Optimization of Clinical Note Entry through Speech Recognition and Dynamic Data Augmentation

1 PROBLEM

In 2008, less than half (42%) of office-based physicians had adopted electronic health records (EHRs) of any kind. (Office-based Physician Electronic Health Record Adoption, n.d.) With the advent of the HITECH act, the usage has more than doubled to nearly 86% in 2017. On the surface this would seem like a positive trend, but physicians are not as pleased with the transition. In a 2018 survey conducted by The Doctors Company, 61% of providers said their EHR systems reduced efficiency and productivity. (The Future of Healthcare: A National Survey of Physicians - 2018, n.d.)

For modernization of the provider office to truly meet its intended goals, the negative impact of EHRs on physicians' productivity and job satisfaction must be addressed. The problems with EHRs continue to impede the industry and have been recognized by the United States' Federal Government. On February 21, 2020, The Office of the National Coordinator Health Information Technology released a report titled "Strategy on Reducing Regulatory and Administrative Burdens Relating to the Use of Health IT and EHRs." (Mason, 2020) The report echoes the problems stated by providers in the 2018 survey mentioned earlier:

> "As EHR adoption has increased in health care settings, so too have concerns about the user experience. The user experience is often closely related to the usability of a health IT product. Poor usability can be a significant contributor to clinician burden." (Strategy on Reducing Burden Relating to the Use of Health IT and EHRs, n.d.)

One of the major goals of the report is to "Reduce the effort and time required to record information in EHRs for health care providers during care delivery." The report further states "clinical documentation tasks in EHRs present another major challenge to clinician workflow."

2 SOLUTION

The NoteX application gives the physician or other healthcare provider an EHR agnostic interface to add clinical notes through a speech to text conversion process. The resulting text is further enhanced by dynamically looking up data in the EHR using keywords from the provider's notes and inserting the results into the text. Once the enhanced notes have been reviewed by the provider, they can be saved directly into the EHR through the NoteX application.

This solution aligns with recommendation #2 from the ONC on optimizing clinical documentation in the previously mentioned Strategy Report. (Strategy on

Reducing Burden Relating to the Use of Health IT and EHRs, n.d.) The strategy recommends "leverag[ing] data already present in the EHR to reduce redocumentation in the clinical note".

3 COMPLEXITY OR EFFORT

3.1 Speech to Text

Microsoft Azure Cognitive Services was utilized for Speech to Text translation. The integration effort was fairly straightforward by following Microsoft's samples. Fine-tuning of the text to speech system for the wide range of healthcare-specific terms is beyond the scope of this project. There are healthcare domain-specific systems available on the commercial market that could be utilized if this project was moved beyond its current scope.

3.2 FHIR Resource

One challenge was locating the FHIR resource required for Clinical Notes. The following documentation sources were located and used to resolve this challenge:

- Clinical Notes at FHIR DevDays 2018 (Miller, 2018)
- FHIR documentation for Clinical Notes (Representing Clinical Notes, n.d.) (Argonaut Clinical Notes Implementation Guide, n.d.) (Clinical Notes Guidance, n.d.)

3.3 External Tools & Libraries

The application was built using Google's Angular Framework and uses the open source PrimeNG User Interface control library. It uses the FHIR JS client to communicate with the FHIR server.

3.4 Natural Language Processing

The application was built with keyword/phrase matching to identify data candidates for FHIR lookup. The application could be further enhanced with Natural Language Processing (NLP) in the future.

3.5 Extensibility

The application was built with a configuration system for linking keywords to specific FHIR observations. This allows the capabilities to grow without additional coding. The configuration is described in the User Manual.

3.6 Security and Data Privacy

Many aspects of security and data privacy are handled by leveraging SMART on FHIR. This provides a secure mechanism for authentication and data connectivity to the EHR. Microsoft provides HITECH and HIPAA certification for their cloud services.

4 BACKGROUND AND SIGNFICANCE

Finding ways to make technology more useable in the healthcare setting is critical for its successful deployment.

The NoteX application simplifies the healthcare provider's interaction with the EHR, decreases the number of interactions required to complete a clinical note, and improves the quality of the note contents. I believe the data augmentation using FHIR data is a unique capability to this tool.

5 REFERENCES

Argonaut Clinical Notes Implementation Guide. (n.d.). Retrieved from HL7 FHIR: http://www.fhir.org/guides/argonaut/clinicalnotes/1.0.0/StructureDefinition-argo-clinicalnotes.html

Clinical Notes Guidance. (n.d.). Retrieved from HL7 FHIR® US Core Implementation Guide: https://build.fhir.org/ig/HL7/US-Core-R4/clinical-notes-guidance.html

Mason, A. G. (2020, February 21). *Final Report Delivers a Strategy to Reduce EHR Burden*. Retrieved from HealthITBuzz: https://www.healthit.gov/buzz-blog/health-it/final-report-delivers-a-strategy-to-reduce-ehr-burden

Miller, M. (2018, November 14). *Clinical Notes*. Retrieved from HL7 FHIR DevDays 2018: https://www.devdays.com/wp-content/uploads/2019/03/DD18-EU-Michelle-Miller-Clinical-Notes-2018-11-14.pdf

Office-based Physician Electronic Health Record Adoption. (n.d.). Retrieved from ONC for HIT: https://dashboard.healthit.gov/quickstats/pages/physician-ehr-adoption-trends.php

Representing Clinical Notes. (n.d.). Retrieved from HealthIT.gov: https://www.healthit.gov/isa/representing-clinical-notes

Strategy on Reducing Burden Relating to the Use of Health IT and EHRs. (n.d.). Retrieved from ONC for HIT: https://www.healthit.gov/sites/default/files/page/2020-02/BurdenReport_0.pdf

The Future of Healthcare: A National Survey of Physicians - 2018. (n.d.). Retrieved from https://www.thedoctors.com/contentassets/23c0cee958364c6582d4ba95afa47fcc/tdc_the-future-of-healthcare-survey-2018.pdf