AHRQ GRANT FINAL PROGRESS REPORT*

Title of project: Improving Accuracy of Electronic Notes Using A Faster, Simpler Approach

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* This corrected version includes final results.

PURPOSE

Physician progress notes are an important record for clinical care and communication with care team members and patients. They also support measurements of care quality, research, automated and manual quality improvement, and billing.[1] Clinical notes are increasingly created using EHR documentation tools and appear in electronic form. The transition from paper to electronic documentation yielded many advantages, including making it possible for multiple people to access notes simultaneously, improved legibility, and the ability to more easily search notes.

However electronic notes are criticized for poor readability, overuse of copy and paste,[2] and increased length due to the importation of data stored in other parts of the EHR. Physicians have voiced strong concerns that writing notes in EHRs takes more time than using paper or dictation; a consequence is that progress notes may not be completed and available to other team members until long after the episode of care.[3] Documentation requirements have also contributed to widespread physician dissatisfaction with EHRs. Though use of voice recognition software, scribes, and other novel approaches may improve physician satisfaction in clinics, inpatient setting workflow is markedly different and is less conducive to these approaches. Traditional dictation turn-around-time and cost are barriers to broader use of dictation for inpatient progress notes.

Most concerning is the perception that electronic notes may not accurately reflect what was observed during a patient encounter, which threatens the primary use of notes—to aid in caring for patients—and also their use for scientific research.[4] Some physicians find modern EHR progress notes too unreliable to use as the basis for decision-making.

The project is an attempt to address the problems of electronic progress notes. In this paper we describe the development, implementation and evaluation of a voice-generated enhanced electronic note system (VGEENS), integrating voice recognition and transcription with natural language processing and links to the EHR, which is designed to match physician rounding workflow. We also present results of a randomized controlled trial to determine the effect of using this new method of writing inpatient progress notes on note timeliness, quality, and physician satisfaction, in comparison with writing notes in the usual way, through typing into partially populated templates.

SCOPE

Moving from paper to electronic physician documentation has improved the availability of notes within EHRs, but is also associated with problems in the quality, timeliness of those notes, and with physician time spent on the process of writing them. The purpose of this project is to address these problems with a novel method of creating inpatient progress notes.

METHODS

Setting and system description

This work was conducted on the medical services of UW Medical Center and Harborview Medical Center, which are major teaching hospitals of the University of Washington. Together there are 34,915 admissions annually. The transition from paper to electronic notes occurred in 2006 using note writing applications Cerner Millennium (Cerner Corp., Kansas City, MO).

Nearly all progress notes on these inpatient services are typed using the Clinical Notes Editor, based on templates that automatically import patient-specific data such as medication lists, vital signs, and laboratory results.

After development and testing of the VGEENS system to create progress notes, and integrating it into the existing commercial EHR, we used a randomized controlled trial to compare the following 3 outcomes between the intervention group, using this new method, and control group, entering notes using a keyboard: 1. The time between the patient isn't on hospital rounds and the availability of the note in the EHR; 2. Physician satisfaction with this new method of writing notes in comparison with the usual method and 3. The quality of the note as assessed by manual quality review using published instruments (PDQI-9).[5]

Study design

To test the effect of VGEENS on the length of time between rounds and availability of notes in the EHR, on physician satisfaction with note writing, and on note quality, we are conducting a randomized clinical trial. Internal medicine residents and attending hospitalist physicians were contacted through meetings and email messages and invited to participate in a trial of VGEENS. After a description of the study, physicians who agreed to participate and who gave informed consent were randomly assigned to either the intervention or control group (See Figure 2). The control group created progress notes as they usually do, typing notes using a locally developed template in Cerner's Clinical Note Editor. The intervention group uses the VGEENS system to create progress notes as described above.

Data sources/collection

We gathered time of hospital rounding using times recorded on paper rounding sheets. We determined the time progress notes were available for other clinicians to view using data extracted from our EHR. Physician satisfaction was assessed using a survey delivered by email. Note quality is being assessed using manual review of notes. Each of these are described in greater detail in *Outcomes*, below.

Interventions

In this study we developed a system to use physician voice to create inpatient progress notes. This new system, which we call VGEENS (voice-generated enhanced electronic note system), was used by study intervention physicians while on hospital rounds. While at the bedside or after leaving it, the physician enters a 9 digit patient identifier and records a voice file on a cell phone using an Android application developed by one of the study personnel (DA). When the dictation is complete, the physician presses a 'send' button causing the voice file to be securely (via encrypted connection) transferred via the existing hospital wireless network to a server for processing and then deleted from the phone. On the server, the file containing the digitally recorded dictation is converted to text using licensed commercial automated speech recognition software (Dragon Medical Practice Edition, Nuance) without interactive editing, using the subject's voice profile. Currently, voice commands are use to break the note into sections corresponding to the preferred UW progress note format (Chief Complaint, Interval History, Exam, Laboratory and Imaging, Assessment and Plan). During the course of the study we added features to automatically format the section headers using bold, capitalized font, and in response to voice commands to insert formatted patient vital signs and select laboratory test results. The transcribed note is sent to the EHR Inbox. All these coordinated automated steps

occur within 5 minutes of the creation of the voice file on the VGEENS application. From the EHR Inbox, the physician can edit the document, route it to recipients and then sign it, which places it in the patient's EHR record.

Control subjects create notes using the Clinical Notes Editor[6] in which the physician types or copies and pastes text into a template automatically populated with patient medication list, vital signs, and laboratory results.

Outcomes

Here we report results of the 3 outcomes measured in this study: the time between when the subject saw the patient on rounds and time the electronic progress note was available in the EHR for authorized users to view, and satisfaction with the note writing process of both intervention and control subjects using an email questionnaire.

Measures

Both intervention and control physicians manually recorded the time they saw each patient during morning rounds on a paper rounding sheet each day in the period in which they participated in the study. The rounding sheets are placed in a box in a secure patient care area and were collected by study personnel. We use the time recorded on this rounding sheet to determine when the patient was visited on rounds, and to determine the number and identity of patients in that physician's hospital census that day. Electronic progress note metadata (but not the text of the note) including EHR logging data showing when the notes were created, when they were viewable in the EHR, and when they were signed, were obtained from our analytical data repository (Amalga, Caradigm) which contains a subset of EHR data extracted for analysis and research. We determined the number of minutes between the patient visit and the availability of a viewable progress note in the EHR by subtracting the time the patient was seen on rounds from the time the note was viewable. Dictated and VGEENS notes are viewable by others when transcribed for intervention notes, and when signed for manually typed (control) notes; for this reason our outcome for notes was signing for typed notes and transcription time for notes created with VGEENS.

Satisfaction with the process of creating notes was measured using a modification of the Canada Health Infoway System And Use Assessment Survey.[7] Sections 1, 2 and 3 covering overall user satisfaction, system quality, and information quality will be adapted for use in this study. The survey will be administered electronically using WebQ survey tools implemented in the University of Washington Catalyst toolkit. A weblink to the survey was sent via email in a format familiar to UW physicians.

Note quality was being measured using the PQRI-9 survey and a single question: "'Please rate the overall quality of this note' with a 5-point Likert scale from 1 ('very poor') to 5 ('excellent')." PQRI-9 scores are being assigned by 4 reviewers. Each note is being separately scored by 2 reviewers. The sum of the PQRI-9 scores and overall score from the reviewers was averaged. Thus, each note had 2 indicators of quality: PQRI-9 and the overall quality score.

Limitations

We limited this study to physicians on the internal medicine in two teaching hospitals for creating inpatient progress notes but not admission notes, procedure notes, discharge summaries and other physician documentation. The VGEENS intervention was developed for this and was enhanced with new features during the period of the study; for this reason, the intervention had more features later in the study than at the beginning. There were few periods of technical difficulty (downtime, note-creation problems) but those that occurred were more common in the first few months of the study than in later months. For this reason, the intervention was improved and more reliable later in the study when fewer notes were created using the enhanced version.

Measurement of note quality is labor intensive and in the judgement of this study investigators is subjective and open to interpretation. We did not systematically measure how frequently copying and pasting of notes occurred though the prevalence of this practice was one of the drivers for this work.

Statistical analysis

Differences between intervention and control groups in note availability delay were compared using a random effects general least squares regression to determine if there was clustering by provider or secular trends. Outcomes were assessed both by an intention-to-treat approach as well by per-protocol use of the VGEENS system.

The University of Washington Institutional Review Board approved this study.

RESULTS

Principal findings

1. Development of application

We successfully developed and deployed our VGEENS application and supporting server application and incorporated it into the workflow of intervention physicians. All cell phone features other than Wi-Fi were disabled and the system was reviewed and approved by the UW Medicine security team. Integration with our commercial inpatient EHR was successfully achieved with very little impact on the EHR and its operation.

Monitoring software and was written to assure that this system was available nearly continuously. Training materials were created, smart phones acquired, and subjects were randomized intervention were instructed on how to use this during hospital rounds.

There were remarkably few problems in using these phones. Occasionally (about 2 or 3 times a month), the software systems have to be restarted. Most of these problems occur early in the trial.

2. Notes written

We solicited subjects using recruitment emails to resident and attending physicians on the Medicine service at UWMC and Harborview. All were internal medicine physicians practicing on

the Medicine service at UW Medical Center or Harborview Medical Center. Forty nine subjects agreed to participate and received informed consent. Of these 49 subjects, 49% percent were randomized to intervention and 51% to the control group. Of these, 31 contributed at least one note during the study period; 58% of those were attendings. The 18 physicians who did not contribute at least one note did not do so because they were not on a medical service rotation in which their responsibilities include writing daily progress notes during the study period or for other reasons.

We excluded from analysis discharge summaries, patients for whom there was a note but no rounding time recorded, and timing data on patients who did not have a progress note written either because the patient was discharged, transferred to another service that day, expired, or because the progress note was written that day by a physician or medical student not participating in this study.

Subjects wrote 1852 inpatient progress notes during the study period. Of these 1143 notes (62%) were written by controls and 709 notes were written by intervention subjects. Most of the notes (86%) were written by attending physicians. Of the notes written by intervention subjects, 70.4% were dictated using the VGEENS application and the remainder were typed, because the VGEENS system was not operating or some technical error occurred, or because the physician elected to type a note rather than dictate using VGEENS.

Outcomes

1. Timeliness of note availability

The 31 subjects recorded rounding timing data on 1850 (99.9%) patient encounters on rounds (Figure 3). The mean time that patients were seen on rounds was 9:58 am (median 9:40 am, earliest 1:30 am, latest 6:20 pm). The median number of minutes between the patient visit on rounds and the availability of a progress note in the EHR for others to view was 190 minutes for the control group (average 228, range 0 - 1149) and 227 minutes for the intervention group (mean 307, range 7 - 1425), an unadjusted difference of 37 minutes longer for intervention compared with control. When adjusting for clustering by provider and secular trends, there was no significant difference between the intervention and control groups in the time between time patients were seen on rounds and when progress notes were viewable by others (95% confidence interval -106.9 to 12.2 minutes).

Among the 499 notes dictated using VGEENS, the median number of minutes between the patient being seen on rounds and the availability of a progress note in the EHR for others to view was 198 minutes (average 238, range 5 - 1420) compared with 350 (average 472, range 7 - 1425) for notes that were typed.

2. Satisfaction with the note writing process

Forty-five of 49 subjects completed the survey, an overall response rate of 91%. We excluded from survey analysis the 18 subjects who consented to the study but did not write at least one note. The response rate for the 31 subjects who completed at least one note was 100%. Among the 13 intervention subjects, 5 (38%) reported they were either highly or moderately satisfied. Among the 18 control subjects, 10 (56%) of subjects rated their satisfaction with note

writing as either highly or modestly satisfied (10). There was no difference between intervention and control for portion highly or moderately satisfied (p=0.35).

Survey comments illuminated subjects' reasons for their reported satisfaction and included suggestions to improve VGEENS. Comments included observation that workflow was changed, that dictating notes between patients while on rounds may delay other work such as calling consultants and that voice recognition errors were bothersome and required editing. There were requests that elements of the note that change less from one day to the next (chief complaint, problem list, key elements of plan) should not have to be dictated anew each day and requests for VGEENS to be available for use to create admission notes and discharge summaries. Some said they did not have prior experience with dictation and so preferred using a keyboard to write notes.

3. Note quality

When taking into account clustering by provider and secular trends, there was no significant difference between the intervention and control groups in the overall assessment of note quality, the sum of all PQRI-9 domains, or any of the individual domains.

Discussion

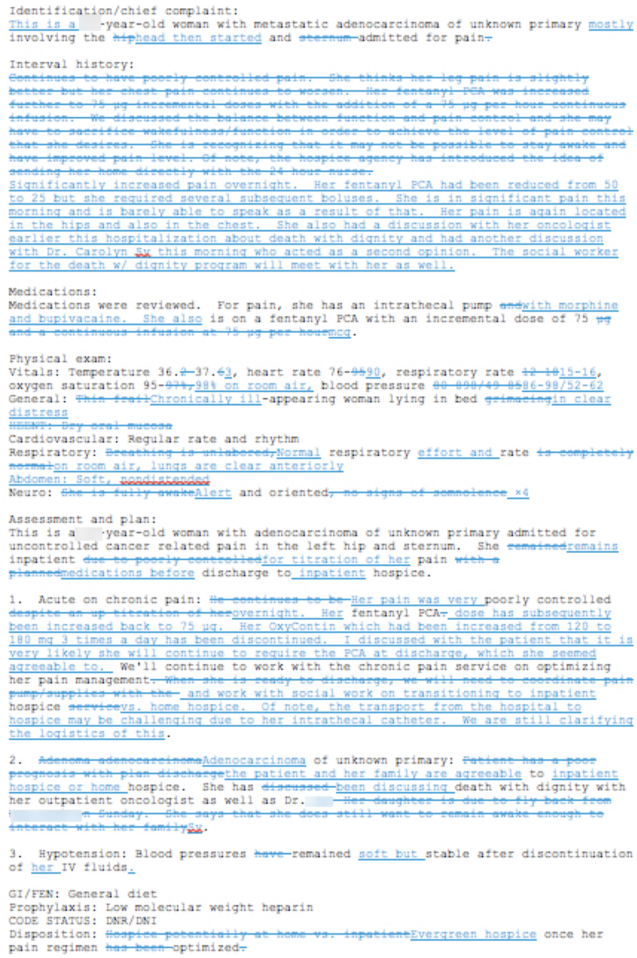
The most important result from this study is that we successfully developed and deployed a simple, portable, open source application to use voice recognition to meet the rapid turnaround and challenging workflow demands of the hospital environment. In addition, our methods to measure note timing provided the data we needed to measure one of our 3 outcomes. When adjusting for covariates, there was no difference in time at which notes were available for others to review. This is an unexpected result, and may be because physicians did not dictate their note at the bedside or immediately after leaving the bedside as we had anticipated. We did not instruct them when to create their notes, but if we had encouraged them to do so soon after seeing each patient then the notes would be available sooner. This could potentially be improved by encouraging and perhaps coaching physicians to create notes during or soon after bedside rounds. This would have the additional benefit that they're less likely to forget details from the history and physical where is if a dictated note hours later some of these details might be forgotten or confused. After the voice file is created, it is available for others to view within 5 minutes.

We also learned that intern and resident physicians were averse to creating notes using VGEENS. When asked why this is, their answers were that they have not had experienced with dictation and are reluctant to learn a new skill during their busy clinical rotations. They also comment that they are very familiar with creating notes using typing, templates and copy paste.

Examination of 2 notes, one from intervention and one from control gives further insight into why control notes were available faster than intervention notes. Below on the left is a VGEENS progress note which is compared to the progress note on the same patient the previous day. On the right is a control note compared to the previous day’s progress note. Blue text indicates new text that day; strikethrough is the text from the previous day that was not present in the current day’s note.

In the VGEENS note the history, physical and most of the assessment are new. In the control note, the physical exam and most of the assessment are unchanged from the previous day.

Note created using VGEENS



Identification/chief complaint:
This is a -year-old woman with metastatic adenocarcinoma of unknown primary mostly involving the ~~hip~~head then started and ~~sternum~~ admitted for pain~~.~~

Interval history:
~~Continues to have poorly controlled pain. She thinks her leg pain is slightly better but her chest pain continues to worsen. Her fentanyl PCA was increased further to 75 µg incremental doses with the addition of a 75 µg per hour continuous infusion. We discussed the balance between function and pain control and she may have to sacrifice wakefulness/function in order to achieve the level of pain control that she desires. She is recognizing that it may not be possible to stay awake and have improved pain level. Of note, the hospice agency has introduced the idea of sending her home directly with the 24 hour nurse.~~
Significantly increased pain overnight. Her fentanyl PCA had been reduced from 50 to 25 but she required several subsequent boluses. She is in significant pain this morning and is barely able to speak as a result of that. Her pain is again located in the hips and also in the chest. She also had a discussion with her oncologist earlier this hospitalization about death with dignity and had another discussion with Dr. Carolyn Sy this morning who acted as a second opinion. The social worker for the death w/ dignity program will meet with her as well.

Medications:
Medications were reviewed. For pain, she has an intrathecal pump ~~and~~with morphine and bupivacaine. She also is on a fentanyl PCA with an incremental dose of 75 ~~µg and a continuous infusion at 75 µg per hour~~mcg.

Physical exam:
Vitals: Temperature 36.~~2~~-37.~~6~~3, heart rate 76-~~95~~90, respiratory rate ~~12-18~~15-16, oxygen saturation 95-~~97%,~~98% on room air, blood pressure ~~88-898/49-85~~86-98/52-62
General: ~~Thin frail~~Chronically ill-appearing woman lying in bed ~~grimacing~~in clear distress
~~HEENT: Dry oral mucosa~~
Cardiovascular: Regular rate and rhythm
Respiratory: ~~Breathing is unlabored,~~Normal respiratory effort and rate ~~is completely normal~~on room air, lungs are clear anteriorly
Abdomen: Soft, nondistended
Neuro: ~~She is fully awake~~Alert and oriented~~, no signs of somnolence~~ x4

Assessment and plan:
This is a -year-old woman with adenocarcinoma of unknown primary admitted for uncontrolled cancer related pain in the left hip and sternum. She ~~remained~~remains inpatient ~~due to poorly controlled~~for titration of her pain ~~with a planned~~medications before discharge to inpatient hospice.

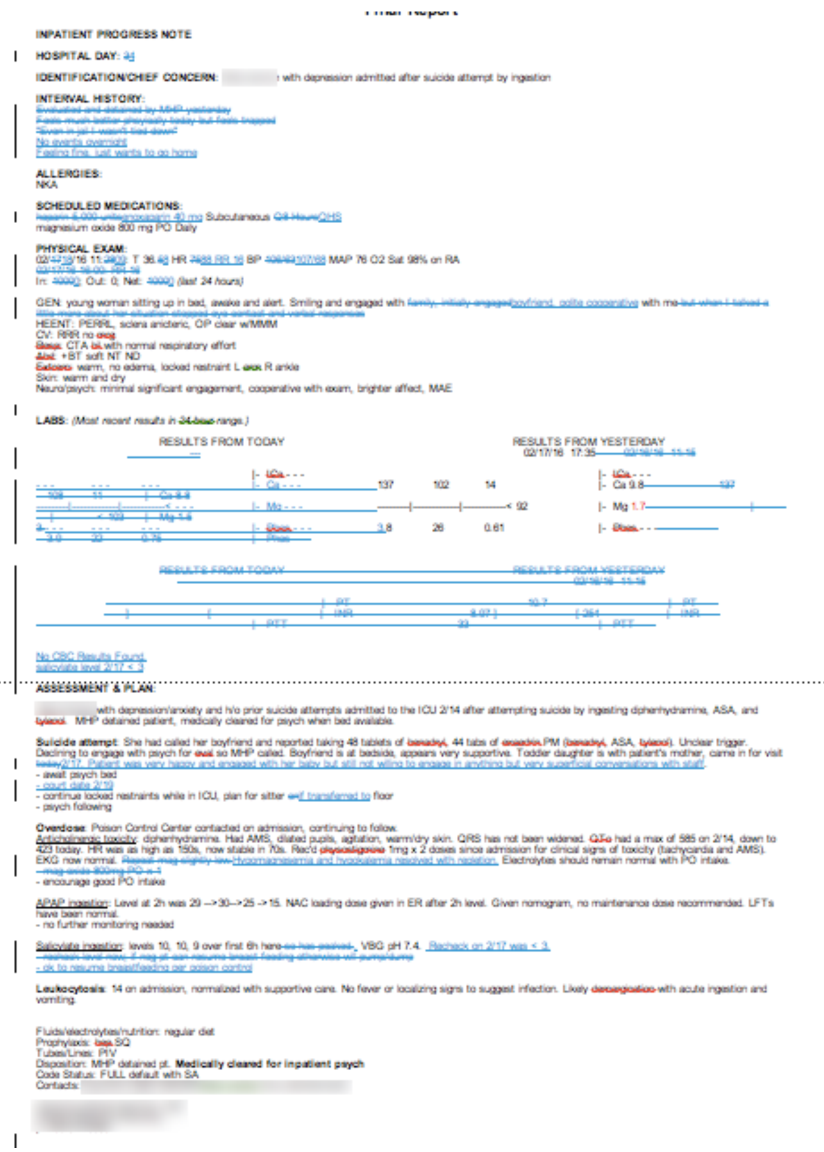
1. Acute on chronic pain: ~~He continues to be~~ Her pain was very poorly controlled ~~despite an up titration of her~~overnight. Her fentanyl PCA~~.~~ dose has subsequently been increased back to 75 µg. Her OxyContin which had been increased from 120 to 180 mg 3 times a day has been discontinued. I discussed with the patient that it is very likely she will continue to require the PCA at discharge, which she seemed agreeable to. We'll continue to work with the chronic pain service on optimizing her pain management~~. When she is ready to discharge, we will need to coordinate pain pump/supplies with the~~ and work with social work on transitioning to inpatient hospice ~~service~~vs. home hospice. Of note, the transport from the hospital to hospice may be challenging due to her intrathecal catheter. We are still clarifying the logistics of this.

2. ~~Adenoma adenocarcinoma~~Adenocarcinoma of unknown primary: ~~Patient has a poor prognosis with plan discharge~~the patient and her family are agreeable to inpatient hospice or home hospice. She has ~~discussed~~ been discussing death with dignity with her outpatient oncologist as well as Dr. ~~Her daughter is due to fly back from~~ ~~n Sunday. She says that she does still want to remain awake enough to interact with her family~~Sy.

3. Hypotension: Blood pressures ~~have~~ remained soft but stable after discontinuation of her IV fluids.

GI/FEN: General diet
Prophylaxis: Low molecular weight heparin
CODE STATUS: DNR/DNI
Disposition: ~~Hospice potentially at home vs. inpatient~~Evergreen hospice once her pain regimen ~~has been~~ optimized~~.~~

Note created using control



INPATIENT PROGRESS NOTE

HOSPITAL DAY:

IDENTIFICATION/CHIEF CONCERN: with depression admitted after suicide attempt by ingestion

INTERVAL HISTORY:
No events overnight
Feeling fine, just wants to go home

ALLERGIES:
NKA

SCHEDULED MEDICATIONS:
Subcutaneous QHS
magnesium oxide 800 mg PO Daily

PHYSICAL EXAM:
T 36. HR BP MAP 76 O2 Sat 98% on RA
In: Out: 0; Net: (last 24 hours)

GEN: young woman sitting up in bed, awake and alert. Smiling and engaged with boyfriend, polite cooperative with me
HEENT: PERRL, sclera anicteric, OP clear w/MMM
CV: RRR no
CTA with normal respiratory effort
+BT soft NT ND
warm, no edema, locked restraint L R ankle
Skin: warm and dry
Neuro/psych: minimal significant engagement, cooperative with exam, brighter affect, MAE

LABS: (Most recent results in range.)

RESULTS FROM TODAY
RESULTS FROM YESTERDAY 02/17/16 17:35

No CBC Results Found.

ASSESSMENT & PLAN:

with depression/anxiety and h/o prior suicide attempts admitted to the ICU 2/14 after attempting suicide by ingesting diphenhydramine, ASA, and . MHP detained patient, medically cleared for psych when bed available.

Suicide attempt: She had called her boyfriend and reported taking 48 tablets of , 44 tabs of PM (, ASA,). Unclear trigger. Declining to engage with psych for so MHP called. Boyfriend is at bedside, appears very supportive. Toddler daughter is with patient's mother, came in for visit 2/17. Patient was very happy and engaged with her baby but still not willing to engage in anything but very superficial conversations with staff.
- await psych bed
- court date 2/19
- continue locked restraints while in ICU, plan for sitter if transferred to floor
- psych following

Overdose: Poison Control Center contacted on admission, continuing to follow.
Anticholinergic toxicity: diphenhydramine. Had AMS, dilated pupils, agitation, warm/dry skin. QRS has not been widened. had a max of 585 on 2/14, down to 423 today. HR was as high as 150s, now stable in 70s. Rec'd 1mg x 2 doses since admission for clinical signs of toxicity (tachycardia and AMS). EKG now normal. Hypomagnesemia and hypokalemia resolved with repletion. Electrolytes should remain normal with PO intake.
- encourage good PO intake

APAP ingestion: Level at 2h was 29 -->30-->25 ->15. NAC loading dose given in ER after 2h level. Given nomogram, no maintenance dose recommended. LFTs have been normal.
- no further monitoring needed

Salicylate ingestion: levels 10, 10, 9 over first 6h here. VBG pH 7.4. Recheck on 2/17 was < 3.
- ok to resume breastfeeding per poison control

Leukocytosis: 14 on admission, normalized with supportive care. No fever or localizing signs to suggest infection. Likely with acute ingestion and vomiting.

Fluids/electrolytes/nutrition: regular diet
Prophylaxis: SQ
Tubes/Lines: PIV
Disposition: MHP detained pt. **Medically cleared for inpatient psych**
Code Status: FULL default with SA
Contacts:

There was no difference in timelines of note availability. Notes are created more rapidly using copying and pasting. It is our impression that this is the case. Though copying and pasting speeds note creation, it may lead to a succession of daily progress notes which are very similar to the note from the previous day, leading the reader to be uncertain as to whether the history, physical and assessment are accurate for that day or instead reflect prior days' observations.

There was no difference between intervention and control for portion highly or moderately satisfied. Comments included in the survey give insight as to why this may be. They include unfamiliarity with use of dictation for progress notes, voice recognition errors, and difficulty in inserting laboratory studies (which became available later in the study period when not available to most intervention participants). VGEENS also requires that any structured plan or 'checklist' information that is often included in progress notes (phone numbers for family, code status, etc.) be manually inserted into the note. Other VGEENS enhancements that became available late in the study were the ability to say "number next" to create a numbered list These and other features can be added to VGEENS but time did not permit us to do so during the period of this study.

Conclusions

We have developed a system to permit physicians to create progress notes in a commercial EHR using voice using a simple approach that fits rounding workflow. Notes created are available in the EHR within 5 minutes. Early results suggest that these voice-generated electronic notes are available in the EHR later after than notes created using the keyboard at a workstation, likely because they were 'dictated' later in the day. We found also that physicians preferred the more familiar method of entering notes, though this may be because time-saving features were not available to most intervention subjects during the time of this trial.

Signficance

Preliminary analysis of a small number of control notes suggests that notes may vary less day-to-day in the control group—that is one day's note is little changed from the previous day's note—and have less similarity when created using VGEENS. If this pattern is confirmed with greater analysis, it could provide evidence that note accuracy may be higher with VGEENS because copying and pasting is not needed to save time if notes are created using voice.

We have more technical enhancements to the VGEENS system underway, and others may follow after detailed outcome analysis and linguistic study of the manual note-editing process to determine if some of this might be automated. This analysis may lead to further improvements in the speed of creating a note using VGEENS, and in its accuracy. Finally, we have not yet leveraged more advanced NLP techniques to correct semantic errors within the note, nor to extract encoded concepts form the narrative text. Work on these system improvements is underway. There are tools available in our EHR to use NLP to extract problem list elements from any note. Perhaps the greatest potential for this work is that we have developed a system to create notes that captures physician thinking as close to rounds as possible; we have the potential to suggest diagnostic and therapeutic interventions based on that thinking in near-real-time rather than the end of the day or later.

We have leveraged a commercial EHR by using mechanisms the EHR vendor provides to extract patient data and to insert notes using the same portal used by transcription services. The latter is available in most EHRs. In the future we might use Fast Healthcare Interoperability

Resources (HL7 FHIR[8]) for the same purposes, making this application more portable across commercial EHRs.

LIST OF PUBLICATIONS AND PRODUCTS

Presentations

"Learning from the Record of Hospital Care. Do Physician Progress Notes Help or Hinder?" Presentation to UW Medicine Center for Scholarship in Patient Safety and Quality Works In Progress Seminar Series, University of Washington, July 5, 2016.

"Improving Accuracy of Electronic Notes Using A Faster, Simpler Approach." Presentation to UW Medicine Center for Scholarship in Patient Safety and Quality Works In Progress Seminar Series, University of Washington, May 5, 2015.

"Improving Electronic Inpatient Progress Notes Using Voice: Results from the VGEENS Project." Payne TH, Markiel JA, Alonso WD, Lordon R, Lybarger K, Yetisgen M, Zech JM, MS, White AA. Presentation at 2017 AMIA Fall Symposium, Washington, DC, November 5, 2017.

"Automatically Detecting Likely Edits in Clinical Notes Created Using Automatic Speech Recognition." Lybarger K, Ostendorf M, Yetisgen M. Presentation at 2017 AMIA Fall Symposium, Washington, DC, November 5, 2017.

"Improving Accuracy of Electronic Notes Using a Faster, Simpler Approach." Presenter in AHRQ's National Web Conference on Improving Health IT Safety through the Use Natural Language Processing to Improve Accuracy of EHR Documentation. February 7, 2017.

Posters

Liu X and Payne T. A study to imitate use of voice software and natural language processing to improve physician documentation." Poster presentation at the Washington Chapter of the American College of Physicians, Seattle, WA, November 6, 2015.

Lordon R and Payne T. Assessing the Delay in Communication Regarding Physician Digital Inpatient Documentation. Poster Presentation – National Library of Medicine Annual Training Conference 2016, June 29, 2016, Columbus, OH.

Manuscripts

Payne TH, David Alonso W, Andrew Markiel J, Lybarger K, White AA. Using voice to create hospital progress notes: description of a mobile application and supporting system integrated with a commercial electronic health record. J Biomed Inform. 2017 Dec 9. pii: S1532-0464(17)30274-5. doi: 10.1016/j.jbi.2017.12.004. [Epub ahead of print] PMID: 29233669

Payne TH, Alonso WD, Markiel JA, Lybarger K, Lordon R, Yetisgen M, Zech JM, White AA. Creating better inpatient progress notes using voice. Submitted for publication.

Lybarger KJ, Ostendorf M, Riskin E, Payne TH, White AA, Yetisgen M. Analysis of Practitioner Editing in Creating Clinical Notes Using Automatic Speech Recognition.

Lee T, White AA, Payne TH. Effects of a portable voice recognition system on hospital medicine professional fee billing. Manuscript in preparation.

PURPOSE

Moving from paper to electronic physician documentation has improved the availability of notes within EHRs, but is also associated with perceived decline in the quality and timeliness of those notes, and with physician time spent on the process of writing them. The purpose of this project is to address these problems with a novel method of creating inpatient progress notes.

SCOPE

Our project seeks to improve daily progress notes written for hospitalized patients on the inpatient medical service in 2 teaching hospitals of the University of Washington.

METHODS

We developed and implemented a new voice-generated enhanced electronic note system integrating voice recognition and transcription with natural language processing and links to the electronic medical record

We then conducted randomized trial to compare note timeliness, quality, and physician satisfaction with the note writing process between physicians using VGEENS in comparison with the usual note writing process.

RESULTS

The voice-generated enhanced electronic note system was successfully developed and implemented. In the randomize controlled trial, control subjects created 1143 notes and intervention subjects 709 notes. When adjusting for clustering by provider and secular trends, there was no significant difference between the intervention and control groups in the time between time patients were seen on rounds and when progress notes were viewable by others (95% confidence interval -106.9 to 12.2 minutes). There were no significant differences in physician satisfaction or note quality between intervention and control.

KEY WORDS

Electronic health records
Physician documentation
Automated speed recognition
Natural language processing

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[1] Cusack CM, Hripcsak G, Bloomrosen M, Rosenbloom ST, Weaver CA, Wright A, Vawdrey DK, Walker J, Mamykina L. The future state of clinical data capture and documentation: a report from AMIA's 2011 Policy Meeting. J Am Med Inform Assoc. 2013 Jan 1;20(1):134-40. doi: 10.1136/amiajnl-2012-001093. Epub 2012 Sep 8. PubMed PMID: 22962195; PubMed Central PMCID: PMC3555335.
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