An Analysis of Electronic Health Records: Implementation, Failings, and Future Outlook

Northeastern University

ENGW 3306: Erik Jaklitsch, Ann Kogosov, Anika Jagow

Abstract

The introduction of electronic health records (or EHRs) has revolutionized approaches to caring for patients, curating their information, and collecting data for medical research. However, EHRs have proven to be a contentious topic: while clear increases in efficiency have been cited, unexpected consequences in a variety of contexts have become apparent (Birkhead, 2015). This has fueled the debate about the impacts of EHRs as they relate to outcomes in the medical field. The debate spans across a wide range; everything from patient privacy concerns and HIPAA violations, in an ethical context, to effects as a contributor to physician burnout have been discussed in the public forum. We seek to comprehensively evaluate EHRs, by identifying failings in their introduction to healthcare from a systemic standpoint to make recommendations for addressing these issues.

Background

Paper health records surfaced in the 20th century, existing as the only source of documentation of interactions between doctors and patients. Since only one paper copy existed, a problem grew with with interhospital communication. In the 1960s-1970s, advancements in computer technology facilitated the development of EHRs (Evans, 2016). EHRs were implemented to improve patient care by facilitating communication between hospitals and standardizing the format of medical information. Some loftier goals included utilizing the newfound technology of computers to diagnose diseases and draw correlations between symptoms while doctors performed the more "human" tasks involved with being a physician (Carter, 2015).

Physician Burnout and Patient Care Quality

A 2016 review of EHRs states “technical issues have been overshadowed by procedural, professional, social, political, and especially ethical issues as well as the need for compliance with standards and information security” (Carter, 2015). A 2018 survey of the public and physician populations found that both populations agreed on the positive impacts of EHRs. However, the majority of physicians believed that an EHR system would be a “burden for their finances (61.6%), for their time concerning training on the system (70.5%), for their everyday workload (79.5%), and workflow (73.2%)” (Entzeridou, 2018). This shows that the system, although beneficial in various other regards, is considered a significant burden from a physician perspective.

At Massachusetts General Hospital Plastic Surgery Grand Rounds, Dr. Elizabeth Harry gave a talk about her work on physician burnout causes and solutions. In addition to being a successful physician, Dr. Harry is also a dominant figure in pioneering the movement to address physician burnout for the current and future generations. Physician burnout can be identified in physicians as worsening and consistent exhaustion, apathy, and lack of feeling fulfilled in one’s work and life (Harry, 2019).

Dr. Harry identifies the 2 factors “Most disliked about medical practice” determined from The Physicians Foundation 2018 Physician Survey to be EHRs and lack of clinical autonomy, determined by a survey of nearly 9,000 physicians across the country as well as a report from the Massachusetts Medical Society, the Massachusetts Health & Hospital Association, and the Harvard T.H. Chan School of Public Health (The Physicians Foundation, 2018; Harry, 2019). These findings, consistent across sources, disvalidate the argument by proponents of EHRs as a tool that increases physician well-being. Overall, EHRs as a new technology create more barriers for physicians to provide optimal patient care. Physician burnout not only affects the well being

of physicians, but leads to physicians lacking empathy, energy, and care for their work. This sets up a path for sub-optimal patient care, which contradicts the original aim of EHRs.

Technology

Due to the increased demand for data storage and analytics in healthcare organizations, new systems of data management need to be developed in order to manage large data sets. These data sets or so-called "big data" follow three main principles: volume -- "exponentially large data sets"; velocity -- "data that arrives in continuous streams"; and variety -- "data… gathered from different sources" (Kuiler, 2015). The increased information scope inundating older systems with data retrieval and update requests have underscored the limitations of traditional storage methods. Relational Databases, the favored method for data storage for many years, was popular due to its easy to learn querying language and ease of mapping real world objects to tables. However, these databases struggle to keep up with the sheer quantity of requests and processing power needed to store information.

Technology has changed the way in which physicians and patients interact with medical records. With the widespread use of web applications, physicians can update and retrieve data frequently and concurrently; thus data becomes "bidirectional instead of unidirectional" and "distributed in an information network ranging from health professionals, relatives, and social networks to the actual patient" (Aragues, 2011). Use cases for this data can be divided into three main types: "body/personal, single/multi-user, and intercommunication". Therefore, data systems have to be able to handle simultaneous data retrieval and update requests from different sources as well as a high volume of traffic. Otherwise, information might become unreliable due to data corruption.

Furthermore, some hospitals are hesitant to take on the financial burden associated with adopting EHRs because of the un-uniformed data structures across different institutions. Limitations on sharing patient data serves as an impetus for hospitals to not switch over to more expensive, complex electronic systems since they can only "exploit the expanded access to patient information" if there are other providers with "whom it's possible to exchange health information" (Miller, 2009).

Different systems have different vernacular and norms, which hinders the "possibility of efficient data sharing". Currently, there a few different standards for structuring data storage which are not "fully compatible" and follow different "communication architectures" which makes it very difficult for two different health information systems to share patient data with each other effectively (Kuiler, 2015).

Data Privacy

Similarly, hospitals and patients are hesitant to trust EHRs due to concerns over data privacy and unclear guidelines for how data can be used. After legislation was passed that required the government to release its data to the public, healthcare information became more readily available to the everyone. While this wealth of data can aid immensely in research pursuits and suggesting treatment options, it also has the potential to expose a lot of people's private medical records out in the open. HIPAA laws don't "cover most entities that operate public-use databases" so they are not subject to "detailed privacy regulations" (Kuiler, 2015). In a survey done by the California HealthCare Foundation, they found that 69% of participants were "very concerned or somewhat concerned that an EMR system could lead to more sharing of your medical information without your knowledge" (Miller, 2009).

Proposal

Many concerns regarding physician burnout stem primarily from factors that take away from physician to patient "face-to-face" communication and overall decreased efficiency of time spent entering medical information. Addressing these problems at the source may be the best way to directly impact improvement systemically. Doctors who experience a dehumanized patient-physician relationship because they are forced to type in medical information during appointments would fare far better with a system that emphasizes human to human communication. Hand in hand with this concept is the influence of being able to spend less of their day entering data and spending more time doing work more relevant to their years of training. One potential solution recently proposed, involving the initiation of a scribe program to reduce EHR burden by Dr. Harry, shows great promise. Scribes are an addition to the routine clinic visit, sitting in on appointments with patients to take notes on the patient-doctor interaction and preparing a draft of an encounter note for the physician. This saves hours of time spent doing dictations and writing notes after a full day of clinic. Implementation, while costly and time-consuming, could have long-term effects on physician well-being greatly that greatly overshadow the efforts required to initiate the program (Harry, 2019).

An MGH Plastic Surgeon summarizes his own experience with implementation of a scribe program by reflecting upon the difference between "editing and signing off on 35-40 notes at the end of a day," for "about an hour or two," and a "[similar] day of clinic," which would involve "[going] back and writing 35-40 full notes." It is apparent that scribes can make an immense individual difference on physicians, as well as improving the function of that center as a whole. Physicians are far less likely to experience systemic moral injury with high associated

rates of suicide and depression when practices like these are incorporated, and far more likely to provide the best quality care. Put simply, a medical center with lower rates of physician burnout has improved patient care as a result of physicians that are not overburdened. This is a global issue, and the solution starts with small steps to reduce this burden, such as implementation of scribe programs at centers with high rates of physician burnout. Governmental regulations, or at a minimum standard suggested practices from government-funded large health agencies, that put pressure on hospital systems to limit physician 'screen time' for their healthcare workers could help.

Further considerations in addressing EHR problems from a technological perspective also have strong potential to positively impact delivery. Old data systems cannot handle the increased amount of information. We recommend transitioning old data systems with new platforms, such as Hive, "an open-source data warehousing solution," which can help physicians search through "petabytes of healthcare records in patients with similar conditions." Access to this information helps them to "predict the healthcare benefits of different drugs and lifestyle choices in patients" so they can recommend the best treatments for patients (Chennamsetty, 2015). A system that is easily scalable so that in the future, it will be able to accommodate even more data is well worth the initial cost and time commitment of switching over data storage systems. Not only would switching to a better system now address present day issues, it would help future-proof a hospital from changes that might happen later in time.

To address privacy concerns over EHRs being shared without a patient's consent, we recommend updating policies to take into account these alternative ways medical information is being stored. While HIPAA laws require publicly released medical records to be anonymized, "data anonymization techniques are not always fool-proof" (Kuiler, 2015). More rigorous

guidelines for obscuring personal patient information should be put in place. Better defined rules for circumstances in which hospitals can share records; specifically, de-identified data needs to be more separated from patient identifying information than are currently in place. Data breaching that takes advantage of server hosting of patient identifying information and their relevant health data within the same system could be helped by further separation. Efforts put towards more cyber security would also help increase the confidence in data privacy and security from a patient perspective as well.

It should be noted that implementation of practices to address the problems must be done in a comprehensive manner, specific to centers of care but with a focus on similar techniques. We suggest an inclusive, holistic plan of scribe implementation at such centers with problems of physician burnout, coupled with the introduction of scalable new platforms like Hive and an updated set of regulations regarding separation of personal health information. Limitations of such an approach are primarily based in cost, but preventative measures such as solutions like these to the problems associated with EHRs are cost-effective in long term spending when factors like physician moral injury and increased litigation opportunity/data breach are considered. A further evaluation of centers where these implementations are made would help to validate such solutions and spur on more research going forward.

Conclusion

Overall, EHR-related setbacks have become apparent in the context of a variety of disciplines. Patient data safety and physician well-being are some of the most important aspects of any functional healthcare system; unintended side effects of EHRs jeopardize this. Improvements can be made on EHRs by implementing scribe programs to lessen the time burden

on physicians associated with updating records in EHRs and enforcing strict data regulations. Steps must be taken to address these problems, and even if the applicability of these specific suggestions may vary across centers of care, doing so may help to reduce the burdens of EHRs and one day achieve a balance where the implementation and usage of EHRs are optimized.

Reflective Note

The authors decided on the topic of EHRs since they are applicable to both computer science and healthcare. Ensuring that patients receive the best care possible and physicians have access to accurate and insightful data is really important. Almost everyone goes to doctor's appointments and receive recommendations for treatment from doctors so we thought EHRs are relevant to a lot of people. We approached this topic by reading different scholarly journal articles and attending informational talks about EHRs and evaluating the shortcomings of the current system. APA citation and formatting was utilized as is standard for published research in science related fields. The authors collaboratively wrote this essay by sharing ideas over messenger, actively editing and revising each other's work, and planning out issues and topics we wanted to address in our paper.

References

1. Aragues, A., Escayola, J., Martinez, I., Del Valle, P., Munoz, P., Trigo, J. D., & Garcia, J. (2011, November 10). Trends and challenges of the emerging technologies toward interoperability and standardization in e-health communications. Retrieved March 17, 2019, from https://ieeexplore.ieee.org/abstract/document/6069727

2. Birkhead, G. S., Klompas, M., & Shah, N. R. (2015). Uses of Electronic Health Records for Public Health Surveillance to Advance Public Health. *Annual Review of Public*

3. Carter, J. T. (2015). Electronic medical records and quality improvement. *Neurosurgery Clinics*, *26*(2), 245-251.

4. Chennamsetty, H., Chalasani, S., & Riley, D. (2015, March 7). Predictive analytics on Electronic Health Records (EHRs) using Hadoop and Hive. Retrieved March 17, 2019, from https://ieeexplore.ieee.org/document/7226129

5. Entzeridou, E., Markopoulou, E., & Mollaki, V. (2018). Public and physician's expectations and ethical concerns about electronic health record: Benefits outweigh risks except for information security. *International journal of medical informatics*, *110*, 98-107.

6. Evans, R. S. (2016). Electronic health records: then, now, and in the future. *Yearbook of medical informatics*, *25*(S 01), S48-S61.

7. Harry, E. (2019). *Burnout and Cognitive Load, How they Impact Performance and Professional Fulfillment*. Presented at Massachusetts General Hospital Plastic Surgery Grand Rounds.

8. Kuiler, E. (2015). Big Data Adoption in the Health Care Domain: Challenges and Perspectives. *Journal of the Washington Academy of Sciences, 101*(3), 11-22. Retrieved from https://www-jstor-org.ezproxy.neu.edu/stable/jwashacadscie.101.3.11

9. Miller, A., & Tucker, C. (2009). Privacy Protection and Technology Diffusion: The Case of Electronic Medical Records. *Management Science, 55*(7), 1077-1093. Retrieved from http://www.jstor.org.ezproxy.neu.edu/stable/40539198

10. The Physicians Foundation 2018 Physician Survey (2018). *The Physicians Foundation*. Retrieved from: https://physiciansfoundation.org/research-insights/biennial-physician-surveys-patient-surveys/

Glossary

Health Insurance Portability and Accountability Act of 1996 (HIPAA): United States legislation that provides data privacy and security provisions for safeguarding medical information.

Electronic Health Record (EHR): a digital version of a patient's paper chart. EHRs are real-time, patient-centered records that make information available instantly and securely to authorized users

Big Data: extremely large data sets that may be analyzed computationally to reveal patterns, trends, and associations, especially relating to human behavior and interactions.