's almost like a side job.

This view was shared by all primary care/family medicine physicians that I interviewed. Because primary care is responsible for the patient's overall health and coordinates care across specialists, these physicians felt it was their role to maintain and clean up the problem list. Without this work, Carol, a primary care physician said, "The problem list is trying to turn itself into this stream of 30 different paragraph-long things. It's like hiding the information from you. It's the

[44] However, it should be noted that the problem list is also tied to billing. Therefore, the type of diagnosis entered the chart needs to reflect a billable diagnostic code as well. I will address how this works in more detail under the Billing section of this chapter.

opposite of what you need". Specialists also expressed concern that the problem list was confusing and potentially outdated. Although designed to provide an overview of the patient's health, if the problem list is not managed then it makes it more challenging to locate information and understand the overall health of the patient.

*Note Bloat and Information Overload*

While Epic works well as a data repository, a common challenge described throughout the healthcare system was Note Bloat. Not unique to Epic, the phenomenon of note bloat is well documented across EHR systems (Versel 2013; Kroth et al. 2019; Rule, Bedrick, and Chiang 2021). Because documenting in EHRs facilitates copying and pulling in information from other parts of the record, each visit note becomes longer and longer. Across the industry, administrators, clinicians, vendors, and policymakers are working on solutions to reimagine the clinical note and return it to a simpler form (Versel 2013; Dvorak 2017; Kahn et al. 2018; Joseph and Levy 2021; Getinger et al. Rossetti 2021). In this section, I will outline the features of Epic that contribute to note bloat and address some of the strategies employed by users to try and get around it.

One contributing feature to Note Bloat is the use of checklists to document care. As described above, these checklists can be incorporated into custom templates and allow the clinician to click through a series of yes/no questions that then populate into the visit note. The checklists are designed to capture standard care questions relevant to the medical specialty. Once completed, this information is added to the visit note. However, clinicians described the challenges of looking through these standard forms to identity relevant information. Carol, a primary care physician, described this style of documenting as "Mad Libs" and shared that it didn't capture the nuances and details of a patient compared to the summaries she'd previously

dictated. Jack, a cardiologist, also found the checklists to be an inefficient way to document and contributed to note bloat. Recall that he customized his visit template specifically to avoid checklists so he could have a free text note that was shorter and highlighted only the relevant clinical information.

A second feature in Epic that contributes to note bloat is "copy forward." This feature allows a clinician to pull from their previous notes into the note they are currently writing. It also allows them to populate the note with information from other modules such as medications and allergies. The purpose of copy forward is to incorporate previous information that is still relevant to the case, thereby allowing the clinician to be more efficient in their documentation[45]. However, in interviews, clinicians reported that other clinicians would copy forward entire notes thus doubling or tripling the length of the note. This made it difficult to parse out what was new, and respondents reported scrolling to the bottom of the note to find the most relevant information on the assessment and next steps.

Through my fieldwork, it became apparent that there were also professional and organizational factors that contributed to note bloat. First, professional norms shaped expectations around notes. Allison, a radiation oncologist, explained that her training emphasized that all patient notes would contain specific sections that were summaries of other oncologists' findings. She reiterated that she could not copy and paste from other clinicians' notes nor could she merely refer to a specific note. Instead, she needed to rewrite these summaries in her own words. She pointed out that this was not unique to her residency training but reflected a practice across her specialty. Thus, in this case, she recognized that note bloat would need to be

[45] I do want to make a distinction that copy forward is different from copying and pasting. At Marlowe Health it is against policy to copy and paste from other clinician notes into your own note. However, respondents shared that while they did not copy and paste, they knew of other clinicians who did.

addressed amongst radiation oncologists and not as much with Epic. Second, all clinicians linked note bloat to billing and medical liability. Physicians frequently said, “if it’s not documented, it didn’t happen”. While I will address billing in more detail in its own section, many respondents attributed the expansion of documentation to reflect billing requirements. With a more detailed and specific the diagnosis, the physician could justify their billing and potentially bill higher.

Although Epic facilitated documentation and allowed for more data to be available, clinicians reported feeling overwhelmed by the information. All clinicians described the challenges of parsing through a patient record to find the relevant data and expressed concerns that they would miss something important. Epic does have a central search tool called Chart Search. Users can search for a diagnosis, medication, order, result, or any term, and Epic will pull everything that includes the search term in the patient’s chart. However, if the search term is not specific, then the Chart Search isn’t as effective. Despite being a feature in Epic, many users are unaware that Chart Search exists. None of my respondents referenced Chart Search and all expressed a desire for such a search functionality akin to Google. Emma, a health information technologist at Marlowe Health reiterated this point and shared that she incorporates reminders about this functionality in trainings and newsletters. To help address the challenges of locating information, some clinicians have also taken to writing important information either at the top or bottom of the note, since they believe that’s where other clinicians are most likely to look. These little summaries act as flags for themselves and other members of the care team so the information is not missed. Anne, a primary care physician, summarized the challenges of note bloat,

> It's a shame to have to say that it's like ... Well, I guess I'm not surprised that it's gotten worse. And it makes me super sad because I'm a stickler for details and obsessive about accuracy. And Epic is so ... The longer that one uses it, the more opaque it is. There's so much data in there, but there's also so much crap in there

> that you just can't see and find all the valuable stuff that's in there. And I see how staff, or when someone goes to the emergency room. I mean, it might as well be a chart in a basement somewhere.

One of the promises of the EHR was that it would provide clear and accurate data that could be used to improve the quality and efficiency of care. However, due to features in Epic as well as organizational and professional norms, the documentation in the EHR appears to undermine its promised potential. Addressing the issue of note bloat is becoming a multistakeholder project and an ongoing policy discussion. Proposed solutions focus on reimagining the medical note to include only the key elements of assessment (diagnosis) and plan, which would shorten the note's length and also highlight the most relevant information for providing care.

*Clinical vs Administrative Tasks*

The previous sections show how the EHR, and specifically Epic's EHR, functions as a data repository. However, the EHR has additional functionalities. This next section will consider these functionalities through the lens of Brennan and Suchman's (2020) framework of whether a disruptive technology in healthcare is clinical or administrative. Refer back to chapter 2 for a more detailed description of the framework.

*Clinical Task: Decision Support*

Clinical decision support is an exemplary functionality of a clinical task. Recall from history of the HITECH Act, which was outlined in chapter 4, that one of the EHR's promises was the inclusion of clinical decision support. By incorporating predictive analytics, evidence-based medicine, and clinical guidelines, proponents of EHRs argued that the technology would aid clinicians in their decision-making, thereby avoiding medical errors and improving the overall quality of care.

Currently the decision support features in Epic are limited. They primarily consist of alerts and checklists. The alerts act as pop-ups that warn the clinician about potential medication interactions or remind them that certain screenings or vaccines are due for the patient. Clinical users can also program their own reminders, known as wildcards, into their custom templates. By adding three asterisks in certain parts of the template, the clinician cannot sign the note until that part of the note is completed. Meanwhile checklists are developed by the healthcare organization and/or department that reflect guidelines from evidence-based medicine.

However, in interviews, clinicians at Marlowe Health highlighted the shortcomings of these decision support features as well as the ability to bypass checklists. For example, Jack, a cardiologist shared,

> The decision support modules, even though the computer knows the patient has a pacemaker, because it's in the pacemaker field, will always say there's a significant drug interaction between these medicines you're given. They can cause bradycardia. They can cause a slow heartbeat. They don't even recognize that, heck, the patient has a pacemaker, that can't happen. They're [Epic] not putting [it] together ... the decision support that could be there, but instead they're just not using their brains, for the same decision.

The popup alerts about medication interactions are programmed to reflect information related to the medications only. They do not incorporate additional information in the record that would counter the alert and stop it from appearing. While this unnecessary popup could be considered a helpful reminder, clinicians instead pointed out that too many alerts were distracting and saw a potential for alert fatigue. Bhanu, an internist at tertiary hospital, said

> So basically, if you're constantly getting warnings, or constantly getting notifications, or constantly getting suggestions through the electronic health records system, at some point you just kind of start pushing through and it decreases your efficiency, increases your mental burden, and it has a tendency to actually worsen care as a result. They've always had alarm fatigue, but I think the electronic health records can be an extension of that. That's what I'm worried about. If it's not going to truly make me more efficient, then it's going to just increase alarm fatigue.

Alarm fatigue has been a source of patient safety concern in healthcare for a long time (Mitka 2013; Maiers 2017; Carroll 2019). It occurs when there are so many alarms from medical equipment that clinicians become desensitized and fail to respond to an alarm. This can result in devastating and deadly consequences (Wallis 2010; Murry, Wachter, and Cucina 2020; Ross 2021). Three other physicians (Jack, Anne, and Maeve) also likened the alerts in Epic to alarm fatigue. And all physicians expressed concern that they may miss an important alert.

In addition to the decision support features offered by Epic, organizations can develop their own homegrown system and link to Epic. Allison, a radiation oncologist explained,

> We have a homegrown decision support tool. So that's separate… You can click through to it through Epic, but it's not as built in, I guess. The content was built out by Marlowe Health. There is radiology decision support in Epic, and I've used that, I guess, although I ignore it if I know that the national guidelines are to do something, even if the Epic guidelines are not. In terms of decision making about my patient cancer care, that's a homegrown product that's been intentionally, like there's a link to it in Epic, but it's not an Epic product.

By allowing organizations to link to their own decision support features, organizations can preserve their innovations. It also allows clinicians to use features that may be more advanced than what Epic currently offers.

Although decision support was highlighted as a key innovative feature of EHRs that would improve quality of care by incorporating evidenced-based medicine, at the time of this study, it is still in its infancy. Epic, as well as other vendors and researchers, are working to incorporate AI and predictive analytics into their EHRs. Recently, Epic's incorporation of algorithms into its system have been criticized for perpetuating health inequalities (Murry, Wachter, and Cucina 2020; Ross 2021). But for the purpose of this study, it is important to note the limitations of decision support and recognize that when discussed it is more of an imagined

future. However, as this functionality advances, it has the potential to create a greater impact and therefore move the EHR into the categorization of a clinical disruptive technology.

*Administrative Task: Billing*

The other side of Brennan and Suchman's (2020) framework classifies a disruptive technology as administrative. This section now considers billing in the EHR as an administrative task as it is involved in the care delivery process. Billing and the medical record are tightly linked. The information contained in the medical record serves as documentation of services provided. When the medical record was in its paper format, professional coders would review notes and assign ICD diagnostic codes. These codes were used to determine the type and extent of services provided. The more specific the codes, the more money the clinician and the healthcare organization could charge.

With the adoption of the EHR, billing can now be streamlined. The information in the EHR can be linked to the billing system. In Marlowe Health, clinicians are now responsible for coding and billing patient visits/encounters. While some EHR systems, such as AllScripts, provide billing assistance, Epic does not. At least it is not built into Marlowe Health's EHR. Instead, clinicians must assign codes. This new task proved challenging as clinicians are not trained in the complexity of ICD codes. In interviews, physicians shared that if they were not specific with the diagnosis entered into the problem list, then they wouldn't receive the same reimbursement. For instance, Carol, a primary care physician described the process as such,

> With the problem-oriented charting in Epic, you have the problem ... Even the problem label became a big deal. There's this hideous look up, this startup cost of it won't accept hypertension as a diagnosis. It will accept it as a diagnosis on the problem list, but it won't accept it as a billing diagnosis. When you're doing problem-oriented charting it'll take essential hypertension or secondary hypertension or much more elaborate forms. Instead of having type II diabetes on your problem list, oh my God, it has to be type II diabetes with or without chronic use of insulin, with or without this complication, that complication. Eventually

> you figure out how to streamline that, but initially there's this totally pointless waste of time. Epic is trying to drag you in the direction of highly specific diagnoses, like type II diabetes with chronic renal disease including stage III renal insufficiency and diabetic retinopathy.

While this would provide very specific medical information, it wasn't necessarily seen as clinically relevant to respondents. Rather, all respondents viewed the incorporation of these very specific ICD diagnostic terms as a reflection of billing needs rather than clinical needs. And some clinicians pointed out that it made it more challenging to quickly glance through the problem list and understand the patient's health status. In addition, respondents linked the documentation necessary for insurance reimbursement as a contributing factor to note bloat.

While assigning coding tasks to clinicians via the EHR may appear to be more efficient/cost saving as it cuts out the review by a separate coding department, there are unintended consequences. There are reports that hospital systems suffered revenue loss following the adoption of an EHR system (Moukheiber 2012; McClusky 2016). The financial loss wasn't just tied to the cost of the EHR system and upgrading the computer system. Rather, it was linked to clinicians' inability to properly bill or up-code for procedures (Moukheiber 2012; McClusky 2016). In addition, several physicians expressed concern of inadvertently overbilling and then being charged with medical insurance fraud. To protect themselves, they adopted a strategy of underbilling for services, which resulted in the healthcare organization receiving less revenue than anticipated.

Recognizing the challenges of billing, entrepreneurs are entering the space to provide services. For example, Dr. Elion, of Chartwise, developed a clinical documentation integrity (CDI) system that connects to the EHR. It reviews the information in the EHR, compares it with the ICD code book, and then suggest more specific codes that would accurately reflect what

happened as well as provide the specificity that would ensure a higher reimbursement rate (Jon Elion, interview with Liz Brennan, Nov 26, 2018).

But for some medical specialties, these billing challenges are no longer an issue. As part of the 2020 Medicare Physician Fee Schedule Final Rule, CMS revised the coding for Evaluation and Management (E/M) office visits (CMS.gov 2020). Reimbursement for outpatient visits is no longer tied to visit levels and documenting diagnostic codes. Instead, beginning on January 1, 2021, reimbursement is based on medical decision making or physician time. This change was a direct result of the AMA's development of Current Procedural Terminology (CPT) codes that are designed to streamline and improve the efficiency of coding (AMA 2021b). The AMA acknowledged that the emphasis on reimbursement for time over coding was to address the problems of note bloat and ease the documentation burden for physicians providing outpatient care, especially for primary care (AMA 2020a). Within Epic, clinicians can rely on the system for tracking their time in a patient record. To assist with this transition, Marlowe Health created a SmartPhrase that allows clinicians to document the time spent on patient care. By entering this SmartPhrase into the patient's note, it counts the time[46] clinicians spent outside the actual patient visit, including time spent reviewing the chart, pre/post charting, corresponding with other clinicians, and care coordination.

The EHR facilitates billing, but this administrative task has undergone a significant shift. While previously this administrative task was performed by professional coders, it has been reassigned to physicians. This has created consequences for the healthcare organizations in terms of revenue loss and consequences for clinicians who feel burnt out from the additional burden –

[46] Anne, a primary care physician, pointed out that this new reimbursement structure only counts time spent on patient care on the day of the visit. Therefore, any work spent preparing the day before the visit or coordinating care with other clinicians in the days following the visit will not be counted. She describes this as "laughable" since so much care is still not captured in this new reimbursement structure.

this will be explored more in the next chapter on physician autonomy. Overall, the emphasis on billing and other administrative tasks, suggests that at this current stage, the EHR should be classified as a disruptive administrative technology.

*Communication*

Finally, this chapter will address how EHRs and Epic deliver on promise of EHR to ease communication amongst care teams, across organizations, and with patients. This part of the envisioned EHR future would address the dual crisis in healthcare, which was outlined in chapter 4. By ensuring clinicians had the most accurate and up to date patient information, it would improve the quality of care and lower costs as clinicians avoided duplicate tests. In the first subsection, the analysis focuses on communication within the organization via the "in-basket". The second subsection addresses interoperability, e.g., the sharing of patient information across healthcare organizations.

*In-basket*

In addition to serving as a data repository, the Epic EHR also has a messaging feature known as the in-basket. The in-basket is similar to email in that this is where in the system clinicians can receive direct messages from other clinicians as well as patients. This is also where clinicians will receive notifications of ordered lab reports, radiology reports, etc., as well as if they are cc-ed on any notes. Usually, a clinician is cc-ed if they are part of the care team.

However, the in-basket was repeatedly criticized by respondents as a source of information overload and a challenge to maintain. All the above forms of information arrive at the in-basket and are sorted into folders. But it still requires the clinician to review the contents of each item. Allison, a radiation oncologist, shared

> I don't love it, because I think it gets a little cluttered ... you just get CC'd on all the notes that you're a part of the care team. I always put myself on the care team

> for the patients I'm taking care of. If someone just CC's the whole care team there may not be anything relevant. The patient may just be doing well in their follow up. You just run into a little bit of inbox fatigue. I do think for urgent or more specific cases worthy of conversation I still stick with email.

While designed to keep the care team informed on a patient's progress, the cc function results in the clinicians receiving a copy of the note in their in-basket. The clinician then needs to read through each note to determine if any of the information is relevant to their care plan. When we consider the documentation issues discussed above, we can begin to understand why clinicians are concerned that important information will be missed. To avoid information being missed in urgent cases, Allison will use email thereby bypassing the messaging system within Epic's EHR.

Because primary care physicians coordinate care for a large patient population, they are more likely to experience in-basket overload. As Anne, the previously quoted primary care physician, shared

> I feel like it's all I do. I sit in front of Epic, in front of my in-basket, in front of these like literally mushrooming folders, ones you've never heard of, you wouldn't have expected something important to be there. The amount of stuff that's coming toward the MD, it's really unbelievable. My team is so stressed out that I find we volley back and forth about simple messages that shouldn't be there.

This sense of stress is echoed by the other primary care and family medicine physicians. For physicians, they attributed the in-basket to being another source of documentation burden. All physicians interviewed, described how they struggle to keep up with their in-basket. Often checking in on nights, weeks, and vacation to try to stay on top of messaging. This contributes to the extended time that clinicians are engaging in work and further structuring their time.

*Interoperability*

The goal of the HITECH Act was to establish a nationwide network of EHRs to facilitate the sharing of patient health information across healthcare organizations and hospital systems. With access to up to date comprehensive health records, clinicians can make informed care

decisions that would not only improve the quality of care but also decrease costs as clinicians wouldn't need to order duplicate tests. However, as noted in the previous chapter on Meaningful Use, interoperability between EHRs has fallen short. In the case of Epic, there are some interoperability features that allow for connecting patients' Epic records across different hospital systems/healthcare organizations. However, interoperability between Epic and other EHR vendors is limited.

Within a hospital system, a patient's record is visible to all those who have access to the Epic EHR. From ambulatory centers to tertiary hospitals to rehab centers, if the organization is part of the hospital system, then there is a shared Epic EHR. This data is sharable and accessible because the hospital system is using the same Epic platform.

Epic also offers a feature called Care Everywhere that allows clinical users to view patients' records if the patients receive care at another organization with an Epic EHR. It will also pull in medications, allergies, immunizations, and problems from other Epic organizations and reconcile them into the local chart. Marlowe Health runs an automatic query the night before a patient's scheduled appointment and searches all Epic organizations within a certain mile range to pull in this information and reconcile it into the local record during the appointment intake. However, unless the two organizations have negotiated for a shared interface (more on that below), when a clinician goes to access Care Everywhere, it opens as a separate window. Bhanu, an internist at North Hospital, summarized the process as such:

> The problem is that the information isn't going to pop up in the same format that you're used to it being in. In other words, let's say I want to see what a patient's potassium level has been over the last six months. It will tell me the last six months it's been at our hospital and other Marlowe Health hospitals, and then it will give me a separate link to say, "Oh by the way, if you want to look at health records in another [hospital] system, you can click on this link," but then I have to look at that system, then manually change everything back, and the correlate it with what I know I see on the screen.

Other physicians described similar challenges of navigating the Care Everywhere platform and taking the time to incorporate the data into their documentation. While this format of interoperability provides additional details to the physician, it is not as seamless as users anticipated and requires additional documentation work.

In addition, because of privacy concerns as well as recognizing the record is organizationally based, patients must consent to have their information shared in Epic's Care Everywhere. Respondents shared how they would click on the Care Everywhere icon and receive a pop up stating they must first obtain consent to access the patient's record. It is an organization-based decision of whether to require an additional patient consent pop-up. While Marlowe Health does not require extra consent, thereby allowing other organizations to access their patients' records via Care Everywhere, the other hospital systems in the region do require the additional consent. Although this feature provides patients with more control over their information, from a continuity of care perspective the need for consent can prevent clinicians from accessing information—for instance prior to a new patient visit or if the patient arrives at the hospital unconscious.

Since 2018 Epic offers a One Virtual World interoperability service, which allows for the integration of multiple organizations' EHRs. This feature allows participating organizations' Epic EHRs to appear as if they are a single EHR with information updating in real-time—unlike Care Everywhere there isn't a separate pop up. Clinicians across the organizations can message each other, appointments can be scheduled, etc. Essentially, with this feature the two separate entities' EHRs act as if they were a single EHR thereby achieving the vision of interoperability. However, organizations must agree to this service and can decide to only incorporate specific features. For example, in Marlowe Health, Ambulatory Center 1 is down the road from a

Community Hospital. Prior to joining Marlowe Health, many of its physicians had admitting privileges at Community Hospital, which continued after the merger. Both Marlowe Health and Community Hospital use Epic and eventually negotiated to have an integrated EHR for their shared patients However, this integration did not extend to messaging so clinicians must email, call, or fax updates to clinicians in the other organization. Reflecting on this situation, Jack stated,

> Our office didn't want Community Hospital to have our patient information freely visible, because basically the data is ... That's power, once you have access to it, so I don't know. I don't make these decisions.

Although not present for the decision-making, Jack attributed the situation to an organizational decision based on healthcare organizations not wanting to share/have limited integration to maintain control over data. This data has value, or "power", as it can be used for targeted marketing. This also reflects the prevailing logic that a patient's health record is organizationally based as opposed to being patient-based. Ultimately, it was negotiated that clinicians with dual appointments at Ambulatory Center 1 and Community Hospital would have an integrated record for their shared patients. However, this negotiation only allows the clinicians to view and update patient information. Other functionalities, such as messaging, are not available. Epic does offer a Message Anywhere functionality, but both organizations must agree to use it. Currently, Marlowe Health and Community Hospital have not agreed to implement this feature. Therefore, this creates an additional work around for the clinicians, who must communicate about patients via phone or email, and then enter that information in the record. It also creates a scenario where a communication breakdown could happen and negatively impact/harm a patient.

Interoperability between an Epic EHR and other vendor EHRs was non-existent during much of the research period. However, this is beginning to change following the passage of the

21st Century Cures Act in 2016 that introduced legislation to prohibit information blocking[47] and encourage interoperability. The regulatory rules on information blocking went into effect in 2021. Epic initially was very vocal against this law—arguing that it would undermine/risk their proprietary information if required to share data across EHR vendors. Other vendors, such as Cerner, came out in support of the legislation. However, following the start of the COVID-19 pandemic, Epic backed off its criticism and the law went into effect. When the US healthcare system will achieve full interoperability across EHR systems is presently unknown.

The lack of interoperability was discussed by all respondents. Often reflecting a sense of frustration and disappointment that the primary promise of EHRs had not yet been delivered. Bhanu's commentary on the situation reflected the sentiments of all interviewees,

> I think the biggest problem we have is that our health record systems don't talk to each other. Health care doesn't exist in a vacuum, people don't just go to one health system, people come to North Hospital, they're not just being seen at North Hospital, they're not just being seen within Marlowe Health, they're being seen at hospitals all over. But I can't access all the health records everywhere at all the other hospitals.

The idea that healthcare doesn't exist in a vacuum reflects one of the key arguments in the EHR policy debate. Recognizing our fragmented healthcare system, the EHR was seen as a solution that would allow for sharing patient information across healthcare organizations. Regardless of where a patient received care, their information would be readily available for their clinicians. With more complete information, the quality and efficiency of care would improve. The inability

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[47] "Cures [Act] defines info blocking as business, technical, and organizational practices that prevent or materially discourage the access, exchange or use of electronic health information (EHI) when an *Actor knows*, or (for some Actors like EHR vendors) should know, that these practices are *likely* to interfere with *access, exchange, or use* of EHI. If conducted by a health care provider, there must also be knowledge that such practice is *unreasonable* and likely to interfere with, prevent, or materially discourage access, exchange, or use of EHI" (AMA 2020).

to easily share and access information reflected a failure of EHR policy and a failure of the technology to deliver on its promises. Thus, it appears that there are two challenges to interoperability. First at the organizational level, different hospital systems/healthcare organizations are unwilling to integrate their records. Second at the healthcare system/EHR system, Epic is doesn't want to integrate their records/share their information with other vendors. At both levels, there is concern regarding control over data – whether patient or proprietary tech data. Addressing this concern will be necessary to move towards a full interoperability.

*Conclusion*

While largely descriptive, this chapter provides an overview of Epic's key features and functions. By focusing on its materiality, we can understand how Epic's EHR operates and how it creates opportunities and challenges for its users at Marlowe Health. This provides important context for understanding how the adoption and implementation of Epic's EHR impacted workflows and practices at a hospital system in the wake of the HITECH Act.

First, this chapter adds nuance to the standardization of EHR technology by highlighting customization at the organizational and individual levels. Recall that in the prior empirical chapters, the Meaningful Use program and the CEHRT process defined the functionalities and set the technical standards for EHR technology. Together, these policy programs moved the EHR towards its dominant design. While the EHR vendors encouraged a more standardized approach, this chapter shows how Epic still offered a certain degree of customization—primarily in structuring workflows and how information is documented in notes. These customizations provide both the client and the clinical user a certain degree of freedom in constructing Epic's system and notes to reflect their idea of care delivery. However, these customizations are subtle. The overall logic and design of the EHR, especially its required Meaningful Use functionalities

and technical standards, are still there and cannot be changed. But Epic has found ways to accommodate preferences from their clients and clinical users. However, this chapter shows how the customization creates tension and has implications for locating patient information within the system.

Second, this chapter also explores how Epic's problem-based charting introduces a new logic to documenting patient care. By focusing on the patients' diagnoses and plan of care, this new approach was supposed to make the most relevant patient information readily available. However, respondents reported that this new approach had yet to be fully accepted and formalized within Marlowe Health. The responsibility of managing and updating the problem list unofficially fell to the generalists, which respondents described as an additional task/burden. In addition, this documentation strategy, as well as how information is displayed in the dashboard/storyboard, also created challenges in locating information. Finally, checklists, templates, and the copy-forward feature also contributed to lengthening notes, which is referred to as note bloat. While documentation should make the information more legible compared to handwritten notes, the amount of documentation created not only additional work for clinicians but also made it more difficult to find and cognitively process relevant patient information.

Third, this chapter helps to further elaborate on Brennan and Suchman's framework and initial analysis of the EHR. Recall from chapter 2, that Brennan and Suchman suggested that the EHR could be classified as an administrative technology. The documentation aspect of the EHR was a consistent translation, for the most part, of paper record keeping. However, when they considered the more disruptive functionalities of the EHR, Brennan and Suchman suggested that the EHR would be a disruptive administrative technology, because of how prior administrative tasks, such as billing, were reassigned to physicians. As this chapter shows, Epic allowed

Marlowe Health to shift billing responsibilities to their physicians. However, this had unintended consequences of not only creating an additional burden on the clinicians, but because they didn't have expertise in ICD codes, many respondents reported undercharging for their work. However, another functionality in Epic, clinical decision-making, could be classified as a disruptive clinical technology. While still in its infancy, advances in predictive analytics and machine learning could allow more sophisticated decision-making support. This has potential to extend physicians' cognitive capabilities, as well as challenge their discretion, which will be explored more in the next chapter. Overall, this part of the analysis suggests that Brennan and Suchman's dimension of clinical vs. administrative technology shouldn't be considered a dichotomy. Rather, it may be more helpful to consider it as a continuum and examine the different functionalities in a technology.

Finally, this chapter examined the extent that Epic EHR supports communication within Marlowe Health and across other healthcare organizations. Epic provides a unified patient record that is visible and accessible to all clinicians within Marlowe Health's hospital system. However, when it comes to interoperability across healthcare organizations, there are limitations. If other healthcare organizations have Epic, then their patient records are visible to clinicians at Marlowe Health via Epic's Care Everywhere app. However, if the healthcare organization doesn't have Epic, then the patient information is not shared. Therefore, the EHR currently fails to create an interoperable system that was envisioned by the HITECH Act.

Overall, this chapter shows how the Epic EHR works at Marlowe Health and how clinical users ascribe meaning to the technology as well as how they work both with and around it. These strategies and acts of resistance highlight potential implications/unintended consequences of the

EHR. Specifically, the next chapter will examine how these implications impact physicians' autonomy.

## Chapter 7: Physician Autonomy

The prior chapter documents how the EHR system, Epic, transformed and altered workflows, processes, and interactions at Marlowe Health, thereby providing insight into how the implementation of the HITECH Act played out on the ground. This chapter examines what this means for clinical users of the EHR, especially the medical profession. Beyond transforming the literal practice of medicine, the incorporation of the computer also marks a shift in the conceptualization of what it means to be a physician. Vasant, a Resident in Internal Medicine at South Hospital, reflects on this change,

> You know I think a lot of us, and I think I can at least speak for myself, we didn't really imagine that being a doctor was going to mean spending most of our day on the computer. I didn't think that, right. I envisioned having this encyclopedic knowledge of medicine and that would be enough to just go see patients, put my stethoscope on them, figure out what's wrong, and then have someone give them the right medicine. That's just not what it is. That's maybe what medicine use to be like when we didn't have all these tests and data to analyze, but it's not like that anymore.

The imagined physician uses their knowledge to diagnose and treat their patient—an ideal type described by all respondents in this study. Absent from this imagined physician is the presence of the EHR and a practice of medicine that prominently features the computer. Thus, the rapid adoption EHRs following the implementation of the HITECH Act's Meaningful Use incentive program required physicians to not only use this tool in their everyday practice, but also reconcile its implications for their professional identity.

There are several models from the professions literature that could be drawn upon to understand this phenomenon: autonomy, expertise, status, and market control (Larson 1977; Freidson 1988; Abbott 1988; Gorman and Sandefur 2011). While any of these models could be the focus of this analysis, a profession's autonomy emerged in preliminary interviews and continued to emerge as the fieldwork progressed as a dominant theme. And in a way, autonomy

encapsulates features from each of these models as the profession's expertise grants it status and jurisdictional control. Therefore, I ask, how does the EHR impact a physician's sense of autonomy?

This chapter examines the impact of the EHR on physicians' sense of autonomy by examining variation within the medical profession. Recall from chapter 2, that a profession is defined by its possession of formal knowledge, obtained through training and abstract knowledge used to diagnose, treat, and infer (Abbott 1988; Freidson 1988). This combination of formal and abstract knowledge enables the use of discretion when addressing a problem, which in turn grants the profession autonomy. Control over the knowledge and its associated work enables the profession to stake a jurisdictional claim. This dominant position in a particular jurisdiction is legitimized by public support and credentialing through the state. Thus, autonomy not only allows a professional to practice independently, but grants status and power to the profession as a whole. Originally, the sociology of professions took autonomy as a given. However, recent scholarship has begun to acknowledge variation in autonomy and its implications for control over work and the organizational field (Gorman and Sandefur 2011).

At the individual level of analysis, research focuses on the extent to which the professional is able to exercise discretion, free from supervision. This technical autonomy is a defining feature of early conceptions of the profession (Freidson 1970; Gorman and Sandefur 2011). However, research has shown that a professional's sense of autonomy is not universal; it varies across and within professions due to organizational structures, changes in the organizational field, and demographics (Stelling and Bucher 1972; Prechel and Gupman 1995; Lin 2013; Jenkins 2018).

This chapter will focus primarily on how the EHR impacts physicians at the individual level. Emerging from interviews, I find that physicians' autonomy varies along the following dimensions:

- Autonomy over time use
- Interactional autonomy
    - Physician-Physicians
    - Physician-Ancillary Clinicians
    - Physician-Patient
    - Physician-Administrator
- Cognitive autonomy

In each dimension, the EHR has the potential to positively impact autonomy in that the physician perceives the EHR to be supporting/increasing their ability to exercise discretion. Likewise, the EHR has the potential to negatively impact autonomy by curtailing, hindering, and preventing the physician from using their discretion. However, not all physicians are impacted equally across these dimensions. Some physicians avoid the impact by refusing to engage with certain features of the EHR and its workflow. But not all physicians are able to resist, and I will show how some acts of resistance are often merely trade-offs where in order to preserve their sense of autonomy along one dimension, they sacrifice it along another dimension. Finally, I will show that the most salient difference impacting physicians' experience is along the professional distinction between generalists (primary care, family medicine) and specialists, as it appears that generalists are experiencing the greatest impact of the EHR on their autonomy and are the least likely to be able to actively resist the system's influence.

*Methods*

This chapter's analysis draws on the qualitative fieldwork conducted between 2018 and 2022. Refer to Chapter 3 for a complete and detailed overview of the fieldwork methodology and Table 3.3 on page 54 for the sample's demographics.

### *Results*

*Autonomy Over Time Use*

Autonomy over time use focuses on physicians' discretion in how they manage their time. A defining feature of the professions is the technical autonomy that allows them to practice free from supervision, which can include organizing how they spend their time. The EHR impacts physicians' autonomy over time use by structuring and standardizing documentation processes.

All physicians discussed how the EHR impacted their time use by creating a documentation burden. While recording patient care in the medical record is a primary and necessary task performed by physicians, the respondents described how the EHR altered this practice to expand what was required. Bhanu, an internal medicine physician, contrasted the experience to the legal profession in order to illustrate the EHR's new demands on the medical profession.

> It's weird in healthcare. I feel like in healthcare this is the only place where this sort of thing happens. What I mean by this is that, when lawyers go to court, yes, they write a lot of briefs and all that, but when they're making an argument in court, they're not worried about taking notes on their argument. They have somebody else who's transcribing the argument. They just focus on arguing their case, knowing that the record is going to be there, but because physicians are made responsible for the record, what ends up happening is, rather than being able to focus all of your energy on taking care of the patient, you're focusing so much of your energy on transcribing your thoughts.

Bhanu's analogy suggests that the EHR infringes on physicians' autonomy as opposed to expanding their capabilities. This is counter to the claims made by EHR proponents during the federal policy debates, which are described in chapter 4. Per these advocates, including early adopters, the EHR would improve clinical documentation. However, the focus of this claim centered on how legible and more detailed documentation would improve the quality of care and

decrease medical errors. It did not consider the documentation process itself. As outlined in the previous chapter, the current iteration of EHR technology creates a more extensive and standardized documentation process that contributes to note bloat and information overload. Across interviews and observations, clinicians questioned whether all this documentation was clinically necessary, and many felt that it was beyond the scope of their work. Rather than expanding on their capability to provide care, physicians describe the EHR as creating a documentation burden that has implications for the physicians' autonomy, especially over managing their time.

Continuing with his reflections on documentation and time, Bhanu, explained:

> I do think that doctors spend way too much time on documentation. Some of that is because of the quirks of the electronic health record system. I think some of that is just because of the way we set up the system where the doctors are responsible for all aspects of it. There's a lot of time spent in redundant work.

This observation was echoed across the other interviews. Not only are physicians expected to record information related to a patient's visit, but are responsible for additional tasks in the EHR. Many of these responsibilities were previously done by other clinical staff, such as refilling prescriptions, and administrators, such as billing. Because the system shifted these tasks to the physicians, it requires them to spend more time working and documenting in the EHR. As a profession, we expect the physicians to be able to exercise discretion in how they manage their daily tasks and in turn their time. However, for these interviewees, the system requirements drive how they use their time.

The additional tasks and documentation burden also add to the hours that physicians work. We know that physicians work long hours, but due to documentation requirements and the ability to access the EHR remotely, all respondents discussed how they are continuing to work

after hours and on vacation. A radiation oncologist, Allison, described "My day runs 7:00 am to 5:30 pm or 6:00 pm in clinic, and then I'll probably put in another hour, hour and a half at home". Other physicians shared similar experiences of how the workday spilled over into the evenings. A cardiologist, Jack, explained:

> There's a constant background pitter patter of notes and comments you have to sign off on. It's nice to get that done in real time and just because you can, you tend to do it. It does cut into both evenings and vacations.

These experiences are also consistent with prior time use research that showed physicians spending 5.9 hours of an 11.4-hour day working in the EHR (Arndt et al. 2017) and that generalists tend to spend more time documenting than other specialties (Young 2018; Melnick et al 2021). In fact, documenting after clinic hours has become such a common occurrence that it's been dubbed "pajama time" amongst the medical profession. Countless blogs, conference presentations, and physician wellness modules are dedicated to addressing and lessening pajama time as it's been linked as contributing factor to physician burnout (Gawande 2018; Getinger et al. 2021; Gaffney et al. 2022).

Clinicians are also required to complete their documentation in a timely manner. The hospital accreditation organization, the Joint Commission on Accreditation of Healthcare Organizations, allows healthcare organizations to set their own timelines for completion. Per Emma, a health information technologist who supports South Hospital's ambulatory centers, Marlowe Health's policy requires clinicians to complete and sign their notes within three days of the visit. If a clinician reaches a certain number[48] of unsigned patient notes, a warning letter is sent to their in-basket and a pop-up warning appears at every log-in. If the clinician goes beyond that limit, then the system blocks them from scheduling new patients until they complete the

[48] Emma could not recall the specific number of days.

notes, thereby introducing a financial sanction as physicians' payment is tied to seeing patients. Emma added that some of the ambulatory sites she supported added fines for going over a certain number of unsigned/incomplete notes. These sites run weekly reports to monitor their physicians' completion rates. Because clinicians' payment is linked to patient visits/encounters, these coercive measures add additional pressure and incentive to complete documentation. While this is important for fulfilling the goal of having timely and accurate information in the medical record, the time constraints add additional structure to the clinicians' work.

Finally, many physicians also expressed concern that the time documenting in the EHR came at the expense of other important activities. Michael, an oncologist at a different hospital system, shared,

> Unfortunately, there's only 24 hours in a day and we have to see patients, take care of their problems plus getting all the regulatory issues, compliance issues satisfied plus and that is before we start reading journals and going to conferences and start updating ourselves to the latest information that is coming out, okay?

His experience reflects concerns raised by the physicians at Marlowe Health. The need to complete extensive documentation within a limited time window comes at the expense of other activities. The most frequently cited trade off was being able to read and stay up to date on the latest research and medical breakthroughs. A significant concern since these medical advances could improve patient care. While proponents of EHRs argued that the technology would be able to incorporate new protocols and best practices, this promise has yet to be fulfilled, as outlined in the previous chapter.

These physicians' experiences suggest that the increase in tasks and documentation associated with the EHR interferes with physician's autonomy over time use. The EHR, rather than the physician, appears to be structuring the physician's time use. While the documentation of patient's medical information is vital for informed decision-making, the time-consuming

process is an issue. And as the prior chapter pointed out, these documentation challenges also make it difficult to locate relevant information for decision-making. Together, this makes it more challenging for the EHR to deliver on its promise to improve patient care. While we want physicians to document in the EHR, we also want to ensure that the documentation allows them to expand upon their capability instead of infringing on their autonomy.

*Interactional Autonomy*

Interactional autonomy focuses on physicians' discretion in interactions across four groups:

- Interactions with other physicians
- Interactions with ancillary clinicians (such as nurses, nurse practitioners, physician assistants, medical assistants, etc.)
- Interactions with patients
- Interactions with administrators

*Interactional Autonomy: Physicians*

This dimension considers how the EHR impacts interactions between physicians. All respondents reported that the EHR facilitated communication between physicians, which made it easier to work together to coordinate patient care. By supporting the interaction, the physicians are able to maintain their overall autonomy. However, there were two ways that the EHR negatively affects autonomy within physician-physician relationships, especially along the generalist/specialist distinction.

First, specialists' autonomy may be negatively affected as generalists use their documentation to evaluate their work for future referrals. The EHR renders all physicians' work visible as their notes are easily accessible for review. This is consistent with previous conceptualizations of the professions regarding reputational supervision and control by peers (Freidson 1970; Freidson 1988; Abbott 1988). The EHR extends this supervision by making the

work more easily visible in real time. For generalists, this allows them to have a better sense of how specialists treated their patients. Lisa, a family medicine physician, described it as such,

> When I look at their notes ... I think actually all the specialists do a good job. Specialty specific, at documenting the things they need to. And I notice, especially oncologists, tend to be very good at addressing the other issues that aren't necessarily cancer related. The psychosocial issues, the other medical issues. And a lot of the other specialists are good about that too. I've learned to recognize who's good about doing this and who's not and refer accordingly because they're seeing the patient more as a person.

As a family medicine physician, Lisa, is responsible for coordinating a patient's care and often plays a crucial gatekeeping role in determining referrals to specialists. Since Lisa, can more easily review notes, she can be more selective in her referrals to specialists who she perceives as having a more holistic and similar approach to treating patients. However, given the challenges of documentation and customization as outlined in the previous chapter, Lisa is basing her evaluation of a referral-worthy physician on what is in the note. It's possible that a specialist is treating a patient in a way that is consistent with Lisa's perspective, but it is not captured in the note. Therefore, a specialists' discretion in how they document can affect whether they receive a referral, especially if there is not a direct interaction but rather reliance on the EHR system.

Second, generalists' autonomy may be negatively affected by the EHR as they assume the primary responsibility for the integrity and accuracy of the patient's EHR, which can then be undermined by specialists. Recall this quotation in the previous chapter from Anne, a primary care physician, who explains,

> It also comes to the primary care physician's responsibility. I'm like a chart manager. I'm like an Epic keeper. Like the dashboard is my job. Specialists go in and do whatever they want. They put two more knee related diagnoses. I'm the one who tries to consolidate it to one. It's almost like a side job. Again, it's not like I want to be paid for the side job, but oh my God, the time.

Maintaining the integrity of Epic's dashboard/storyboard falls to the generalists according to all interviewed primary care and family medicine physicians. Recall that the dashboard is the main page of the patient's record, i.e., the storyboard, and is to serve as the initial snapshot of the patient's health status. Because of their role in coordinating care, the generalists I interviewed felt like they had to undertake additional documentation upkeep. This is perceived as unpaid labor and an additional time-consuming job. Therefore, for the generalists, this new role is perceived as negatively affecting their autonomy as they spend more time conducting "clerical work" (Carol) on behalf of specialists.

Specialists in the sample reiterated this perspective. For example, Adrian, an oncologist, shared,

> I've seen those [screening alerts] in the patient's charts. Because I'm not a primary care doc, most of those are pointed towards the primary care physician. I'm more hone to things like a mammogram, colonoscopies. So, I don't look. If a patient's coming to me and I'm dealing with their iron deficiency I'm not looking to see if they've had their colonoscopy in the last five years and that'll come up there [in the chart as pop up], but it's kind of not for me, it's for the primary care doc. To be honest, I'll ignore it. I don't look at that unless it's an issue around what I'm doing…I'll pick and choose.

While the EHR alerts any clinician clicking into a patient chart of overdue screenings as well as problems that may require action, the clinician can choose to ignore them, especially if it is deemed as unrelated to the care they are providing. In this way it supports a physician's autonomy to engage with medical information and action as deemed necessary by their discretion and reflective of their specialty's jurisdiction. However, this has potential implications for patient care. If a patient does not have a primary care physician or the primary care and specialist do not coordinate/communicate effectively, it's possible that important alerts will fall through the cracks. In addition, while an alert may not appear to be directly relevant to a specialist, it's also possible that it may actually matter for the patient's care. For instance, by not

focusing on alerts about tests that could indicate cardiac issues, an oncologist could make care decisions that don't factor in underlying cardiac problems. The oncologist's decision would likely have benefited and been more accurate if that information was available. Thus, while specialists are able to exert their autonomy and avoid the role of "chart manager", it could have implications for patient care.

Despite assuming the role of "chart manager", the work of generalists can also easily be undone by specialists. In a follow up interview, Anne, shared a recent incident, where the actions of a specialist undermined her medical decision-making. Her patient has a rare genetic disorder that requires a colonoscopy for cancer screening every three years as opposed to the recommended five years. Anne entered this information in the patient's problem list and health maintenance module. However, when the patient saw a gastroenterologist, the specialist included a line in his visit note that the patient was scheduled for a colonoscopy every three years and he corrected it back to the recommended five years. She noted that if he had not included this line in the note, she wouldn't have known he had changed the screening alert, because there was no other notification of the change, and the patient would have missed their screening. In response to this event, Anne filed a safety report. Ultimately, she faulted the EHR system, and not the specialist, for the error, as she believed the system should not allow her work to be so easily overwritten by another physician. Although just one example, it highlights the potential for a physician's autonomy to be negatively challenged by the EHR as physicians can change other physicians' orders without a direct interaction.

*Interactional Autonomy: Ancillary Clinicians*

The EHR reinforces the professional hierarchy between physicians and ancillary clinicians (e.g., nurse practitioners, nurses, physician assistants, and medical assistants). By

design, the EHR codifies roles and tasks that had often been delegated to other clinicians by requiring the physician to sign off on an order, prescription, note, etc., in the record. This workflow was most evident in the prescription process. Several physicians described how prescribing practices shifted back to physicians. For Lisa, a family medicine physician, she explained,

> Now, at least at South Hospital, and this isn't probably just Epic, this is South Hospital. They won't let the nurse send that final prescription, even though I clearly said what I want to do. The physician has to be the one that signs it. And in theory, it's really not a big deal, it's just a couple of extra seconds to put in our password, every single time. But it is, when it's something chipping away, when you do ten of these a day, and then there are ten of something else a day, and ten of something else that used to only take a second. It's a whole lot of extra seconds that really add up, and it delays us getting back to patients. We've had a lot of problems with things taking a lot longer to get back to the patient, they're frustrated.

Interestingly, Lisa isn't sure if this decision reflects an original Epic design or is a policy from South Hospital. However, regardless of the origin of the decision, for Lisa and other generalists, this was an example of another task redelegated back to the physician that went against the vision of a team-based approach to patient care.

However, it wasn't just generalists who pushed back on the ways that Epic designed its system. A former Epic employee, Priya, described a moment during a Go Live at a hospital in the Midwest where:

> A surgeon yelled at me once about not wanting to put in the orders and sign off on orders. He's like, "My nurse always does that for me." Legally, you [the surgeon] can't do that. Because he was like, "You need to find a way for Epic to do this." And I was like, yeah, I can't.

Epic is unable to change the order entry workflow for this surgeon because the order entry is linked to medical licensing. The surgeon is legally liable for the orders and sign off. Prior to Epic, it is likely that he was able to delegate these tasks to a nurse to complete. However, in

Epic, since the system documents everything, the workflow needs to reflect who technically is licensed and therefore liable for patient care. In this case, it's the surgeon.

Both examples illustrate moments where tasks that had been delegated to ancillary clinicians were returned to physicians. Because physicians are licensed to prescribe medications and enter orders, the systems' workflows recognize and reflects these statutes. While this creates additional work for the physicians, in this way the EHR is positively supporting their autonomy, especially at the level of the profession, by reiterating the boundaries of their professional jurisdiction.

This counters examples in medical sociology and the professions literature that highlight the internal challenges to the medical profession's jurisdiction by ancillary clinicians. Even when the EHR system design allows for a care team approach to medicine, it still reinforces the medical hierarchy. For example, Carol, a primary care physician, outlined how this team approach to care was supposed to work but also questioned its efficiency and accuracy.

> I think the workflow that the hospital envisions for us is that our medical assistant would do the med reconciliation. Not, I think. I know for a fact that their vision is our medical assistants will do the med reconciliation, which is fine if you don't care that it's not the least bit accurate. If you're just trying to check a box with a gesture, then that's fine. But the problem is our medical assistants finished high school. Maybe they went to community college. Maybe they didn't. Maybe they have a bachelor's degree, and they're trying to go nursing school or whatever. But for the most part, they don't have any background. So, they're capable of telling the patient, "Oh, okay. Look at this list. Are you taking these things?" And the patient looks at the list and is like yep or no. The medical assistant doesn't have the background to know like, "Wait a minute. That doesn't make any sense. Are you sure you're still taking this antibiotic?" So, they're being tasked with something that they're actually not able to execute on. I feel like it's a bit disingenuous of the administration possibly to be like, "Okay, so if I have a conscience, and I hear that it's done right, I'm going to have to do it myself." But you're the administration and you're telling me, "You don't have to do that yourself. Have your medical assistant do it." So, I don't know, that's not a great feel good thing.

This care team approach represents a newer logic that is supposed to help offload some of the burden on physicians, while also expediting care by incorporating medical assistants (MAs) and physician assistants (PAs) into the workflow of a patient visit. However, Carol's skepticism of the MA's medical expertise prevents her from trusting the MA to perform an initial screening task. While this would in theory lighten her workload, Carol questions whether this efficiency comes at the cost of quality care.

Meanwhile, another generalist, Lisa, has embraced this care team approach to lighten her workload. In our follow up interview, Lisa shares,

> So, we can easily see all the information [in Epic's Care Everywhere], but we don't get credit for it if it's not in under health maintenance. So, what I've done to try to make that easier [for myself] is I've trained my medical assistant. And so, he typically will look at my schedule a week ahead of time. If he sees any patient coming in as a new patient, he knows to check Care Everywhere. And if he finds any of the stuff our health maintenance list is assessed as overdue. He's been trained by our population health team on how to document that, so that it's already updated when I walk in the room because a lot of us were frustrated with the fact that we're in the room with the patient and we're furiously spending all this time, typing in dates. It's not doctor work, it's administrative work and it felt like there had to be a better way. There are only a few of us who have actually gotten to that level of doing that. I think a lot of other doctors they've just resigned themselves to doing this personally. It probably is burning people out, frankly. That hasn't gotten any easier.

By training and trusting her MA, Lisa shifts some of the administrative tasks to a paraprofessional to complete. This new approach helps to lighten some of the documentation burden. While Lisa and Carol differ in their views as to whether an MA is able to complete the role/task, both reinforce the professional status hierarchy in healthcare by emphasizing their expertise in medical knowledge. In addition, although this model is labeled as a care team approach, it's effectively reassigning administrative tasks back to ancillary clinicians/paraprofessionals. Therefore, even though the MA expands their role in documenting,

it reinforces that their role is more administrative and less reliant on using their medical expertise.

*Interactional Autonomy: Patients*

At the core of the physician experience is providing direct patient care, where they exercise their expertise. However, almost all the interviewees described how documenting in the EHR altered how they interacted with patients. Primary care physician, Carol, describes how this plays out:

> What Epic encourages you to do, when you're sitting there with a patient, is to open each problem and type directly into each problem. What that ends up doing is making you do a lot more clicking and a lot more staring at the computer, which is really erosive of the interaction.

Because of the way Epic structures the documentation process, the physician spends more time during the patient visit focusing on the screen. Each problem can trigger a series of pop ups and check lists that the physician needs to complete in order to move onto the next area of the chart. However, as Carol points out, this means that her focus, in particular her eye contact, is on the computer rather than on the patient. It also means that Epic is structuring the patient encounter to follow the check boxes on the screen as opposed to how the physician may want to structure the visit. She believes this in turn negatively impacts the patient relationship.

Another family medicine physician, Lisa said: “And I think the patient just leaves feeling like I'm a robot. So, that's extremely frustrating. I feel like I'm not serving patients, I feel like I'm serving this machine.” By describing/identifying as a robot, she highlights how the EHR is driving the interactions with patients. Lisa no longer feels like she can utilize her expertise to structure the patient visit.

Even specialists, such as Maeve, an anesthesiology resident, also describe how the EHR negatively impacts her ability to interact with patients

> No, it [the EHR] definitely detracts. I'm getting better at it, and I'm sure later on I'll get even faster at doing it simultaneously... Or I can just click it all after I leave the patient's bedside. I don't love doing it while I'm talking to them. I find that rude. I don't like doing that for bedside manner. But at the same time, there's a lot of production pressure in anesthesia and surgery to get through seven surgeries in one day. If there are seven surgeries booked, we shouldn't be running late.

As the anesthesiologist, Maeve has limited contact with the patient. It's likely for a single operation and most of the time she is with the patient, the patient is unconscious. However, establishing rapport during pre-op is important for Maeve, as she wants to ease the patient's concerns about their impending surgery. While she hopes to improve the balance of documenting while interacting with the patient, she ultimately feels that it negatively impacts her interaction with the patient. However, the surgery process cannot start until she has completed the pre-op documentation, so there is added pressure to stay on schedule. Because of this pressure, Maeve cannot avoid interacting with the patient and the EHR simultaneously.

To get around this issue, Bhanu, an internal medicine physician has adopted the following strategy: "I document after I see the patient. It definitely is a very, very slow process. I think I spend the majority of my day documenting". By not documenting during the patient visit, he is able to focus on the patient and structure the interaction based on his discretion. While he is able to avoid having the EHR negatively impact his sense of interactional autonomy, this strategy means that he has to complete his documentation after the patient encounter. This results in spending additional hours documenting. Allison, a radiation oncologist, also uses this same strategy.

Similarly, Vasant, an internal medicine resident, doesn't document in the room. However, his decision is not an act of resistance to maintain control over his interactional autonomy with the patients. Rather, he explains how the data in the EHR actually empowers him to determine a

diagnosis prior to seeing the patient[49], which in turn allows him to structure his patient interaction to emphasize mental and emotional support. He says,

> I think "man, my patients must feel freaked out when they don't hear from us." And they have no idea what's going on. So, I try to make it a point to use that time in the room with the patient to reassure them and make them feel better. Because honestly if I really think I know what the diagnosis is already there's really not that much more I have to ask them.

He acknowledges that this is a different approach compared to his Attendings, i.e., senior physicians, who were trained prior to the implementation of the EHR. Instead of relying on the data in the EHR, the Attendings use the patient interaction to gather important information to inform their clinical decision-making. This generational difference in how to approach data and patient care shows how for Vasant, the EHR supports his autonomy to interact with patients in accordance to his discretion. Thus, in this instance, not documenting in the record is not an act of resistance, but rather an act of adaptation.

Finally, the COVID-19 pandemic and shift to telemedicine illustrates another strategy for managing the physician-patient interaction that may allow some physicians to reclaim their autonomy. Anne describes how she sets up zoom on her phone, so the patient's video is next to her computer screen. This allows her to make "eye contact" with the patients while also looking through their record. She explains this is beneficial because,

> And basically, just not having to worry about that thing that I've perfected over decades of using the computer or talking to a patient who's sitting to my right at the same time. Like, that's hard to do and just be polite, let alone warm and engaging. And so, it's actually nice to just put all that body language and nodding and pretending to be listening aside and to be really listening and really engaging with Epic all at the same time.

Like Lisa and Carol, Anne felt that the EHR negatively impacted her interactions with patients. She adopted strategies to appear like she was connecting with her patients to build rapport and

[49] See the Cognitive Autonomy section for more detail on this process.

preserve the physician-patient relationship. However, in the shift to telemedicine, these strategies were no longer necessary. Instead, she could focus on the patient as well as the information in the chart. In this way, it appears that the use of telemedicine actually positively supports her sense of autonomy as she could structure the interaction to engage with the patient and provide care while simultaneously documenting in the EHR.

Overall, for some physicians, the EHR negatively impacts their interactional autonomy when they document in the record during a patient visit. These physicians point out how the EHR structures the patient interaction, as opposed to their own discretion. Other physicians are able to avoid this impact and maintain their interactional autonomy by documenting after each patient visit. Finally, two physicians demonstrated adaptative strategies that allow them to reclaim their interactional autonomy.

*Interactional Autonomy: Administrators and Health Information Technologists*

The EHR can positively or negatively impact the interaction between physicians and administrators/health information technologists, which in turn effects physicians' sense of autonomy. For instance, prior research has shown how administrators could use metric reports to question and challenge physicians' care decisions (Reich 2012). However, overall, the respondents in my study viewed their relationship with their administration positively. They didn't consider the administration using the EHR and its data to question or challenge their autonomy. For example, Anne welcomed the metric reports to improve her practice. However, she acknowledged,

> I have a colleague who is sort of much more resentful when we're presented with metrics about our prescribing practices or radiology practices. I don't feel that way. I sometimes wish it was explained to us a little better if they're going to show us those numbers.

Anne's personal experience is echoed by other respondents, who view the metric reports as a point of interest and a way to improve overall care. However, Anne's reference to her colleague's resentment suggests that other physicians view these metric reports as challenges to their autonomy.

However, it seems that most of the challenges and complaints about the system impacting physicians' perception of autonomy were directed to Epic itself as opposed to the administration. Carol was particularly vocal about this issue:

> Part of the reason doctors get so emotional about this is it's so offensive because I have this mental picture of these smarmy 20-somethings working for the Epic company thinking they're all that. In my mind I'm like, "You guys are torturing me and there's nothing I can do to stop it." At the end of the day, you're sucking the juice out of my life and you're going home and doing whatever stupid 20-something thing you want to do[50]. I work really hard at letting go of that resentment, but it just ... There is something ... I don't mind working hard. I didn't go into medicine to work a 30 hour week or a 40 hour week. I'm totally happy with working hard, but it gets emotional after a while. Today I was trying to order a thyroid ultrasound so I type US thyroid. The default that pops up, it's like, "Oh, did you mean a non-thyroid ultrasound of the neck?" No. I meant a thyroid. Then it's an extra click just to pop open a bigger list. There's the thyroid ultrasound. That's shoddy, shoddy, cheesy implementation.

For Carol, it's Epic's system that is challenging her autonomy and therefore she places blame on the Epic employees. It's interesting because many of the features that she cites as creating additional work could actually reflect decisions from South Hospital and Marlowe Health's administration during the initial customization process. Michelle, an administrator in health information management, shared that initially many of the decisions regarding the Marlowe Health's EHR reflected the ideas/understanding of its clinical leadership. However, after a couple of years, they realized that this decision-making model didn't work as leadership didn't

[50] Priya, a former Epic employee, cited long workdays and the lack of a work-life balance as a primary factor in her decision to leave Epic. Contrary to Carol's vision of Epic employees, they are actually working long hours. It seems like everyone is working long hours and are unhappy about it.

understand the everyday, on the ground workflows and variation amongst physicians and ancillary clinicians. Therefore, a new decision-making model was instituted that took a more representative approach by creating committees composed of clinicians who will use the workflow. Reflecting on this new model and her role as a representative of HIM, she shares

> From our perspective we're there to provide guardrails. As long as you guys [clinicians] are staying within those guardrails or when we see you're skirting the edge of the guardrail, let's actually have a conversation about it.

This new approach suggests that Marlowe Health is aware that their past decisions created challenges for clinicians. With this new model, HIM, compliance, and administration, including clinical leadership, is stepping back. Thus, updates and new workflows should better reflect the actual care conditions on the ground. However, just like it mattered with the policy and technology cycle, who sits on these committees and are involved in the decision-making will impact what workflows, logics, etc., are incorporated or ignored. But because it is difficult to parse out what is an Epic vs. administration decision, in some ways the administration can protect itself from the ire of the physicians.

In summary, the introduction of the EHR both supports and challenges physicians' interactional autonomy. In interactions with other physicians, ancillary clinicians, and administration, physicians are mostly able to maintain their autonomy. However, the EHR negatively impact their interactional autonomy with patients. Physicians detail both acts of resistance and adaptation to preserve their autonomy in these interactions.

*Cognitive Autonomy*

Cognitive autonomy focuses on physicians' discretion in how they use their expertise and medical knowledge. One of the defining features of a profession is the control of expert knowledge. It is this knowledge that is key to granting their autonomy.

The EHR can positively impact a physician's cognitive autonomy by supporting their ability to make informed medical decisions. Vasant, an internal medicine resident, explains how he uses the information in the EHR to make a preliminary assessment and care plan based on the data in Epic's storyboard/dashboard.

> My initial run through is I'll look at those [vital] numbers and immediately in my mind I have a sense of what kind of patient am I working with. And that's just from a set of five numbers…I can read that story and I can read the symptoms and I can read the physical that they did downstairs [in the ED], and then I can start to say "okay, that all fits with the numbers I'm seeing or that doesn't fit with the numbers I'm seeing." And now in my mind I'm saying, "this is now what I think is going on and when I go and see the patient these are the questions I'm going to ask." Or I may say "you know what everything I read here makes complete sense." So, when I go see the patient rather than asking them all the same questions for the 10th time where somebody downstairs already asked them, as a senior resident I may go say hello, ask a couple of questions, do an exam and generally I already have the diagnosis formed before I've seen the patient.

Because of access to all the data in the EHR, Vasant can use his medical knowledge to frequently form a diagnosis prior to seeing the patient. In this way, the EHR supports his cognitive autonomy because it provides the necessary information to diagnose, treat, and infer. It also allows him to structure his time with the patient to be more efficient and focus on new questions that will add to his understanding of the patient's medical status. This also supports his strategy to avoid documenting while being with the patient and instead focus on the patient, rather than the machine, to reassure and provide good bedside care.

However, the EHR can also negatively impact a physician's cognitive autonomy by replacing or challenging physicians' medical expertise via decision-support features. The EHR incorporates decision-support features to facilitate adherence to evidence-based medicine and other standards of care. In its current iteration, decision support in the EHR uses check boxes and pop-up alerts to assist; however, EHR companies are developing predictive analytics, data aggregation, and artificial intelligence in order improve decision-support capabilities. But even

in their basic form, some physicians, such as Lisa in family medicine, find that the decision support undermines her cognitive autonomy. She shared:

> I sit there during the entire visit entering diagnosis and entering orders. And going down drop-down screens, explaining why I need to do those orders. Listening to Epic's decision support tell me whether or not I've ordered the right test. Offering to do something else instead of what I've done, "are you sure you want to do this"? Picking a diagnosis that is going to make sure that our organization gets paid for that, which is a lot of where this comes from is, you know, having to meet [a payor's criteria of] medical necessity.

As she documents in a patient's record, Epic's decision support challenges her clinical decisions and requires that she justify them. This suggests that the system is the expert, rather than the physician. And while these suggestions were likely designed to reflect standards of care, for the individual physician, they may not align with the physician's clinical judgment. In addition, she attributes concerns about maximizing compensation as the reasoning behind many of these challenges as opposed to medical standards. This suggests that administrator concerns are also involved in the design. While this physician can refuse the decision support suggestion, she must provide justification via documentation, which further adds to her workload. But it also suggests to her that the system challenges her medical knowledge authority. The other generalists shared similar experiences.

However, for specialists, the EHR did not impact their cognitive autonomy. Jack, a cardiologist stated: "I never use decision support. My decision support is in my head". Instead, he relies on his medical knowledge by directly pointing to his brain. He was able to ignore the decision support features in Epic by customizing his own individual note template to be akin to a word document and not include the checklists associated with decision support.

Meanwhile, Allison, a radiation oncologist points to the limited abilities of decision support within her specialty.

> Again, I feel pretty lucky. I get to be a doctor. Much of the decision making I do has nothing to do with Epic. How I work is I see a patient, I say, "You need radiation," or not, and much like a surgeon, all of the work that I do comes with, "How do I do the radiation plan? How do I decide what I'm going to give doses to and not?" None of that happens in Epic. That's not something you can decision support.

At its current stage, the EHR is unable to provide analysis/support, and therefore does not impact her cognitive autonomy. It is possible that this will change over time as EHR companies develop more sophisticated decision support features. But at the moment, it appears that the EHR negatively impacts some physicians' cognitive autonomy, while others are able to avoid this impact.

**Discussion**

The EHR impacts physicians' autonomy across three dimensions: time use, interactions, and the use of medical knowledge.

First, the EHR negatively impacts physicians' autonomy of time use across all medical specialties. All physicians described how the requirements in EHR structured their time use. In addition, they described how the EHR created a documentation burden that creeped beyond their clinic hours. These findings are consistent with research on physician burnout (Shanafelt et al. 2015; Shanafelt et al. 2016; Southwick and Southwick 2018), which is characterized as a state of emotional exhaustion, loss of satisfaction in work, and detachment from the patient relationship (Deckard, Meterko, and Field 1994; West et al. 2018). It is also associated with negative impacts on patient care, increases in cost, and attrition of the workforce (Halbesleben and Rathert 2008; Dyrbye and Shanafelt 2011; Babbott et al. 2014; West et al. 2016). Thus, the perceived loss of autonomy over time use has important implications for health policy experts to consider.

However, there does appear to be variation in autonomy across the other dimensions. For interactive autonomy, it appears that some physicians are negatively impacted, especially as it

pertains to patient interactions. This is especially the case for the family medicine/primary care physicians. As generalists, the family medicine/primary care physicians take a broad approach to medicine to diagnose and treat a patient, focusing on treatment of chronic illness as well as preventative health measures. Acting in the capacity of the primary care physician, a generalist often has a more robust understanding of the patient's medical history and current health status, and often acts as coordinator of healthcare by referring patients out to specialists or coordinating across specialties during in-patient treatment. The generalist tends to form a close, trusting relationships with patients in order to encourage the patient to share health information, especially sensitive information, that will allow the generalist to infer, diagnose, and treat. A generalist will devote time to counseling and educating the patient on preventative measures. Therefore, because of the physician-patient interaction is so central to the work of the generalist, the EHR appears to impact this interaction more than in the case of specialists. One generalist physician, Bhanu, demonstrates a way to avoid this negative impact on interactional autonomy by actively deciding to not document during the patient visit. However, while this act of resistance may preserve his sense of interactional autonomy, it is a trade-off of his autonomy over time use, since he now has to work additional hours to complete the documentation.

Finally, it also appears that at this stage of development, the EHR negatively affects the cognitive autonomy of generalists compared to specialists, such as radiation oncologists and cardiologists. This is likely due to differences in the complexities of the data that is being recorded and how it can be incorporated into decision support features. Both Jack, a cardiologist, and Allison, a radiation oncologist, acknowledge that the EHR has yet to develop functionalities that can predict their work—though this may change as predictive analytics advance. However, in the case of the generalists, since so much of their care is preventative and managing chronic

illness, the EHR can more easily incorporate standards of care checklists, thereby negatively impacting their cognitive autonomy. At the professional level, family physicians acknowledge this challenge to their cognitive autonomy and are seeking ways to reclaim it. For example, at the 2019 American Academy of Family Physician's National Conference of Constituency Leaders Conference, a presentation on the Future of AI described efforts by the professional association to "better leverage AI" in the EHR (Waldren 2019). This involved rolling out a pilot program that sought to better filter and structure the information in the EHR so that the generalists could then use the data to inform their clinical decisions, rather than have the EHR make the decision[51]. Whether this pilot program will achieve its goals is currently unknown. However, its existence further illustrates how the current state of the EHR negatively impacts the cognitive autonomy of generalists.

Overall, this chapter contributes to our understanding of how a disruptive technology impacts a profession's autonomy. While it is possible for a technology to extend a profession's capability, it can also infringe upon their autonomy. For the EHR, it extends physicians' abilities to communicate and draw upon patient information to provide care. However, it also infringes upon their autonomy along the dimensions of time use, interaction, and cognition. This contributes to organizational sociology's literature on the professions by highlighting how autonomy can vary by different dimensions. While we can still think about autonomy on the whole, by focusing on individual dimensions, we can have a more nuanced understanding as well as see variation in experience across the profession. In other organizational fields, such as the legal field, a disruptive technology could impact a profession's autonomy along these dimensions or different ones that are more pertinent to their profession. As information

[51] To date, the EHR does not make a clinical decision. But when discussing their thoughts on the future of EHRs, many respondents discussed their imagined dystopian future, where the EHR made/force clinical decisions.

technology, especially predictive analytics and algorithms, advances, it is likely that it'll impact the professions' autonomy, and considering along which dimensions will yield a richer analysis.

Second, for medical sociology, this chapter shows how experiences with the EHR vary by medical specialty. While prior research has highlighted the differences between medical specialties, especially generalist and specialists, (Turner and Laine 2001; Starr 2008; Martin, Currie, and Finn 2009), the EHR allows us to see how this variation plays out with a single technology. Generalists who are more engaged in patient-centered, longitudinal care are more likely to have their autonomy impacted than specialists, since the EHR in its current iteration has more directly impacted their work, especially regarding how they interact with patients and their cognitive discretion. As the EHR advances, it will be interesting to see if specialists begin to experience more infringement along dimensions of interaction and cognition.

## Chapter 8: Conclusion

This dissertation set out to answer the following research questions:

- How does a disruptive technology impact an organizational field?
- What role does law play in supporting, shaping, standardizing, and/or deterring a disruptive technology?
- How does a disruptive technology impact a profession's sense of autonomy?
    - Since prior research has highlighted the link between autonomy and perceptions of an EHR (a) How do the different professions experience/perceive the EHR and (b) How does the EHR enable or constrain a professional's work within a healthcare organization?

To answer these questions, I selected the case of the EHR to consider how this technology impacts the field of healthcare. Usually, advancements in medical technology are limited to a specific medical specialty. However, every specialty uses a medical record to document patient care. Therefore, the transition of the paper medical record to an electronic format provides an opportunity to see how a new disruptive technology alters workflows and practices across medical specialties, organizational context, and clinical users.

While the EHR allows us to consider its implications across the field of healthcare, this case also provides an opportunity to examine the role of law in its formation and adoption. The EHR existed in healthcare since the1970s, but its design had not yet converged on a single definition of what constituted an EHR, and its adoption rate remained low. However, its identification as a potential solution to dual crises in American healthcare –rising costs and declining quality of care—led to a federal policy push to encourage its widespread adoption in the early 2000s. These legislative and regulatory processes ultimately produced the HITECH Act and its EHR Incentive Program, known as Meaningful Use, which led to the rapid adoption and implementation of EHRs across the field of healthcare. Thus, this recent policy intervention allows us to also examine the interplay between law and innovation, as both sides influenced and shaped the meanings and technical designs of the EHR.

To study the case of the EHR, I conducted a multi-method qualitative project. First, I employ a historical analysis of federal EHR policy. Focusing on Congressional hearings; Proposed and finalized legislation; Congressional debates; Proposed, Comments, and Final Rules of Meaningful Use; and policy reports, I construct a detailed narrative of the legislative and regulatory processes of the HITECH Act and Meaningful Use. I also highlight how key stakeholders constructed an envisioned EHR. I also conduct fieldwork, including semi-structured interviews with physicians/clinicians, administrators, and health information technologists, as well as observations at these professionals' association meetings and webinars. This field work provides insight into how the EHR impacted not only these professions' use of the technology, but also its implications for their autonomy. Taken together, this methodological approach allows me to see how the law on the books came to be and how the law in action played out. They also provide a rich analysis of the EHR and its impact on the field of healthcare.

Therefore, in this dissertation, I argue that law plays a significant role in the innovation and adoption of disruptive technologies. To understand the implication of these legal processes – both for the materiality of the technology itself and for the experiences of its users, especially regarding a profession's autonomy – I examine the codification of law on the books and the implementation of law in action. Usually, these two sides of law are analyzed separately. However, by employing a more holistic approach, I contribute to a more detailed understanding of the entanglement of law and technology, and that their iterative relationship has direct, yet varied, consequences for the professions who use it. Specifically, when law standardizes and supports the widespread adoption of a technology across an organizational field, the technology can positively or negatively impact a profession's autonomy. I argue that in the case of the EHR, it impacts the medical profession's autonomy across three dimensions: time, interaction, and

cognition. But this impact varies by medical specialty, where generalists experience a negative impact to their autonomy across all three dimensions, while specialists experience negative autonomy on time but no effect on interaction and cognition.

I situate this dissertation in the organizational scholarship on innovation and technology, healthcare organizations, and professions, as well as sociolegal scholarship on the role of law. Together these literatures allow us to consider the iterative process by which technology and policy impact each other within the context of healthcare. By bringing these literatures together, it produces a more comprehensive understanding of how law/policy and technology interact and have the potential to generate/develop a disruptive technology. And importantly, it considers the subsequent consequences for the professions within the field as the technology alters workflows, routines, and relationships. While the dissertation focuses on and contribute to an examination of this phenomenon in the field of healthcare, its contributions may extend to other organizational fields. Although the iterative interplay between technology and policy could vary by organizational field, that interaction still plays a critical role in how the innovation is developed, designed, and deployed.

I will now provide an overview of each empirical chapter to show its contribution to this larger argument.

In chapter 4, I examined the legislative and regulatory processes that led to the codification of EHR policy into the HITECH Act and its EHR Incentive program, Meaningful Use. Through a historical analysis, I show how policy makers, innovators, early adopters/proponents of EHRs, and patient advocates linked the EHR as a solution to the dual crisis in healthcare—rising costs and declining quality of care. The technology had yet to converge on a dominant design, yet these stakeholders/actors constructed an envisioned

technology that had bipartisan support. However, a legislative solution stalled until Democrats identified the 2009 federal stimulus package as a political opportunity to finally pass a law to accelerate the adoption of EHRs. The HITECH Act included a provision to develop an incentive program to accomplish this goal. An iterative public comment process took place to finalize both Meaningful Use and the technical standards associated with the program. Overall, this chapter's analysis builds on the literature on the technology and policy cycles to show how they interact and shape each other. In this case, innovators and adopters/proponents of the EHR constructed what the EHR could do, and politicians created a law to support the innovation. However, the subsequent regulatory process that produced the Meaningful Use program than further defined and standardized the technology. Throughout both processes, all stakeholders engaged and therefore the law and incentive programs reflect the iterative interaction between technology and policy. While this policy seems like a successful intervention, its roll out on the ground was not as smooth and had implications for EHR vendors, healthcare organizations, and importantly clinical users.

Chapter 5 then shifts our focus from law on the books to the law in action. This analysis provides a field level overview of the HITECH Act's impact on healthcare and the EHR industry. Primarily drawing on secondary sources, the HITECH Act's success in accomplishing its goal of EHR adoption is evident. Within six years, 96% of hospitals had adopted an EHR. However, this policy also led to a transition within the field away from homegrown systems to commercial EHR systems. The early adopters, especially the vocal proponents that participated in the Congressional hearings, had homegrown EHRs, which reflected internal, tailored workflows, processes, logic, and organizational culture. This transition to commercial EHRs

meant a more off the shelf, standardized design came to dominant the field, which had important implications for healthcare organizations and clinical users.

To further examine the impact of the law on the ground, chapter 6 looks at its effects at one healthcare organization. Drawing on fieldwork, I show how Epic EHR works at Marlowe Health paying particular attention to how it shapes and alters documentation and workflows. The analysis considers the standardization introduced by Epic but also highlights how the EHR system allows for customization at both the organizational and individual level. While this customization provides the organization and clinical users some latitude in performing their work, they still comply with the standard. The tension between standardization and customization also provides some clinical users with ways to adapt/resist to system requirements, but it also introduces further challenges to documentation. This chapter also extends Brenan and Suchman's (2020) framework analysis of the EHR to show how classifying the EHR as an administrative vs. clinical technology is more useful if we consider each functionality separately. For instance, the billing features of Epic allow for an administrative function to be shifted to the physician, while its decision-support functionality is clearly still a clinical task.

Finally, in chapter 7, I show how the EHR's impact on workflows and practices also impacts individuals' experiences and perceptions of the EHR. Drawing on my fieldwork, I focus on how the EHR impacts physician autonomy. I develop a new typology that considers how physicians' autonomy varies along the following dimensions: autonomy over time use; interactional autonomy; and cognitive autonomy. While all physicians' autonomy over time use is negatively impacted by the EHR, there is variation by medical specialty in experience across the other two dimensions. Specifically, the variation centers on a distinction between generalists (primary care, family medicine, internal medicine) and specialists. The generalists' autonomy

across the other dimensions is negatively impacted while specialists' autonomy is unaffected. This difference is driven by the generalists' approach to medicine –both in the broad knowledge used to diagnose and treat and in their longitudinal patient engagement. Generalists become the unofficial keepers of the patient record and are the least likely to be able to actively resist the system's influence.

Overall, these empirical chapters provide a holistic overview of how the HITECH Act came to be and how its implementation played out on the ground. By tracing the law on the books to the law in action, this dissertation provides insight not only into the process in its entirety, but it also highlights the interplay between technology and policy. We can take these insights to other organizational contexts that are experiencing a technical discontinuity. It can serve as a reminder that innovation and law do not develop in a vacuum, rather an iterative relationship constructs a vision of the technology and policy can support/encourage, deter/block, and/or standardize/codify it. It also highlights how despite a seemingly positive policy intervention and successful roll out of an innovation across the organizational field, this process can influence the convergence on a dominant design that has implications for organizations and users of the technology. Finally, these findings also suggest that whether a technology extends a profession's ability or infringes on their autonomy can vary.

*Future research*

This dissertation provides a solid foundation for understanding how the EHR impacts the field of healthcare. However, there is always more to study and unpack. First, future research should replicate this study in other organizational settings and with other EHR systems. This will help to further disentangle key organizational features as well as the materiality of the EHRs.

Second, future research should continue the historical analysis to understand the passage and regulations associated with the 21st Century Cures Act. This bill was passed in 2016 and included provisions to promote interoperability and introduced new information blocking rules. While this bill intended to complete the original goal of the HITECH Act, its new rules have implications for patient care. For instance, patients now receive information, such as test results, to their patient portal in real time. While this expanded access is intended to empower patients and facilitate their engagement, clinicians and administrators are concerned that patients are receiving this information without a translation from a clinician.

Third, future research should also further examine the impact of COVID-19 on health information technology. The pandemic accelerated the adoption and use of virtual care. In the case of Marlowe Health, they had a three-year plan to roll out a virtual care platform. Instead, the program went live in five days. Moving to the virtual space created new workflows and challenges, but also brought unexpected benefits. For the generalists I spoke with during follow-up interviews, they found greater balance in their work. In addition, virtual care is not just confined to the hospital systems and traditional healthcare organizations. New iterations of technology are emerging. For example, in a follow up interview, Charlotte, a nurse practitioner, shared that she had left Marlowe Health and was now providing entirely virtual primary care via a text-based app, Galileo. Not only is this a different approach to patient interaction, but it also has a different approach to documentation, which is more concise. In addition, Charlotte shared several ways in which the app seemed to address health inequalities – one by texting with the patient and not seeing them, patients reported feeling less bias from providers. And two, for patients in areas where care was primarily provided by religious hospitals and/or more socially

conservative states, LGBT patients shared that they could receive appropriate care through the app.

*Policy implications*

Finally, I highlight several policy implications that emerged from my research. Overall, there was consensus in my fieldwork that the EHR is better than a paper medical record. No one wants to return to paper[52]. Rather by addressing the challenges presented by the EHR, this tool could be improved for clinicians and patients.

First, one of the most cited challenges of the EHR is the documentation burden and note bloat. This raises questions about what type of patient information must be included, to what extent, and for what purposes Respondents pointed to documentation needs being driven by billing and liability. The more specific and detailed information provided, the more a clinician could demonstrate the work they did and therefore justify their insurance coding. In addition, this information could be used in medical malpractice cases to justify appropriate care. Thus, when thinking about how to address the documentation burden, we need to consider how these two issues contribute to note bloat.

Second, the role of documentation management needs to be clarified. This dissertation shows that generalists have become the unofficial recordkeepers. While positioning the generalist as recordkeeper is consistent with an organization of healthcare that centers primary care, this adds to the generalists' workload and left many respondents feeling burnt out. Especially, since healthcare organizations did not lessen the number of patients being seen to accommodate this new time-consuming work demand. It appears that the maintenance of the EHR is one symptom of the challenges facing primary care.

[52] At least no one I interviewed.

Third, the vision of the HITECH Act was to have a nationwide interoperable EHR system. While the law was able to accomplish the widespread adoption of EHRs so that nearly all patients have an EHR, it fell short on interoperability. EHRs are still siloed by organizations. Interoperability is limited amongst organizations using the same EHR system. The 21st Century Cures Act has the potential to address healthcare's current limited interoperability with its information-blocking rules. But this policy's results have yet to be seen. In addition, even if interoperability is reached in that patient information is visible, there are not guarantees of it being automatically updated. Therefore, policymakers and innovators need to consider how to move the EHR to being a truly integrated patient record.

Overall, this dissertation shows how a policy and technology that seem to have so much promise and optimism do not translate easily on the ground. Many of the issues with the EHR actually reflect larger policy/organizational issues in healthcare, because the technology is codifying roles and rules as reflected in innovators and administrators' understanding of healthcare and its statutes. The EHR makes these challenges more visible. To address these EHR challenges, policymakers, administrators, and clinicians will need to think more broadly.

**Appendix A:** Full Sample of Congressional Hearings from 2000-2016

| Date | Hearing Title | Summary[53] |
|---|---|---|
| 2/17/00 | Confidentiality of Patient Records | Hearing before the Subcom on Health to review HHS Nov. 1999 proposed rule on the privacy of individually identifiable health information, as required by the Health Insurance Portability and Accountability Act if Congress failed to enact privacy legislation by Aug. 21, 1999 (Subcom advisory, p. 2-3) |
| 3/30/00 | Changing Face of Healthcare in the Electronic Age | Hearing before the Subcom on Technology to examine issues related to healthcare information technology (IT) system security and privacy. |
| 4/26/00 | Proposed Rule on the Privacy of Individually Identifiable Health Information | Hearing to review Nov. 1999 HHS proposed rule on the privacy of individually identifiable health information, as required by the Health Insurance Portability and Accountability Act. |
| 9/21/00 | Hearing II on Information Technology | Hearing before the Subcom on Oversight and Investigations to examine concerns with VA information technology programs. |
| 2/8/01 | Making Patient Privacy a Reality: Does the Final HHS Regulation Get the Job Done? | Hearing to assess HHS Dec. 28, 2000 final rule governing the use and disclosure of individually identifiable health information, as required by the Health Insurance Portability and Accountability Act of 1996. |
| 3/13/01 | H.R. 811 Veterans' Hospital Emergency Repair Act | Hearing to consider H.R. 811 (text, p. 39-44), the Veterans' Hospital Emergency Repair Act, to authorize FY2002-FY2003 funding for VA major medical construction projects. |
| 3/22/01 | Assessing HIPAA: How Federal Medical Record Privacy Regulations Can Be Improved | Hearing before the Subcom on Health to review HHS proposed rule to improve privacy of protections for individually identifiable health information, as required by the Health Insurance Portability and Accountability Act |
| 5/23/01 | How Secure Is Private Medical Information? A Review of Computer Security at the Health Care Financing Administration and Its Medicare Contractors | Hearing before the Subcom on Oversight and Investigations to assess Health Care Financing Administration (HCFA) Medicare systems information security. Also examines role of Medicare contractors in HCFA information security weaknesses. |
| 6/23/01 | E-Health and Consumer Empowerment: How Consumers Can Use Technology Today and in the Future to Improve Their Health | Hearing before the Subcom on Science, Technology, and Space to examine role of new technologies in health care system improvements. |
| 9/23/03 | HIPAA Medical Privacy and Transition Rules: Overkill or Overdue? | Hearing to review implementation of regulations required by the Health Insurance Portability and Accountability Act (HIPAA) of 1996, including HHS-administered regulations to modify privacy protections for individually identifiable health information and to standardize health care |

[53] Summaries taken from Congressional Records as provided by Congress.gov and Proquest Congressional

| | | |
|---|---|---|
| | | industry electronic administrative transactions and code sets (TCS) |
| 6/17/04 | Health Care Information Technology | Hearing before the Subcom on Health to examine public and private sector initiatives to promote use of health information technology to reduce medical errors and improve quality and cost of patient health care (Subcom advisory, p. 2-3). |
| 7/22/04 | Health Information Technology: Improving Quality and Value of Patient Care | Hearing before the Subcom on Health to examine development and use of health information technology (HIT) to reduce medical errors and improve the quality and cost of patient health care |
| 6/30/05 | Health Information Technology | Hearing before Subcom on Tech, Innovation and Competitiveness of the Com on Commerce, Sci, and Transportation |
| 7/27/05 | Is There a Doctor in the Mouse? Using Information Technology to Improve Health Care | Hearing before Subcom on Federal Workforce and Agency Org of the Com on Govt Reform. House of Reps. |
| 9/29/05 | Last Frontier: Bringing the IT Revolution to Healthcare | Hearing to examine development and use of health information technology (IT) to reduce medical errors and improve the quality and cost of patient health care. |
| 2/23/06 | Health Care Information Technology: What are the Opportunities For and Barriers to Inter-Operable Health Information Technology Systems? | Field hearing before Subcom on Environment, Tech, and Standards; Committee on Science. As a field hearing it took place in Seattle, WA. Purpose is as stated in the name- what are opportunities and barriers to inter-operable health IT systems? |
| 3/16/06 | Legislative Proposals To Promote Electronic Health Records and a Smarter Information System | Hearing before the Subcom on Health to examine proposals to promote use of health information technology (IT) to reduce medical errors and improve the quality and cost of patient health care. |
| 4/6/06 | Can Small Healthcare Groups Feasibly Adopt Electronic Medical Records Technology? | Hearing before the Subcom on Regulatory Reform and Oversight to examine implementation and use of electronic medical records technology in small medical practices to reduce medical errors and improve quality and cost of patient health care. |
| 4/6/06 | Fourth in a Series on Health Care Information Technology | Hearing before House Committee of Ways and Means and Subcom on Health. Call for hearing went out on March 30 2006 from Congresswoman Nancy L. Johnson (R-CT). Witnesses from public and private sector to discuss processes in place to dev and adopt IT standards, how they are currently used, and what additional actions are necessary to expand use. |
| 6/21/06 | Accelerating the Adoption of Health Information Technology | Hearing before the Subcom on Technology, Innovation, and Competitiveness to examine options for accelerating adoption of health information technology (IT). |

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| 9/1/06 | Using Information Technology: For the Health of IT | Hearing in St. Louis, Mo., before the Subcom on the Federal Workforce and Agency Organization to examine development and use of health care information technology (IT) to reduce medical errors and improve quality and cost of patient health care. |
| 2/1/07 | Private Health Records: Privacy Implications of the Federal Government's Health Information Technology Initiative | Hearing before the Subcom on Oversight of Government Management, the Federal Workforce, and D.C. to examine privacy issues related to development and use of health information technology (IT) to reduce medical errors and improve the quality and cost of patient health care, and to review HHS activities concerning health IT implementation. |
| 3/28/07 | Subcommittee Hearing on the Value of Health IT to Solo and Small Medical Practices | Hearing before the Subcom on Regulations, Health Care, and Trade to examine implementation and use of health information technology (HIT) in small medical practices to reduce medical errors and improve quality and cost of patient health care. |
| 6/19/07 | Protecting Patient Privacy in Healthcare Information Systems | Hearing before the Subcom on Information Policy, Census, and National Archives to examine privacy issues related to development and use of health information technology (IT) to reduce medical errors and improve the quality of cost of patient health care, and to examine proposals to improve patient privacy protections under the Health Insurance Portability and Accountability Act (HIPAA), which established regulations for use and disclosure of patient health information |
| 9/26/07 | Meeting the Need for Inter-Operability and Information Security in Health IT | Hearing to consider H.R. 2406 (text, p. 89-98), to direct the National Institute of Standards and Technology to establish a secure, inter-operable healthcare information technology (HIT) enterprise integration plan (Committee witness list and hearing charter, p. 2-6). |
| 11/1/07 | Too Many Cooks? Coordinating Federal and State Health IT | Hearing before the Subcom on Government Management, Organization, and Procurement to examine Federal, State, local, and private sector health care information technology (IT) initiatives to reduce medical errors and improve quality and cost of patient health care, including care for medically underserved populations |
| 6/4/08 | Discussion Draft of Health Information Technology and Privacy Legislation | Hearing before the Subcom on Health to consider draft bill, to institute various measures to promote use of health information technology (HIT) in the health care system to improve quality and efficiency of health care and protect patient electronic health records privacy. |
| 7/16/08 | Getting Better Value in Health Care | Hearing to examine strategies to reduce health care costs and improve health care system. |
| 7/17/08 | The Right Care at the Right Time: Leveraging Innovation to Improve Health Care Quality for All Americans | Hearing to examine health care quality improvement and cost containment issues and strategies, focusing on the role of health and |

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| | | comparative clinical effectiveness information technology. |
| 7/24/08 | Hearing on Promoting the Adoption and Use of Health Information Technology | Hearing before Subcomm on Health of the Com on Ways and Means, House of Reps. |
| 7/31/08 | Committee Hearing on Cost and Confidentiality: Unforeseen Challenges of Electronic Health Records in Small Specialty Practices | Hearing to examine obstacles facing implementation of electronic health records (EHR) technology in small medical practices to reduce medical errors and improve quality and cost of patient health care. |
| 1/15/09 | Investing in Health IT: A Stimulus for a Healthier America | Hearing to examine development and use of health care information technology (IT) to improve quality and cost of patient health care, including role in the economic stimulus package. |
| 1/27/09 | Health Information Technology: Protecting Americans' Privacy in the Digital Age | Hearing to examine development and use of health information technology (IT) to reduce medical errors and improve quality and cost of patient health care, focusing on issues regarding patient privacy protection. |
| 4/21/09 | Roundtable Discussions on Comprehensive Health Care Reform | Hearings to review options to improve health care delivery system and health insurance affordability, and to examine potential sources of financing for health care reform. |
| 6/24/09 | Subcommittee on Regulations and Healthcare Hearing on Health IT Adoption and the New Challenges Faced by Solo and Small Group Health Care Practices | Hearing before the Subcom on Regulations and Healthcare to examine implementation and use of health information technology (HIT) in small medical practices to reduce medical errors and improve quality and reduce cost of patient health care. |
| 6/24/10 | Overcoming Rural Health Care Barriers: Use of Innovative Wireless Health Technology Solutions | Hearing before the Subcom on Health to examine use of wireless health information technologies (HIT) to assist veterans living in rural communities in accessing health care services. |
| 7/20/10 | [Health IT Promotion] Pre-Published | Hearing before the Subcom on Health to examine efforts to promote adoption and meaningful use of health information technology. |
| 7/27/10 | Implementation of the Health Information Technology for Economic and Clinical Health (HITECH) Act | Hearing before the Subcom on Health to examine implementation of the Health Information Technology for Economic and Clinical Health Act (HITECH Act), which contains funding to promote adoption of health information technology (IT) among hospitals, doctors, and health care providers through HHS Office of the National Coordinator initiatives and through Medicare and Medicaid incentives |
| 9/30/10 | Standards for Health IT: Meaningful Use and Beyond | Hearing before the Subcom on Technology and Innovation to examine development, use, and security of health care information technology (IT) to improve quality and cost of patient health care (Subcom witness list and hearing charter, p. 2-7). |

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| 6/2/11 | Not What the Doctor Ordered: Barriers to Health IT for Small Medical Practices | Hearing before Subcom on Health Care and Tech of the Committee on Small Business |
| 3/20/13 | Health Information Technologies: How Innovation Benefits Patients | Hearing before the Subcom on Health to examine use of innovative technologies to advance health and well-being of patients, and to review issues related to FDA regulation of health information technologies (IT). |
| 3/21/13 | Health Information Technologies: Administration Perspectives on Innovation and Regulation | Hearing before the Subcom on Oversight and Investigations to examine new and emerging health care information technology (IT), and to review recent developments related to HHS Office of the National Coordinator for Health Information Technology (ONC) and growing market for mobile medical applications in the health care community |
| 7/24/13 | Health Information Technology: Using IT To Improve Care | Hearing to examine use of health information technology (HIT) to improve patient care and outcomes and reduce expenses. |
| 3/17/15 | America's Health IT Transformation: Translating the Promise of Electronic Health Records into Better Care | Hearing to examine health information technology (IT) transformation, focusing on efforts to translate promise of electronic health records (EHRs) into better patient health care. |
| 5/5/15 | Continuing America's Leadership: Realizing the Promise of Precision Medicine for Patients | Hearing to examine developments in patient-focused precision medicine to improve health and disease treatment. |
| 6/10/15 | Health Information Exchange: A Path Towards Improving the Quality and Value of Health Care for Patients | Hearing to examine development and adoption of health information technology (HIT), focusing on use of electronic health records (EHRs) to improve quality of patient health care. |
| 6/16/15 | Achieving the Promise of Health Information Technology: What Can Providers and the U.S. Department of Health and Human Services Do To Improve the Electronic Health Record User Experience? | Hearing to examine developments in and use of health information technology, focusing on ways in which HHS and medical providers can improve electronic health record (EHR) user experience. BACKGROUND AND CONTEXT: There are claims that EHRs are a source of widespread dissatisfaction among providers. The increased user adoption of EHRs in clinical practice has not led to universally improved provider experience. Complaints of increased time burdens on the practitioner, loss of provider interactions with patients, and frustration with new requirements and changed workflows dominate discussions among providers even as the capability of EHRs to reduce errors and improve communications has grown. |
| 7/23/15 | Achieving the Promise of Health Information Technology: Information Blocking and Potential Solutions | Hearing to examine challenges facing electronic health records data sharing and health information technology (IT) systems interoperability among health care providers and other health care industry entities, and to review proposals to improve electronic health records data sharing and reduce patient information blocking |

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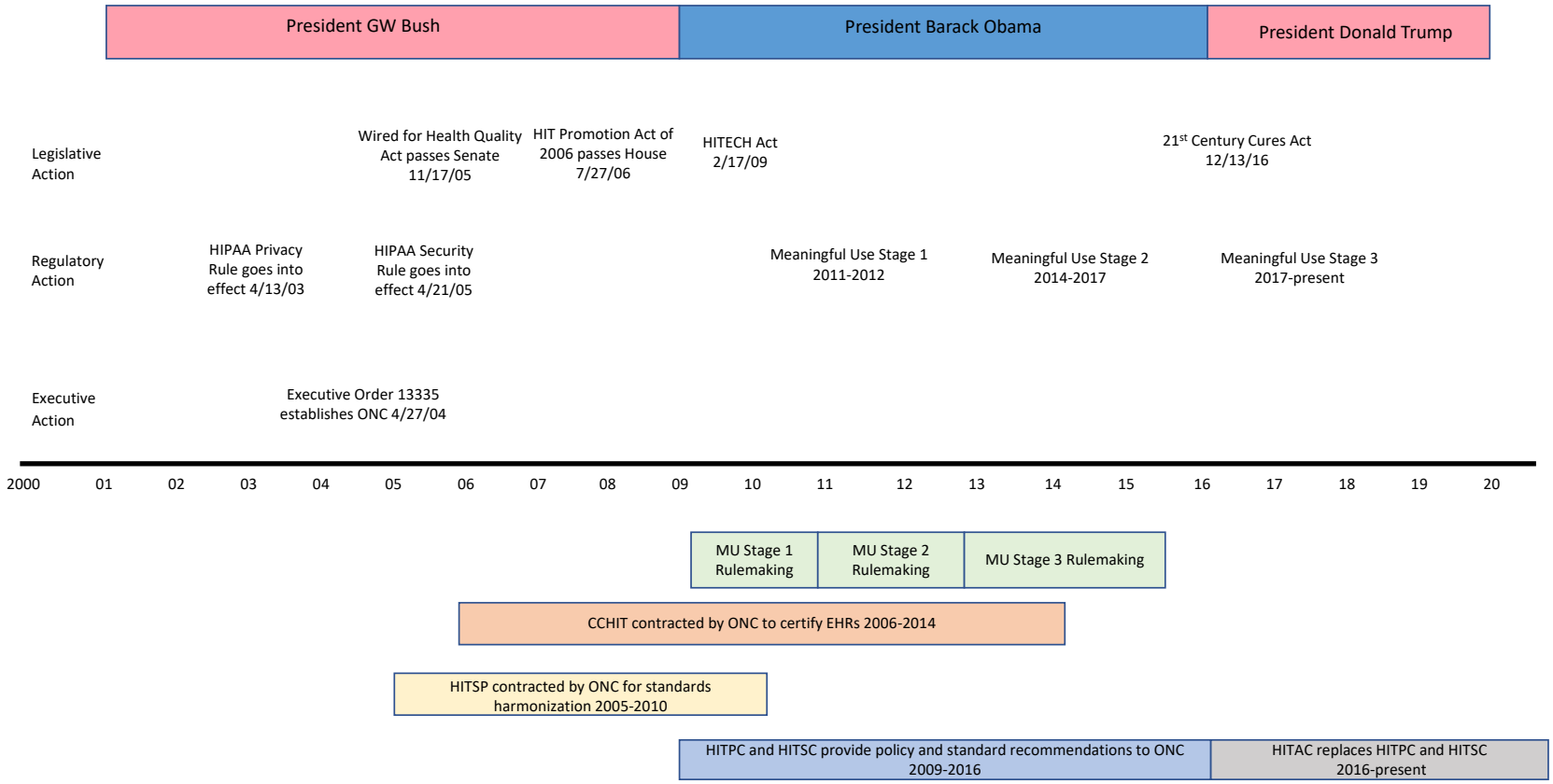
| 9/16/15 | Achieving the Promise of Health Information Technology: Improving Care Through Patient Access to Their Records | Hearing to examine development and adoption of health information technology (IT), focusing on use of electronic health records (EHRs) to improve patient care and outcomes. |
| 10/1/15 | Achieving the Promise of Health Information Technology | Hearing to examine status of health information technology. |
| 3/22/16 | Opportunities and Challenges in Advancing Health Information Technology | Hearing before the Subcom on Information Technology and the Subcom on Health Care, Benefits and Administrative Rules to examine advancements in health information technology (health IT) and how it can be used to improve patient care and outcomes. |

## **Appendix B:** Timeline of EHR Policy 2000-2020



**Appendix C:** Frequency of Organizational Type a Witness Represented between 2004-2008

| **Org Type** | **2004** | **2005** | **2006** | **2007** | **2008** | **Total** |
|---|---|---|---|---|---|---|
| Education | | | | | 1 | 1 |
| Federal Agency | 5 | 12 | 6 | 9 | 4 | 36 |
| Hospital/Healthcare Org | 2 | 3 | 10 | 4 | 3 | 22 |
| Healthcare Other | 2 | 2 | 5 | 1 | | 10 |
| Health Information Exchange (HIE) | 1 | | 3 | | | 4 |
| Health Information Management (HIM) | 2 | | 3 | 3 | | 8 |
| Individual | 2 | | 1 | 1 | 2 | 6 |
| Industry | 8 | 5 | 12 | 3 | 6 | 34 |
| Interest Group | 2 | 3 | 4 | 2 | 5 | 16 |
| MD Association | 3 | 1 | 4 | 6 | 8 | 22 |
| Patient Advocate | 1 | | 1 | | 3 | 5 |
| Standards | 1 | | 4 | 2 | | 7 |
| State | | | | 2 | | 2 |
| Think Tank | 1 | 1 | 2 | 2 | 3 | 9 |
| **Total** | 30 | 27 | 55 | 35 | 35 | 182 |

## Appendix D:

Original Members of the Health Information Technology Policy Committee (HITPC)

| First name | Last name | Organization | Organizational Type |
|---|---|---|---|
| Connie | Delaney | University of Minnesota School of Nursing | Academics & Policy Analyst |
| Michael | Klag | John Hopkins University, Bloomberg School of Public Health | Academics & Policy Analyst |
| Latanya | Sweeney | Carnegie Mellon University | Academics & Policy Analyst |
| David | Blumenthal | National Coordinator for HIT | Govt Official |
| Art | Davidson | Denver Public Health Dept | Govt Official |
| Gayle | Harrell | Former Florida State Legislator | Govt Official |
| Paul | Egerman | Businessman/Entrepreneur | Industry Advocate |
| Charles | Kennedy | WellPoint, Inc | Industry Advocate |
| David | Lansky | Pacific Business Group on Health | Industry Advocate |
| Scott | White | 1199 SEIU Training and Employment Fund | Industry Advocate |
| Christine | Bechtel | National Partnership of Women and Families | Patient Advocate |
| Adam | Clark | Lance Armstrong Foundation | Patient Advocate |
| Devin | McGraw | Center for Democracy and Technology | Patient Advocate |
| David | Bates | Brigham and Women's Hospital | Provider & Vendor Org |
| Neil | Calman | Institute for Family Health | Provider & Vendor Org |
| Rick | Chapman | Kindred Healthcare | Provider & Vendor Org |
| Judith | Faulkner | Epic Systems Corporation | Provider & Vendor Org |
| Frank | Nemec | Gastroenterology Associates, Inc. | Provider & Vendor Org |
| Marc | Probst | Intermountain Health Care | Provider & Vendor Org |
| Paul | Tang | Palo Alto Medical Foundation | Provider & Vendor Org |

Original Members of the Health Information Technology Standards Committee (HITSC)

| First name | Last name | Organization | Organizational Type |
|---|---|---|---|
| John | Halamka | Harvard Medical School | Academic & Policy Analyst |
| Douglas | Fridsma | Arizona State University | Academic & Policy Analyst |
| Sharon | Terry | Genetic Alliance | Academic & Policy Analyst |
| Dixie | Baker | Science Applications International Corporation | Industry Advocate |
| Anne | Castro | BlueCross BlueShield of South Carolina | Industry Advocate |
| Linda | Dillman | Wal-Mart Stores, Inc | Industry Advocate |
| Steven | Findlay | Consumers Union | Industry Advocate |
| Wes | Rishel | Gartner, Inc | Industry Advocate |
| Janet | Corrigan | National Quality Forum | Patient Advocate |

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|---|---|---|---|
| Jonathan | Perlin | Hospital Corporation of America | Provider & Vendor Org |
| Christopher | Chute | Mayo Clinic College of Medicine | Provider & Vendor Org |
| John | Derr | Golden Living, LLC | Provider & Vendor Org |
| James | Ferguson | Kaiser Permanente | Provider & Vendor Org |
| C. Martin | Harris | Cleveland Clinic Foundation | Provider & Vendor Org |
| Stanely M. | Huff | Intermountain Healthcare | Provider & Vendor Org |
| Kevin | Hutchinson | Prematics, Inc | Provider & Vendor Org |
| Elizabeth O. | Johnson | Tenet Healthcare Corporation | Provider & Vendor Org |
| John | Klimek | National Council for Prescription Drug Programs | Provider & Vendor Org |
| David | McCallie, Jr | Cerner Corporation | Provider & Vendor Org |
| Judy | Murphy | Auroa Health Care | Provider & Vendor Org |
| J. Marc | Overhage | Regenstrief Institute | Provider & Vendor Org |
| Gina | Perez | Delaware Health Information Network | Provider & Vendor Org |
| James | Walker | Geisinger Health System | Provider & Vendor Org |

**Appendix E:** List of Acronyms

| Acronym | Full Name |
|---|---|
| AHIC | American Health Information Community |
| AHIMA | American Health Information Management Association |
| ANSI | American National Standards Institute |
| ARRA | American Recovery and Reinvestment Act |
| CAH | Critical Access Hospital |
| CCHIT | Certification Commission for Health Information Technology |
| CEHRT | Certified EHR Technology |
| CITL | Center for Information Technology Leadership |
| CMS | Centers for Medicare and Medicaid |
| CPOE | Computerized Provider Order Entry |
| CQM | Clinical Quality Measures |
| DHHS | Department of Health and Human Services |
| EHR | Electronic Health Record |
| EP | Eligible Provider |
| FFS | Fee for Service |
| HIMSS | Health Information and Management Systems Society |
| HIPAA | Health Insurance Portability and Accountability Act |
| HIT | Health Information Technology |
| HITECH Act | Health Information Technology for Clinical and Economic Health Act |
| HITPC | Health Information Technology Policy Committee |
| HITSC | Health Information Technology Standards Committee |
| HITSP | Health Information Technology Standards Panel |
| IOM | Institute of Medicine |
| MMA | Medicare Modernization Act of 2003 |
| MU | Meaningful Use, CMS EHR Incentive Program |
| NAHIT | National Alliance for Health Information Technology |
| NAM | National Academy of Medicine |
| NHIN | National Health Information Network |
| NPRM | Notice of Proposed Rule Making |
| ONC | Office for the National Coordinator of Health Information Technology |

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