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Using voice to create hospital progress notes: Description of a mobile application and supporting system integrated with a commercial electronic health record

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ABSTRACT

We describe the development and design of a smartphone app-based system to create inpatient progress notes using voice, commercial automatic speech recognition software, with text processing to recognize spoken voice commands and format the note, and integration with a commercial EHR. This new system fits hospital rounding workflow and was used to support a randomized clinical trial testing whether use of voice to create notes improves timeliness of note availability, note quality, and physician satisfaction with the note creation process. The system was used to create 709 notes which were placed in the corresponding patient's EHR record. The median time from pressing the Send button to appearance of the formatted note in the Inbox was 8.8 min. It was generally very reliable, accepted by physician users, and secure. This approach provides an alternative to use of keyboard and templates to create progress notes and may appeal to physicians who prefer voice to typing.

1. Introduction

The note creation process represents one of the most problematic aspects of electronic health records (EHRs) for physician users [1]. Though physicians express concern about aspects of EHR documentation, including note expressiveness [2], intrusion into patient-provider relationship during visits [3], note length and accuracy [4], their main concern regarding EHR documentation is the time required to create notes [5]. In 2010 and 2012 studies showed inpatient resident physicians spend between 40 and 49% of their time using a computer, and 70% of this time is spent in documentation and order entry [6,7]. This documentation burden often extends into the evenings, and contributes to dissatisfaction with electronic health records [8,9].

In most commercial EHRs, physicians combine typing into templates with tools to automatically insert patient information into the note. Typing and EHR interface navigation skills vary among physicians [10]. To save time, many physicians copy the previous day's note into the current day's note and modify it rather than beginning the note anew. This practice, known as copy/paste or copy-forward, can speed note writing, but may also lead to successive daily notes that substantially overlap in content. Critics of templates and copy/paste cite research identifying these methods as sources of potentially unsafe inaccuracies within notes [11]. Use of dictation for hospital daily progress notes addresses some of these issues, but is less common because transcription introduces significant delays and costs.

Automatic speech recognition software (ASR) is increasingly used by physicians. It can be used in 2 ways: In the first, which is more common, the note author speaks into a microphone and watches a screen as spoken voice is converted into text, and corrects errors interactively as they occur. This interactive method of using ASR does not

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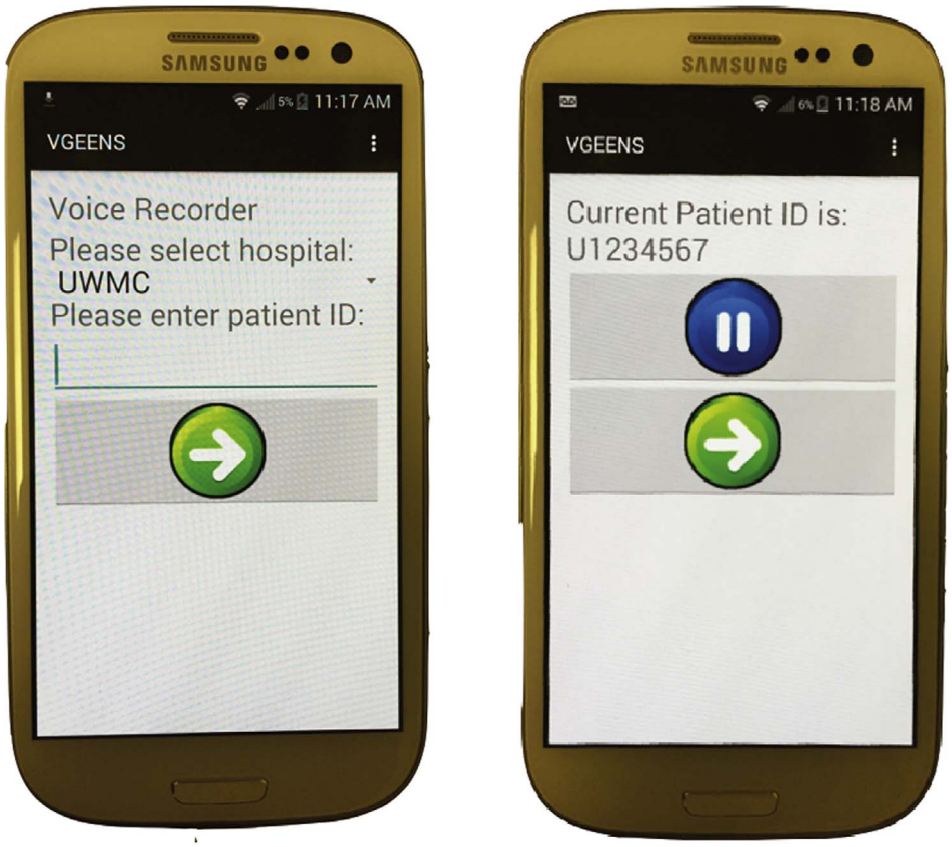

Fig. 1. Smartphone application developed for VGEENS showing simple user interface. After entering patient ID (MRN), there are 2 buttons, one for Send and one for Record/Pause.

fit hospital workflow well because it limits the mobility of physicians with patients dispersed through a hospital. The second way, supported by ASR vendors but used less commonly, is to create a recorded voice file which is converted to text without interactive involvement of the author. Although this approach facilitates physician mobility, the user must break their workflow to conduct downloads and they sacrifice the benefits of templates, automated data insertion, and real-time error correction.

This paper describes a system we developed to support a prospective trial using voice to create hospital progress notes. The goals of this project were to solve two key design and technical challenges. The first was to design a portable ASR system to seamlessly and securely record, transcribe, format, and enter notes into the EHR in a manner that fits physician rounding workflow. The second was to integrate the system with a commercial EHR so allow patient-specific data insertion and place the draft note into the EHR.

2. Material and methods

2.1. Context

This work to develop a new method for creating hospital progress note was part of the Voice Generated Enhanced Electronic Notes (VGEENS) project funded by the Agency for Healthcare Research and Quality. VGEENS tested the hypothesis that the newly developed system for creating inpatient progress notes described in this paper would change the time require to write notes, their quality, and physician satisfaction with the note writing process. A description of this clinical trial and the note-revision habits of enrolled physicians will be available elsewhere; this manuscript describes the design and technical lessons learned from VGEENS [12,13]. This project was conducted at Harborview Medical Center and the University of Washington Medical Center, major teaching hospitals of the University of Washington in Seattle. Together they comprise 863 beds and 34,915 discharges each year. Hospital care is supported using Cerner Millennium (Cerner Corporation, Kansas City, MO) as the application for documentation [14], results review, and order entry. The University of Washington Human Subjects Division approved the VGEENS project.

2.2. Design requirements

Our primary goal was to enable physicians to prepare an inpatient progress note quickly and accurately. The solution had to be reliable, portable, secure, and easy to use. We aimed to design a system integrated with our existing EHR that was simple enough to be preferred to typing a note. Additionally, we required the VGEENS system to fit into workflow of hospital rounding, a complex and sometimes chaotic daily activity for hospital physician teams. Our hospitals employ two types of physician care teams: teaching teams with a senior resident, one or more interns, medical students, and an attending physician; and hospitalist services with an attending physician sometimes joined by a resident. In both types, the team visits patients during bedside rounds, usually in the morning, and the time for a patient visit varies between 1 and 30 min but typically lasts about 10 min. The intent of the VGEENS project is that a short voice recording of less than 5 min would be created during or shortly after the bedside visit during rounds, when what was learned from patient history and examination was fresh in mind. Another important design requirement was that the application, smart phones, server, ASR and development costs remain within the budget of the grant funding.

Our objective was to require no more than 15 min of training for use of the VGEENS system beyond that required for each physician using our commercial EHR. To achieve this, we purposely designed the system with few features and an intuitive interface. Study investigators provided support for study participants directly and did not utilize the UW Medicine Information Technology Services Help Desk.

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