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Real-time Captioning for Improving Informed Consent: Patient and Physician Benefits

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Abstract

Better methods are needed to improve physicians' skill in communicating information and to enhance patients' ability to recall that information. We evaluated a real-time speech-to-text captioning system to aid hearing-impaired patients that simultaneously provided a speech-to-text record for both patient and anesthesiologist. The goals of the study were to assess patient's recall of an informed consent discussion about regional anesthesia using real-time captioning and to determine whether the physicians found the system useful for monitoring their own performance.

Methods—We recorded two simulated informed consent encounters with hearing-impaired older adults in which physicians provided descriptions of regional anesthetic procedures. The conversations were conducted with and without real-time captioning. Afterwards, the patient-participants, who wore their hearing aids throughout, were tested on the material presented and video recordings of the encounters were analyzed to determine how effectively physicians communicated with and without the captioning system.

Results—The anesthesiology residents provided similar information to the patient-participants regardless of whether the real-time captioning system was used. Although the patients retained relatively few details regardless of the informed consent discussion, they could recall significantly more of the key points when provided with real time captioning.

Conclusions—Real-time speech-to-text captioning improved recall in hearing-impaired patients and proved useful for determining the information provided during an informed consent encounter. Real-time speech-to-text captioning could provide a method for assessing physicians' communication that could be used both for self-assessment and as an evaluative approach to training communication skills in practice settings.

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Introduction

In practice settings, the physician-patient encounter is used to explain, inform and answer questions about the anesthetic management for the surgical procedure.^{1,2,3} Advances in real-time speech-to-text software have reached the point where it could be used to supplement physician-patient communication.⁴ For regional anesthetic procedures, the majority of patients have a limited understanding of regional anesthesia and often require a more detailed description of the technique and information about associated risks.³ Unfortunately, most approaches that have been implemented to improve a patient's comprehension have had limited success in improving the retention of the content of the physician-patient encounter.⁵ The more accurate and rapid conversion of speech to text now possible appears capable of providing real-time captioning for both physician and patient simultaneously, and such captioning could improve the ability of hearing-impaired patients to comprehend and later recall their conversations with physicians.⁴ In addition, captioning might assist physicians in assessing the content of these conversations while they are ongoing as well as creating transcripts that could be useful both for self-assessment and as part of an evaluative approach to training communication skills in practice settings.^{6,7}

Nearly half of all adults in the United States over 50 have significant hearing loss^{8,9} that can lead to problems understanding spoken discourse even under quiet listening conditions.⁹ Like closed captioning on television, speech-to-text devices can be used to improve comprehension of everyday conversations by the hearing impaired. The benefit of real-time captioning in medical settings might be most readily evident in this patient population although additional applications are possible. The purpose of this study was to determine whether real-time captioning can improve patients' recall of their informed decision-making encounters and also to assess whether this approach could be used to help physicians improve their communication both while it is ongoing and through post-assessment analysis of transcripts of their conversations with patients.

Materials and Methods

To evaluate the contribution of real-time captioning to physician-patient communication, we videotaped simulated informed consent encounters between physicians and older adults in which the physicians were asked to provide descriptions of two forms of regional anesthesia used to manage post-operative pain: a brachial plexus nerve block for major shoulder surgery and an epidural for total hip replacement.

Two sets of materials to be covered by the physicians during the informed consent encounters were developed as follows. Faculty experts in regional anesthesia were asked to contribute to and then review lists of information that should be provided in informed consent discussions for the two surgical procedures. The resulting checklists provided the key items that the physicians were to include in informed consent discussions with patient-participants, 12 key items for a brachial plexus block used during shoulder surgery and 13 key items for an epidural procedure typically used during hip replacement surgery, and the physicians were provided with this information at least two days before each session (see

Appendix). In addition, two lists of test questions were developed for the patients based on the items included in the informed consent discussions for each procedure.

Participants

Each of the physicians and patients who agreed to participate in the study provided written consent. Five physicians conducted two patient-participant encounters and two physicians conducted one encounter. The patients were twelve older adults (Mean age = 75.2 years, SD = 7.1), 6 male and 6 female, with impaired hearing who were recruited from the subject pool maintained by Washington University's Volunteers for Health Program. All were experienced hearing aid users with sloping hearing losses (Mean pure-tone-average threshold in the better ear = 54.2 dB HL, SD = 15.6) and wore their hearing aids throughout the informed consent encounters. All patient-participants had normal or corrected-normal near-field visual acuity of 20/40 or better. They were screened for dementia using the MMSE and also screened to ensure that neither they nor their spouses had undergone one of the surgical procedures to be discussed in the informed consent encounters.

Apparatus

The device for providing real-time captioning was assembled using commercially available hardware and software. The physician's voice was transmitted to a Dell tablet PC via a Bluetooth microphone, and speech-to-text transcription was accomplished using Dragon Naturally Speaking© software. The text was displayed using a program written in LabVIEW specifically for this purpose. The PC was positioned on an A-frame stand with the original screen facing the physician and an additional USB-powered screen facing the patient so that both the physician and the patient could see the transcribed text.

Procedure

Recorded Encounters

The physicians completed the speech-familiarization protocol for Dragon Naturally Speaking© and then practiced using the real-time captioning system. In separate encounters, each physician described both the epidural and brachial plexus block procedures, and each patient-participant heard both procedures described. After each informed consent encounter, the patient was asked to recall aloud as much of the information as they could from the encounter, and this free recall portion of the assessment was videotaped for scoring. Recording was then stopped, and the patient was asked to complete the multiple choice portion of the assessment. The duration of the encounter was measured using the videotape, which was also used to determine whether key items had been covered during the encounter. If the encounter had been captioned, the speech-to-text transcript was also used. Both physicians and patients completed questionnaires evaluating each encounter.

Scoring

Before scoring a patient-participant's responses for a particular encounter, the recording of that encounter was examined in order to determine which of the key items the physician had covered. The number of items covered averaged 10.1 (SD = 1.5) out of 12 for the Brachial

Plexus procedure and 12.1 (SD = 1.6) out of 13 for the Epidural. Participants' free recall and multiple-choice scores were both calculated as percentages of the items actually covered by their physician. Recordings were not available for one participant, and thus their responses could not be scored.

Results

Figure 1 illustrates our finding that although captioning did not affect patients' ability to recognize information about the anesthetic procedures when they saw it on a multiple choice test, captioning did improve their ability to actually recall (as opposed to recognize) that information. A 2 (recall vs. multiple choice) $\times$ 2 (with captioning vs. without) repeated measures ANOVA revealed an effect of test type, $F(1, 10) = 134.9$, $p < .001$, and although the main effect of captioning was not significant, there was a significant interaction between test type and captioning, reflecting the fact that captioning affected recall but not recognition, $F(1, 10) = 8.81$, $p = .014$. Indeed, although recall was much poorer than recognition, participants were able to recall nearly half again as many key items from encounters with real-time captioning compared to encounters without captioning.

The physicians appeared more enthusiastic than the patients about captioning and its use in future encounters, giving it average scores of 5.1 (SD = 2.3) and 5.5 (SD = 2.3), respectively, compared to the patients' scores of 4.1 (SD = 1.8) and 3.5 (SD = 2.1) on these post-encounter questionnaire items. Comments by the hearing-impaired individuals on a panel of experts who viewed the recordings suggest patients' ratings may partly reflect their feeling that the physicians did not effectively use captioning to improve patient comprehension. Analysis of speech-to-text transcripts revealed that physicians typically covered all or all but one of the key items (Table 1), but the number of words spoken varied widely, ranging from less than 500 to more than twice that number and suggesting that having transcripts that can provide this information as well as the content of physician-patient encounters could assist physicians in improving their communication skills.

Discussion

Of the numerous investigations of informed consent encounters, few have examined the problems of hearing-impaired elderly patients in such situations.⁶ Our results suggest that, like younger patients in previous studies, they are able to retrieve only a small portion of the information presented by their physicians.^{6,7} Fortunately, however, our results also suggest that hearing-impaired patients' ability to recall such information can benefit substantially from the use of speech-to-text software to provide real time captioning. Although captioning did not affect performance on multiple-choice tests, such tests are less sensitive because for the most part they measure the ability to merely recognize previously presented information.⁸ In contrast, recall tests are more demanding and measure the ability to retrieve this information when it is needed, an ability that is critical for following physicians' recommendations as well as for understanding what is involved in prospective medical procedures and weighing the potential risks against the benefits.⁹

We selected an informed consent discussion of regional anesthesia because, similar to many patients, our elderly hearing-impaired patients had a more limited understanding of regional anesthesia than of the surgical procedure. In clinical settings, the conversation about regional anesthesia frequently occurs in a time-compressed setting. In evaluating the role of a speech-to-text device, we believed that hearing-impaired adults would be most likely to benefit from this technology. Although giving patients the ability to listen to a fast, accurate translation of what their physician is saying (and vice versa) is highly desirable, we believe that real-time captioning also can provide a valuable supplement to the spoken word. This is because the text of a physician's most recent utterance can function as a short-term memory store for patients trying to deal with unfamiliar medical terms and concepts.⁸ Indeed, this function may be part of the reason why hearing-impaired patients benefited significantly from real-time captioning in the current study. In addition to improving physicians' ability to communicate with hearing-impaired patients, real-time captioning may have a wide range of other applications that include improving communication with other patient groups and in other patient-care situations.^{11,13} For example, language translation software has improved to the point where simultaneous translation between speakers of different languages is possible.¹³

The study's limitations include 1) a relatively small sample size of hearing-impaired adults were studied and a limited number of physician-patient encounters were conducted, 2) the study was performed in a simulated environment which had fewer distractions and less extraneous noise than occur in a clinical setting, 3) the patients were hearing-impaired volunteers who may not be typical of patients encountered in clinical settings. The physicians were given instructions on the key points that they were expected to cover in their informed consent discussion and were also able to refer to the 'key point' document during the encounter. While a script might have offered even more standardization, our goal was to determine the role of a speech-to-text device in a conversational setting.

From a physician education perspective, the transcripts automatically produced by speech-to-text software could be used to evaluate residents' encounters with patients and to assist faculty in providing them feedback.¹⁴ One unanticipated insight was the realization that speech-to-text software could be used to encourage the development of reflective learning strategies.^{16,17} That is, the ability of the physician-participants to read what they just said not only enabled them to immediately correct errors in the transcription, it also provided an opportunity for them to think about how they said it and to use that information to guide further communication in the ongoing encounter. Similarly, the ability to examine transcripts created by speech-to-text software could be an invaluable aid to self-evaluation whenever physicians seek to hone their communication skills.

In summary, real-time captioning of physicians' speech, made possible by the increasing availability of digital devices with speech-to-text capabilities, has the potential to improve communication during the informed decision-making process and in physician-patient encounters in general. The use of real-time captioning may also have broader application in medical education as well as in patient-care settings whenever hearing difficulties or language differences limit the ability of physicians to communicate with their patients.

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FIGURE 1.
Patient and physician encounter using the dual screen speech-to-text device.

FIGURE 2.
Multiple choice and free-recall test results following the informed consent encounter.

Table 1

Key items to be discussed by the resident during the informed consent encounter.

Brachial Plexus Block (for shoulder surgery)	Epidural Anesthesia (for hip surgery)
Describe interscalene block	Describe epidural goal: sensory and motor changes
Describe brachial plexus	Describe local anesthetics
Describe regional anesthesia	Describe catheter placement and duration
Describe nerve block	Describe epidural space and nerve roots
Describe local anesthetics	Describe duration of pain relief with single and continuous local anesthesia
Describe ultrasound guidance	Describe potential for urinary catheter
Risk for potential paresthesia during placement	Risks of postdural headache
Breathing and transient diaphragm function	Risks of transient paresthesia during placement
Risk for pneumothorax	Describe catheter removal
Risk for seizure	Describe changes in ambulation
Duration of anesthesia	Describe pain management with catheter
Potential for nerve injury	Describe removal of catheter and pain management following removal
	Potential for nerve injury

Table 2

<u>Condition</u>	<u>Items Covered</u>		<u>Encounter Duration</u>	
	<u>Mean</u>	<u>SD</u>	<u>Mean</u>	<u>SD</u>
With captioning	92	15.4	5.25	1.35
Without captioning	94.6	10.1	5.18	1.57