Thesis Portfolio

Infectious Diseases Data Analysis Program: A Proof of Concept for User-Friendly Patient Data Analysis

(Technical Report)

The Influence of Researchers, Clinicians, and Legislation on one another, and the Effects on Electronic Health Records

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science
University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree
Bachelor of Science, School of Engineering

Elnaz Ghajar-Rahimi
Spring, 2020

Department of Biomedical Engineering

Table of Contents

Sociotechnical Synthesis

The Capstone project and STS paper focus on improving electronic health record (EHR) systems, EHRs themselves and their adoption in hospital systems, respectively. The Capstone Project seeks to improve the technology and efficiency of EHRs, while the STS project explores the social implications of EHRs in hospital systems. EHRs expand the realm of possibility for medical data analysis, medical research, and ultimately patient care. With much debate that poor EHR interfaces increase physician workload, scientists and engineers continuously seek to improve EHR systems. In combination with one another the STS paper and Capstone Project form the basis for improving the technical and social aspects of EHRs.

During the summer of 2019 at the University of Virginia (UVA) hospital, a capstone team member noticed that a clinician was counting the number of patients with a specific condition by hand. However, a customized computer code can automate such a filtering and counting process. This served as the motivation for the Capstone Project, *Infectious Diseases Data Analysis Program (IDDAP) to Supplement Electronic Health Record Systems*. A series of in person interviews and electronic surveys conducted with clinicians in the Infectious Diseases department and the data analytics team at UVA, revealed the need for a method for reducing the time necessary for filtering patient data files. Clinicians at the UVA hospital must work with data analytics members to sort patient files, a tedious process with a slow turnaround time that limits the ability of clinicians to quickly conduct their analysis. The surveys and interviews also revealed that clinicians and researchers find most data analysis programs to be complex and not user-friendly. Mock infectious disease patient data served as the foundation around which IDDAP was developed. The final iteration of IDDAP, written in Rstudio with the flex dashboard package, serves as a proof of concept for a patient filtering software that can efficiently input an

EHR or medical record and output a series of filters that sort patient information in real time, as well simple statistical analysis calculations. Filtering options include gender, antibiotic, and date of admission. IDDAP improves the efficiency of clinical research that focuses on patient data analysis, while also encouraging the use of standardized patient data files. When applied on a large scale, programs like IDDAP may enhance a clinician's ability to identify trends in data.

The STS Research Paper, *The Influence of Researchers, Clinicians, and Legislation on one another, and the Effects on Electronic Health Records*, unravels the ways in which actors in health care and EHR development influence one another. Sheila Jasanoff's theory of co-production revealed that the scientific community and legislators simultaneously influence one another. The assessment of the advantages and disadvantages of EHRs then influence the actions of researchers, clinicians, and legislators when developing new iterations of EHRs. This cycle is depicted in **Figure 1**. The perceptions that physicians, researchers, and lawmakers have of one another, as well as their perceptions of EHRs, guide the way for effectively implementing change.

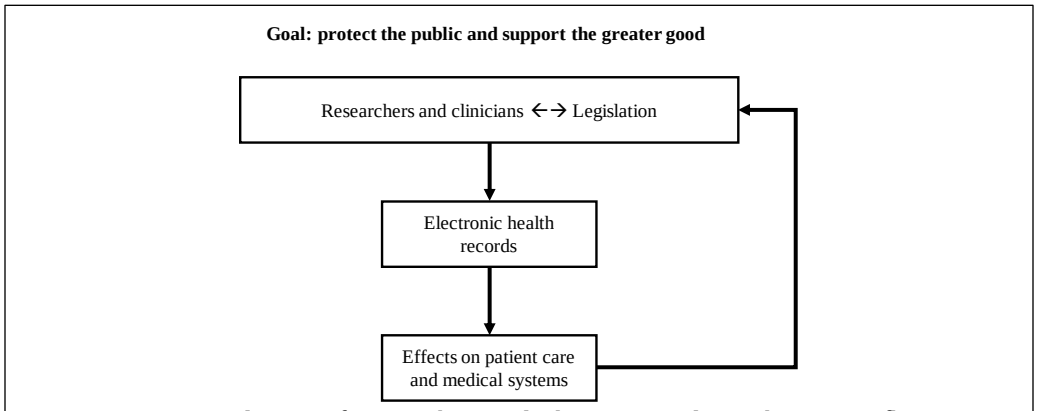

Figure 1 Co-Production of Researchers and Clinicians, and Legislation in Influencing Electronic Health Records (Ghajar-Rahimi, 2019)

Simultaneously completing the STS Paper and Capstone Project encourages an appreciation for the complexity of technological advancement. Understanding and acknowledging the

complexities of EHRs, both the design limitations and the impact on society, motivated a capstone project that was completed with compassion and interest. Clinicians and medical researchers aim to improve the lives of patients, prevent and treat disease, and promote good health; and technology serves as a tool for them to do so. Similar to the *de jure* vs *de facto* nuances of the civil rights movement, discrepancies between the intended purposes of a given technology and the real-life implementation said technology will never cease to exist. Considering both the theory and implication of a technology in action are thus crucial to ensuring that engineers seamlessly integrate their technologies into society.

References

Ghajar-Rahimi, Elnaz. (2020) Figure 1: Figure 1 Co-Production of Researchers and Clinicians, and Legislation in Influencing Electronic Health Records (Unpublished undergraduate thesis). University of Virginia, Charlottesville, VA