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EXPANDING THE INTEROPERABILITY OF HEALTHCARE RECORD SYSTEMS, IN SPITE OF PERSONAL PRIVACY ISSUES

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ABSTRACT

EXPANDING THE INTEROPERABILITY OF HEALTHCARE RECORD SYSTEMS, IN SPITE OF PERSONAL PRIVACY ISSUES

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There has been a push to implement the tenets of the Management Information Systems (MIS) by the American Recovery and Reinvestment Act (ARRA) of 2009, the Federal Communications Commission (FCC) Broadband Plan, and the Patient Protection and Affordable Care Act and the Health Care and Education Reconciliation Act of 2010, which have led to continued growth in the use of the electronic healthcare record (EHR). The adoption of innovative technologies in the digitization of health records, use of telehealth solutions, and global problems, such as the pandemic, have presented MIS professionals with “big data” concerns that effect source systems, marketing, strategic

development, and data integration opportunities, both internally and externally. This paper addresses these concerns as healthcare moves forward as a major component of the domestic economy. Focusing on not only privacy and data security, but also addressing interoperability.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

CHAPTER 1

INTRODUCTION

Interoperability in general terms means the ability of computer systems or software to exchange and make use of information. In healthcare systems, interoperability of the healthcare records and its uses heavily rely on EHR (Electronic Health Record), HIE (Health Information Systems), and Telehealth. The American Recovery and Reinvestment Act (ARRA) of 2009, the Federal Communications Commission (FCC) Broadband Plan, the Patient Protection and Affordable Care Act, and the Health Care and Education Reconciliation Act of 2010 have pushed for EHR, HIE, and telehealth, with the main objectives of digitalization of healthcare data and the best uses of emerging technologies to provide access to remote health services. In the most recent times, the use of EHR, HIE, and telehealth has massively grown due to COVID-19 and emerging innovative technologies. With this growth, there have been concerns regarding privacy and data security, and its usability in making strategic management decisions, research, and marketing decisions (Venable, 2015).

1.1 EHR (Electronic Health Record)

The Office of the National Coordinator for Health Information Technology describes EHR as the comprehensive patient health information. It includes administrative and billing data, patient demographics, progress notes, vital signs, medical histories, diagnoses, medications, immunization dates, allergies, radiology images, and lab test results from all the clinicians involved in a patient's care. It is designed to reach out beyond

the health organization that originally collects and compiles the information (Office of the National Coordinator for Health Information Technology [ONC], n.d.).

1.2 HIE (Health Information Exchange)

HIE allows for the exchange of patient health records electronically in a reliable manner protecting patients' confidentiality, privacy, and security of the information to improve the speed, quality safety, and cost of patient care.

According to ONC, there are currently three types of HIE:

- Directed Exchange: Ability to send and receive secure information electronically between care providers to support coordinated care
- Query-based Exchange: Ability for providers to find and/or request information on a patient from other providers, often used for unplanned care
- Consumer Mediated Exchange: Ability for patients to aggregate and control the use of their health information among providers (ONC, n.d.).

1.3 Telehealth

Telehealth is the use of electronic information and telecommunications technologies to support and promote long-distance clinical health care, patient and professional health-related education, public health, and health administration. It can include Live (synchronous) videoconferencing, Store-and-forward (asynchronous) videoconferencing, Remote patient monitoring (RPM), and Mobile health (mHealth) (ONC, n.d.).

CHAPTER 2

ADAPTATION ON INTEROPERABILITY OF HEALTH CARE SYSTEMS

The Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009 included an incentive of $19 billion for hospitals and physicians to implement meaningful use of EHR, which has shown promising results (ONC, n.d.). From the data collected by ONC in 2019 and 2021, 86% of non-Federal, general acute care hospitals have adopted a 2015 Edition certified EHR and 96% of them have adopted at lease some form of EHR. However, only 40% of rehabilitation hospitals and 23% of specialty hospitals had adopted a 2015 Edition certified EHR (ONC, n.d.).

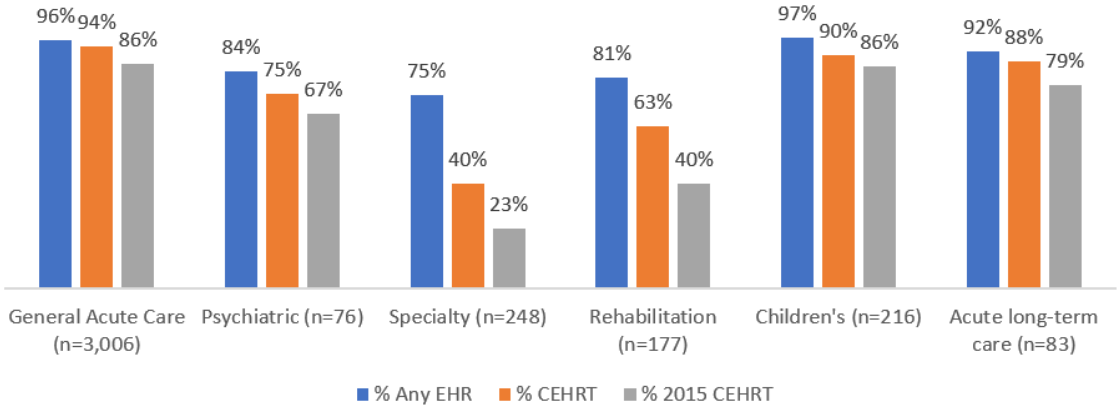

Figure 2.1: Adoption of Healthcare Records by Hospital Service Type 2019-2021 (ONC)

Keeping interoperability in mind in 2020, ONC also published the Final Rule for the 21st Century Cures Act, establishing FHIR R4 as the standard required for Health IT Certification. HL7 FHIR (Fast Healthcare Interoperability) is a next-generation interoperability standard created by the standards development organization Health Level

7 (HL7). FHIR is designed to enable health data, including clinical and administrative data, to be quickly and efficiently exchanged. The philosophy behind FHIR is to create a set of resources that, individually or in combination, satisfy the most common use cases by adopting existing standards and concepts already familiar to software developers outside of health care. FHIR reduces the learning curve, makes real-time interoperability easier, and enables faster and simpler application creation. A primary motivation behind FHIR's design is to enable interoperability through well-structured data models that use simple and efficient exchange mechanisms (ONC, n.d.).

The US Congress passed the Health Information Portability and Accountability Act (HIPAA) to protect the patients' confidential health information. HIPAA established several guidelines for dealing with privacy and security problems involving patients' Protected Health Information (PHI). Except for educational or employment data, PHI refers to "Individually Identifiable Information" that is transferred by electronic or other means (Shah et al., 2020). HIPAA gives detailed instructions on how to utilize technology for collecting, storing, and transmitting PHI. It aids in the establishment of strong links and partnerships between healthcare institutions and health information exchange organizations to facilitate patient access to their EHR data in a format that is simple to understand and use, secure while accessing, and can be updated automatically (Shah et al., 2020).

2.1 EHR Service Provider and Interoperability

Currently, there are two major software companies dominating the market share for the interoperability of health care records. According to the May 2021 KLAS Research 2021 US Hospital Market Share Report, as cited by Health Leaders Media, Epic and Cerner

together dominate with a combined 56% of the market share and are followed by Meditech, CSPI, Allscripts, MEDHOST, Azalea Health, and others (Ahmed, 2021, August 3).

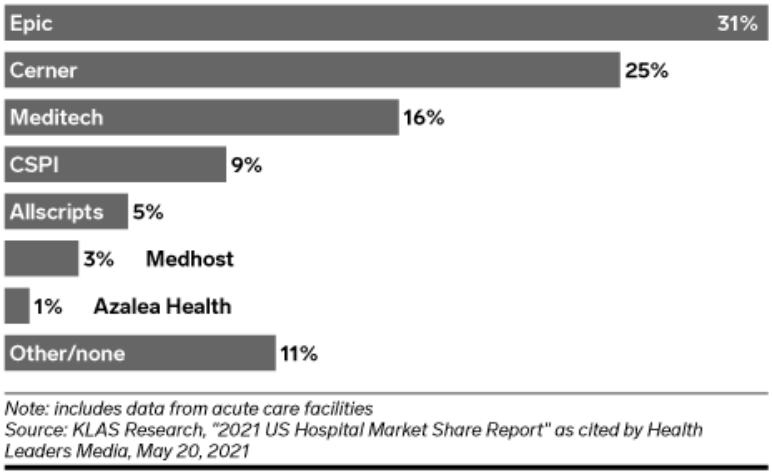

Figure 2.2: US EHR Market Share 2020 (Health Leaders Media)

Epic and Cerner are software companies that promise to help people get well, help people stay well, and help future generations live healthier through their services to various health care providers and patients by making health documents more accessible and interoperable. They provide services that aid in patient experience, clinicals, mobile applications, telehealth, specialties & ancillaries, managed care, population health, patient flow, cosmos, analytics, interoperability, and community connect. Epic and Cerner's software's allows the patients to have access to their medical records with the convenience of their computer or mobile application. They also offer telehealth services. Above all, their platforms allow for the interoperability of data, not just among the health care providers using their services, but also among other providers that use HL7 FHIR standards, which allows for the interoperability of health care records more conveniently and safely (Epic, n.d.; Cerner, n.d.).

The services that these companies provide are not just for the ease and accessibility of health care records for patients. These systems also help the health care providers and researchers by providing insights to discover new patterns and optimizing strategic use of the data presented (Cerner, n.d.). They aid the health care providers with administrative and revenue cycles, managing their financial and management data, payer-provider collaboration, artificial intelligence and analytics, and many more. These software companies help healthcare providers to deeply engage with customers and, while they help customers, reduce administrative overhead, avoid missing charges, reduce Admit/Release days, and increase total revenue. They also help to strengthen the relationship between payer-provider by reducing administrative costs, improving patient experience, and enhancing care delivery with bidirectional data exchange through the payer platform. They also bring in data from any standards based EHR or compatible data source and drive outcomes through analytics and machine learning. These services help the health care provider to provide more care, data, and analytics to make business decisions and provide value-centric marketing decisions (Epic, n.d.; Cerner, n.d.).

2.2 The Framework of Health Information Systems

EHR, HIE, and Telehealth can be significant for patients and health service providers. There are many components of the framework of the health information systems that allow for the better use and implantation of the health records. It is common for hospitals that have implemented the EHR system to rely on third-party software companies like Epic or Cerner.

From a patient's perspective, it is essential to be able to access their health record at the convenience from the comfort of their electronic devices. There are front-end

implementations that are provided by Epic and Cerner for the patients to access their health records. Epic's application is called MyChart, which the patients and their family can access their family medical records online. MyChart allows users to manage doctors, book appointments, e-visits, complete questionaries, stay in touch with the care team, receive reports, and many more. Along with that, senor technology and wearable devices are also now available for the users. These wearable technologies can be connected to their MyChart that would drive patient engagement by collecting data and providing valuable insights. 'Connected information, target-oriented healthcare networks, and gamification are three significant advantages of these wearable sensor technologies' (Islam et al., 2015). Apple Watches and Fitbit are some examples of wearable sensor technologies that collect data and can be used to monitor patients online. There have also been many instances where these smart devices have been able to notify customers when their health is acting abnormal and notifying them to go to visit their doctors ultimately saving their life (Apple, n.d.).

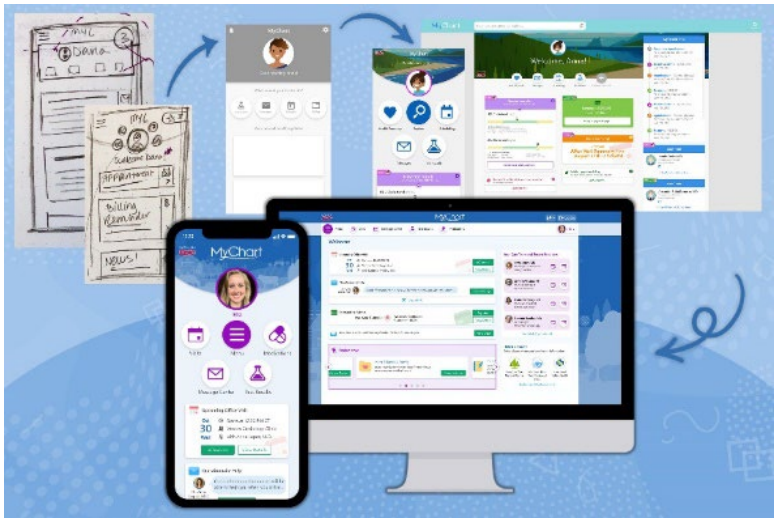

Figure 2.3: Display of MyChart on Different Viewing Devices

From the perspectives of the healthcare providers, these software companies give the hospitals, nurses, doctors, pharmacists, lab, etc. access to the patient information quickly. Lab technicians can upload the test results quickly, doctors can utilize telehealth to provide patient care, as they can access the patient data online, and pharmacists can see the prescription through the online portals as well. Many medical applications, such as remote health monitoring, fitness regimens, chronic illnesses, and senior care, are enabled using EHR, HIE, and Telehealth. 'To support these virtual/electronic services, the physical architecture of the healthcare network includes a variety of networks, ranging from short-range communications (e.g., WPANs, WBANs, WLANs, 6LoWPANs, and WSNs) to long-range communications (e.g., any sort of cellular network). In addition, the use of ultra-wideband (UWB), Bluetooth Low Energy (BLE), NFC, and RFID technologies can aid in the development of low-power medical sensor devices and communications protocols' (Islam et al., 2015).

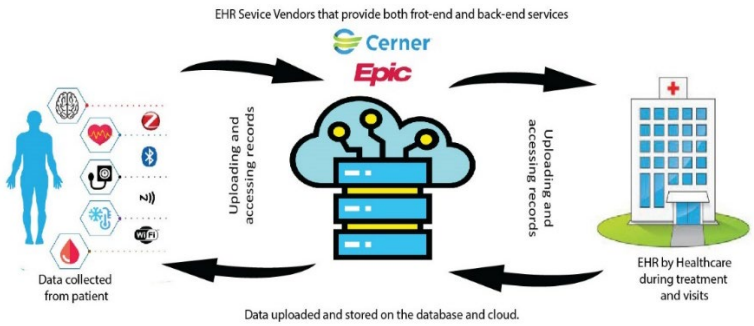

Figure 2.4: Framework of Health Information Systems

Healthcare providers are now relying on software providers like Epic and Cerner. These services then rely on cloud computing, grid computing, and ambient technologies to provide support for the healthcare system and store their database. Both companies rely on AWS (Amazon Web Services) as their preferred cloud provider. Cloud computing provides facilities with access to shared resources, offering services upon request over the network

and executing operations to meet various needs. The computers in healthcare are connected through a network and the cluster of those computers are called grid computers, which is another integral part of the interoperability of the healthcare records and is the backbone of cloud computing. The insufficient computational capability of medical sensor nodes can be addressed by introducing grid computing (Epic, n.d.; Cerner, n.d.; Shilo et al., 2020).

CHAPTER 3

SIGNIFICANCE

EHR interoperability certainly has its benefits of easy access for patients to access their health records, reduced paperwork, putting information accurately into the hands of people who need it, allowing doctors to coordinate on patient's care and safety, and reducing the unnecessary tests and procedures (ONC, n.d.). However, EHR's applications and scope have expanded beyond assistance administration (registration, scheduling, billing) and basic clinical treatment to include research. The amount of data collected has increased over the last decade, and with it, so has the number of applications that enhance healthcare results and efficiency (Kim et al. 2019). EHRs are gradually being redesigned to make them more valuable for research (Kim et al., 2019).

The interoperability of EHR and HIE has proved essential in access to correct patient information on time (Martin et al., 2018). It is especially crucial in EMS–ED (Emergency Medical Care - Emergency Department) when the patient's life is in immediate threat (Martin et al., 2018). On both sides of the emergency care continuum, timely access to patient information may expedite clinical handoff, preserve the continuity of care, and reduce the risk of a medical mistake (Martin et al., 2018). In addition to providing for more informed decision-making, the use of HIE is believed to have contributed to the lower admission rates (Ben-Assuli et al., 2018). EHR was also linked to a considerable decrease in single-day admissions and readmissions (Ben-Assuli et al., 2018). Emergency Department patients who had their EHRs accessed had a decreased

likelihood of being admitted to the hospital, and a similar incidence of lower admission rates following the adoption of an EHR, even for a newborn ward, was also noted (Ben-Assuli et al., 2018). This decrease is attributed to increased treatment quality, which is a possible correlate of EHR adoption (Ben-Assuli et al., 2018). The short stay at hospitals is not just good news for a patient spending so much money for their stay, but also for healthcare itself to provide proper patient care to more patients as they can properly utilize their resources, like beds and hospital staff.

Due to the rise in EHR and the use of wearable technologies, a huge amount of big data among various healthcare organizations are generated. These large-scale medical data analyses can uncover new and previously undiscovered connections, patterns, and trends in the data, potentially leading to scientific breakthroughs in illness causation, categorization, diagnosis, therapy, and progression. The data can be used to build computational models to accurately predict clinical outcomes and disease progression, which have the potential to identify people at high risk and prioritize them for early intervention strategies and evaluate the impact of public health policies on real-world data (Shilo et al., 2020). These data sets have the potential to anticipate, shape/reshape, and redefine the whole healthcare business globally through increased patient care, recommendations, image processing, fraud detection, research, and more (Vijayan, 2019). The five keys to making big data a large part of the industry are volume, velocity, diversity, veracity, and value (Vijayan, 2019).

Healthcare is one of several areas where the interoperability of big data can improve in terms of efficiency, innovation, and efficacy. Raghupathi and Raghupathi (2014) discussed Premier, a U.S. healthcare alliance network with thousands of members,

hospitals, facilities, and physicians in their research. The alliance was able to compile a huge database of clinical, financial, patient, and supply chain data, which allowed the network to provide complete and comparative clinical outcome reports, resource usage measurements, and cost statistics. These bits of information were crucial in helping them save thousands of lives and billions of dollars (Raghupathi et al., 2014). It is just one of many instances of how the interoperability of big data has the potential to change healthcare.

With the knowledge retrieved by the interoperability of patient vitals, demographics, habits, behavior, and pattern, health care professionals can understand what worked and what did not on a larger scale. It is extremely helpful to predict/build models for new products and services to assist in making strategic management decisions and predictive maintenance (Bosch, 2016). Big data is now allowing companies to access the information of user experience like never before (Oracle, n.d.). New sensor technologies and processing architectures are capable of new possibilities for gathering and processing information. In the long term, it can be predicted that big data can change research at its core (Bosch, 2016).

The potential of big data analytics is realized in processing large data sets that are recorded continuously, which helps in the real-time discovery of abnormal behavior and predicting a patient's future conditions. The introduction of 5G and efficient wearables and other implantable sensors are useful in further acceptance of wearable technologies in the market (Dimitrov, 2016). Apple Watch and Fitbit are some examples that have brought wearable sensor technologies into the mainstream market. Fitbit's software developer's kit (SDK) and Apple's Research Kit can be a huge asset as they provide researchers access to

vast stores of biometric data on users, which can then be used to test hypotheses on nutrition, fitness, disease progression, and treatment success (Dimitrov, 2016).

In addition to the advancement in technologies and better interoperability of health care records, the COVID-19 pandemic has also played a vital role in acceptance and implementation of Telehealth. The CDC reviewed deidentified encounter (i.e., visit) data acquired from four of the biggest U.S. telehealth providers that offer services in all states to assess changes in the frequency of utilization of telehealth services throughout the early pandemic period. The trends in telehealth interactions from January to March 2020 were compared to those from the same periods in 2019 (Koonin LM et al. 2020). The number of telehealth visits was increased by 50% in the first quarter of 2020 compared to the same period in 2019, with a 154 percent increase in visits noted in surveillance week 13 of 2020 compared to the same period in 2019, indicating that health care centers are increasingly using telehealth as a result of the pandemic (Koonin et al. 2020). With its raise, it has also shed light on the importance of analysis of not only security vulnerabilities but also current or future EHR integration to fully implement and make the best use of telehealth post-pandemic (Wosik et al., 2020).

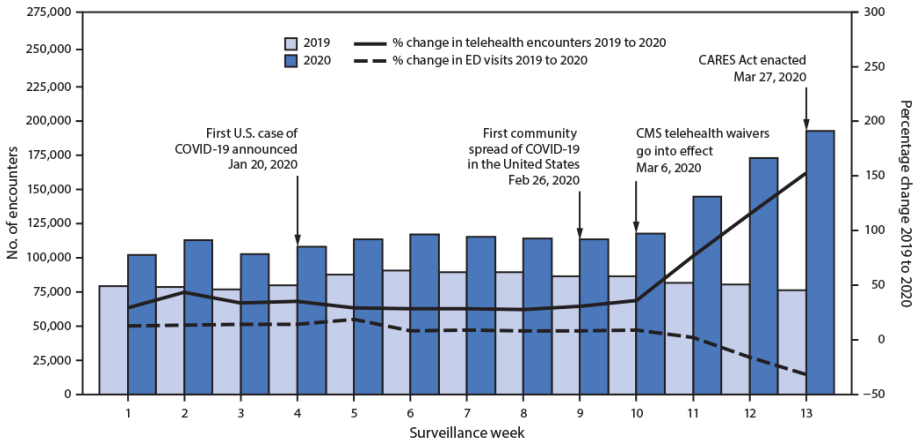

Figure 3.1: Trends in the Use of Telehealth During the Emergence of the COVID-19 Pandemic - United States, January-March 2020

Telehealth programs paired with the right EHR and HIE system enhance care access, increase patient satisfaction, and reduce medical spending even more, and by improving clinician experience (Zhang et al., 2022). The integrated system can contribute to achieving the best use of interoperability of healthcare records. On a systemic level, health policy should accelerate the acceptance of telehealth to enhance treatment quality, cost-effectiveness, and value of care to help integrate telehealth into clinical practice and improve patient care (Zhang et al., 2022). At the same time, hospitals must devise strategies for implementing and integrating various forms of telehealth services, as well as assess and evaluate telehealth products for healthcare delivery (Zhang et al., 2022). There must also be consistency in the level of treatment provided, whether in person or online (Zhang et al., 2022).

During the time of COVID-19, telehealth enabled health care professionals to ask specific questions and collect required information, triage patients and supply consultations, and determine whether a person could continue to self-monitor symptoms at

home while recovering using live video conferencing or a simple mobile call along with electronic health records (EHR) (Monaghesh et. al., 2020). Furthermore, telehealth offered online mental health services in the scenario of patient isolation by lowering the COVID-19 mental health burden and exchanging information about burnout, depression, and anxiety symptoms (Monaghesh et. al., 2020). It was also used in patients own homes for routine check-ins, such as respiratory, blood pressure, oxygen level rate, cancer, and diabetic consultations/reviews, avoiding direct physical contact between patients and healthcare professionals and therefore lowering the risk of infection to physicians and other healthcare providers while taking care of the patient (Monaghesh et. al., 2020).

During the COVID-19 outbreak and lockdown in China, mental health experts and authorities used online mental health surveys along with communication apps like Weibo, WeChat, and TikTok to provide safe mental health treatments online. Chinese government authorities also created a remote consultation network that was used to provide mental health treatments via the internet or over the phone in a secure environment, reducing the risk of cross infections (Monaghesh et. al., 2020).

CHAPTER 4

CHALLENGES

The data collected through all these sources has limitless applications in health care research, knowledge discovery, clinical treatment, personal health management, and making strategic management choices. However, there are many other challenges, including privacy and security concerns. Researchers in this discipline regard big data security and privacy to be major roadblocks (Abouelmehdi et al., 2017). Data transparency, traceability, immutability, audit, data provenance, flexible access, trust, privacy, and security are all major concerns for today's healthcare data management systems. Furthermore, many present healthcare data management systems are centralized, posing the danger of a single point of failure in the event of a natural disaster (Yaqoob, et al., 2021).

The data breaches in the health care system are increasing at an alarming rate. “The HIPAA definition of a data breach is the procurement, access, use or expose [*sic*] of confidential health information illegitimately, which compromises the privacy or security of that confidential health information” (Seh et al., 2020). Besides the huge financial setback that organizations face in cases of data pilferage, such instances also impact the image of the organizations, damaging their reputation and brand value. The Privacy Rights Clearinghouse (PRC), a nonprofit organization based in the USA, reported that there were 9016 data breach instances in different sectors from January 2005 to October 2019 (Seh et al., 2020). The total number of records exposed in these breaches was more than 10

billion (10,376,741,867). The different types of attacks used to breach the information were Intentional Insider Attacks (INSD); Frauds Using Cards (CARD); Physical Damage, such as the theft or loss of paper documents (PHYS); Damage of Portable Devices, such as lost or theft (PORT); Hacking or Malicious Attacks (HACK); Stationary Computer Loss (STAT); Unknown Approaches (UNKN); and Unintentional Disclosure (DISC) (Seh, et al., 2020).

An EHR contains highly confidential information in various forms, like physicians' notes, lab results, and reports. When hackers obtain EHR data, they are able to sell this vital information in the dark web for money. There are several cases which show that extremely sensitive information of patients was easily stolen by simply stealing EHR data (Shah et al., 2020). For example, hackers were able to steal EHR data from North Carolina-based Catawba Valley Medical Center. It contained patients' names, dates of birth, medical data, health insurance information, and social security numbers, which were critical information that could be easily sold in the black market (Shah et al., 2020).

The study on cyber-analytics by (McLeod et al., 2018), summarizes on the level of exposure and security factors related to healthcare. The article also states the prevention of these privacy issues is even harder since the healthcare field is sensitive as it relates to people's lives. At the same time, there are cases where patients' data were stolen, exchanged, and exploited for the organizational benefits of the institution (McLeod et al., 2018). Due to their incorrect setup of web servers and loose standards for providing database access, New York-Presbyterian (NYP) Hospital was fined 3.3 million dollars for the Internet leak of 6800 patient's data (McLeod et al., 2018). Moreover, the article states encryption might not be enough to protect data from theft (McLeod et al., 2018). Healthcare

institutions are required to adopt a risk management strategy that protects the confidentiality, integrity, and security of all data they produce, keep, receive, or transfer under the HIPAA Security Rule (McLeod et al., 2018).

Justice Samuel Dennis Warren and Justice Louis Brandeis define privacy as the right “to be left alone” (Ozair et al., 2015). According to The Privacy Rule, HIPPA gives patients’ rights over their health information and sets rules and limits on who can look at and receive their health information (ONC, n.d.). The Privacy Rule applies to all forms of individuals' protected health information, whether electronic, written, or oral. These laws are strictly applicable to all health care providers and any entities associated. Along with the data breaches and security concerns, privacy issues are also raised when patient data is being shared or linked without their consent. One such example of a violation of the privacy of EHR was in Washington's Howard University Hospital. One of the hospital's medical technicians was charged with breaching the Health Insurance Portability and Accountability Act on May 14, 2013 (Ozair et al., 2015). Laurie Napper, according to prosecutors, exploited her position at the hospital to obtain access to patients' names, addresses, and Medicare numbers for 17 months to sell their information. She was found guilty and sentenced to 6 months in a halfway home as well as a fine of $2,100 during a plea hearing on June 12, 2013 (Ozair et al., 2015).

As the use of EHR and HIE has grown in recent decades, so has the amount of time spent by hospital doctors on documentation and clerical chores, reducing the amount of time available for direct patient care and connection with patients and family (Baumann et al., 2018). Usability issues, according to the experts, cause inefficiencies, frustrations, productivity losses, and hazards to patient safety across all sites and suppliers (Staggers et

al., 2018). The increased focus on documentation quality, as well as the necessity to document more detail about the treatment process, has resulted in increased time pressure and personnel unhappiness. Burnout is a result of this, with studies indicating that up to 49% of hospital physicians fulfill burnout criteria (Baumann et al., 2018). Burnout is linked to a drop in care quality and an increase in costs. These issues tend to be a result of poorly designed UX design, EHR systems that do not support Health professionals' workflow, and the lack of internal and external Interoperability (Baumann et al., 2018; Staggers et al., 2018).

In addition, not all the data amassed are useable. More data does not always equate to useable data, and more does not automatically mean better. Big data must be evaluated scientifically in market research to attain its full benefits. Big data can easily tempt us to fall into the "the more, the better" trap. While dealing with big data, it is not possible to measure all units of interest and avoid bias, but it is possible to achieve precision with non-representative digital approaches, for which keeping everything updated is necessary. Despite the overwhelming amount of data collected daily, the number of useful and informative variables might be low and might be missing (Bosch, 2016). If the value of the collected data is limited in terms of critical variables, then the evaluations, such as target group or segment-specific analyses, cannot be conducted. Due to this, big data poses challenges for research and its proper implication in health care (Bosch, 2016).

Incomplete, inconsistent, and incorrect data all lead to misinterpretation of data, which can lead to further challenges. Data accuracy collected through EHR ranges between 44% to 100% (Shah et al., 2020). This means that the interpretation of the data collected can have several errors. These errors include inaccurate predictions by clinical researchers,

degradation in health standards and statistics as data analyzed was error-prone, and false health surveillance results that may lead to a unforeseen medical emergency (Shah et al., 2020). The survey also found that in a pool of 1.1 million patients, 31% visit two or more hospitals, while one visited more than five, which leads to holes in the EHR of the patient records. In a study conducted at Columbia University on 3068 pancreatic cancer patients, 52% of patients had incomplete pathology records about the disease. The involvement of different individuals and the use of different recording tools in the preparation and processing of EHR leads to an inconsistent form of data (Shah et al., 2020).

CHAPTER 5

SOLUTIONS

The amount of data being produced and at the speed at which it is being produced is in substantial amounts which can be quite hard to handle and manage. It leaves the organizations with the responsibility to handle, contain, and properly use the data produced. There is a lack of studies examining the long-term repercussions of EHR implementation on staff documentation time within a hospital setting. As staff initially adapt to the new system, the proportion of time spent on documentation tasks appears to increase for physicians, nurses, and interns on the documentation of the EHR while they have fewer chances to interact with patients while building an EHR system. The design of the system must be easily adaptable by the health care professionals and less time-consuming. The UX design and the database should work with the daily proceedings of the health care worker. Along with that, proper training should be available for the professionals on how to use the systems. The medical fields should also need to invest in good system design and IT solutions and hire IT professionals to decrease the IT-related work burden on the healthcare professionals.

According to the research by Dolezel et al., (2019), there is a lack of skilled human resources and tools for data scientists in the medical field. They suggested that there needs to be more opportunities and funding from the university level to push for data science and data scientists more aggressively (Dolezel et al., 2019). They concluded that there exists a knowledge gap in the pool of healthcare job applicants (Dolezel et al., 2019). So, there is

an important need for aggressive, planned dissemination of big data analytic skills to future job seekers (Dolezel et al., 2019).

Companies like Epic and Cerner are already moving towards the cloud to store data in two different environments, hybrid environments and multi-cloud environments, for the safeguarding and decentralization of data. In the hybrid environment, the companies are storing essential data on their premises and others on the cloud, whereas in a multi-cloud environment the companies are storing their data in private/public clouds (Khvoynitskaya, n.a.). Since the majority of data is stored in cloud servers, which are highly susceptible to threats and breaches, there is an imminent need to safeguard them from unauthorized access (Ozair et al., 2015). Additional security steps, such as strong privacy and security policies and their strict implementation, are important. Security measures, such as firewalls, antivirus software, and intrusion detection software, must be included to protect data integrity. Routine random audits should be conducted regularly to ensure compliance with hospital policy. All system activity can be tracked by audit trails. The HIPAA security rule requires organizations to conduct audit trails, requiring that they document information systems activity and have the hardware, software, and procedures to record and examine activity in systems that contain health information (Ozair et al., 2015).

CHAPTER 6

CONCLUSION

The adoption of EHR, HIE, and Telehealth are only increasing because of technological advancement and COVID-19. The interoperability of the health care record system has far-reaching benefits, including better patient care, easy access to patient data, fewer hospital admission in the Emergency Department, and the use of big data for research, value-centered marketing, and making strategic business solutions. However, there are many challenges and issues, like healthcare professional burnout, holes/gaps in EHRs due to incomplete, inconsistent, and incorrect data, uncontrollable amounts of data collected, privacy, and security threats, like data breaches.

Privacy and security concerns need to be addressed for the better use of Health Information Systems. It is extremely hard to make the data and information systems to be completely secure. However, the implementation of security strategy and policies, better Information Systems infrastructure and training programs can help limit the data breaches and tackle this issue to some extent. Better user interface and user experience design solutions can be used to ensure that the design of the system follows the work of the healthcare staffs. In addition, investments in Information System design, security, and hiring IS workers are very important as well.

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