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Clinical speech to text: Evaluation setting

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Abstract
Failures in information flow from clinical handover are the leading cause of sentinel events in the USA and associated with nearly half of all ad-verse events and over a tenth of preventable adverse events in Australia. Verbal clinical handover provides a good picture of the background clinical history and current state of clinical management of a group of patients cared for by a nurs-ing team. However, all this valuable verbal information is lost after three con-secutive shifts if no notes are taken during handover. When traditional note-taking by hand occurs, less than a third of data is transferred correctly after five shifts. We propose using an automated approach of cascading speech-to-text con-version, standardisation with respect to controlled thesauri, and structuring in accordance with documentation standards. This transcribes verbal handover in-formation into written drafts for subsequent clinical review, editing, and addi-tion to electronic health records. In this paper, we introduce the evaluation setting for this technology devel-opment in a laboratory environment. It ranks a wide range of recording devices used alone or in combination with headsets and lapel microphones based on cli-nicians' preferences and their accuracy in speech-to-text conversion. The sam-ple consists of four student nurses and four experienced academics from diverse clinical specialties and speaking styles. To simulate realistic nursing clinical handovers, twenty handover scenarios have been scripted. The subsequent eval-uation in a clinical environment will address speech-to-text conversion, stand-ardisation, and structuring with the short-listed devices in six hospitals with the sample of thirty authentic handover situations per hospital. To compare recorder-microphone combinations across all participants, pro-fessional-level recording devices are used to record each participant. The re-cordings are then played using professional-level speakers across all recorder-microphone combinations to achieve equivalency in voice input. Statistical ac-curacy in speech-to-text conversion with noise experimentation is used to de-termine the most accurate combination. Two speech-to-text systems are com-pared against transcription by hand. An eighteen-item pre-experimental survey addresses initial perceptions of us-ing the proposed automated approach in clinical settings. This includes partici-pants' opinion on the improvement of clinical handover with the proposed au-tomated approach, their understanding of the related technologies and perceived problems with the clinical application. An eleven-item post-experimental sur-vey examines device usability with reference to the specific experimental de-vices. Each participant is asked to complete both surveys and participate in a one-to-one interview. All participants are videoed using the recording devices and accessing typical device functions to further examine human-device inter-actions for usability assessment. We are seeking additional partners to further develop and evaluate the ap-proach and setting.

Keywords
text, evaluation, speech, setting, clinical

Disciplines
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Clinical Speech to Text

Evaluation Setting

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Abstract. Failures in information flow from clinical handover are the leading cause of sentinel events in the USA and associated with nearly half of all adverse events and over a tenth of preventable adverse events in Australia. Verbal clinical handover provides a good picture of the background clinical history and current state of clinical management of a group of patients cared for by a nursing team. However, all this valuable verbal information is lost after three consecutive shifts if no notes are taken during handover. When traditional note-taking by hand occurs, less than a third of data is transferred correctly after five shifts.

We propose using an automated approach of cascading speech-to-text conversion, standardisation with respect to controlled thesauri, and structuring in accordance with documentation standards. This transcribes verbal handover information into written drafts for subsequent clinical review, editing, and addition to electronic health records.

In this paper, we introduce the evaluation setting for this technology development in a laboratory environment. It ranks a wide range of recording devices used alone or in combination with headsets and lapel microphones based on clinicians' preferences and their accuracy in speech-to-text conversion. The sample consists of four student nurses and four experienced academics from diverse clinical specialties and speaking styles. To simulate realistic nursing clinical handovers, twenty handover scenarios have been scripted. The subsequent evaluation in a clinical environment will address speech-to-text conversion, standardisation, and structuring with the short-listed devices in six hospitals with the sample of thirty authentic handover situations per hospital.

To compare recorder-microphone combinations across all participants, professional-level recording devices are used to record each participant. The recordings are then played using professional-level speakers across all recorder-microphone combinations to achieve equivalency in voice input. Statistical accuracy in speech-to-text conversion with noise experimentation is used to determine the most accurate combination. Two speech-to-text systems are compared against transcription by hand.

An eighteen-item pre-experimental survey addresses initial perceptions of using the proposed automated approach in clinical settings. This includes participants' opinion on the improvement of clinical handover with the proposed automated approach, their understanding of the related technologies and perceived problems with the clinical application. An eleven-item post-experimental survey examines device usability with reference to the specific experimental devices. Each participant is asked to complete both surveys and participate in a one-to-one interview. All participants are videoed using the recording devices and accessing typical device functions to further examine human-device interactions for usability assessment.

We are seeking additional partners to further develop and evaluate the approach and setting.

Keywords: Evaluation; Natural Language Processing; Nursing Informatics; Speech Recognition Software

1 Introduction

Failures in information flow from clinical handover are the leading cause of sentinel events in the USA and associated with nearly half of all adverse events and over a tenth of preventable adverse events in Australia.[1-3] *Verbal clinical handover* provides a good picture of the background clinical history and current state of clinical management of a group of patients cared for by a nursing team. However, all this valuable verbal information is lost after three consecutive shifts if no notes are taken during handover. When traditional note-taking by hand occurs, less than a third of data is transferred correctly after five shifts.[4-5]

We propose using an automated approach of cascading *speech-to-text* conversion, *standardisation* with respect to controlled thesauri, and *structuring* in accordance with documentation standards. This transcribes verbal handover information into written drafts for subsequent clinical review, editing, and addition to electronic health records. We have already demonstrated the suitability of the document structure scientifically and practically by introducing a documentation template to be populated by typing. After its initial pilot testing in six wards, implementation across four major teaching hospitals in Australia is nearing completion.[6-7]

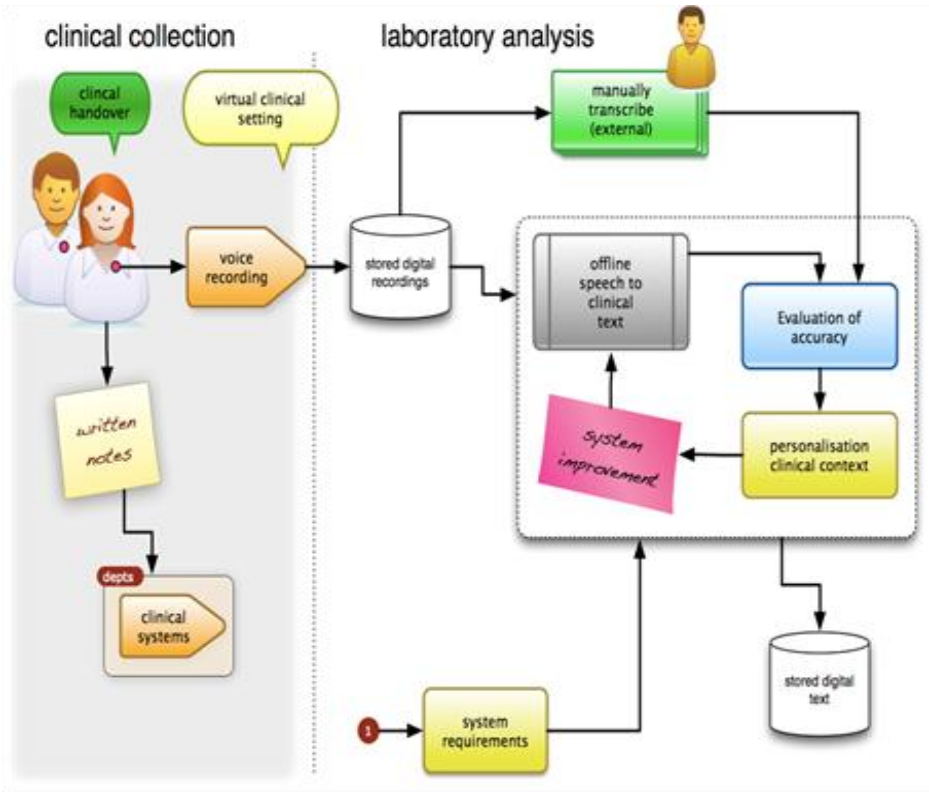

Fig. 1. Laboratory environment for evaluation

In this work-in-progress paper, we introduce the evaluation setting for this technology development in a *laboratory environment* (Figure 1). This setting aims to define hardware to be used in a subsequent evaluation in a clinical environment. It ranks hardware alternatives based on clinicians' preferences and their accuracy in speech-to-text conversion when using fixed software. The subsequent evaluation in a clinical environment will address not only speech-to-text conversion but also the steps of standardisation and structuring.

2 Materials and Methods

A wide range of *recording devices* are considered and compared. These include an MP3 player, medium and high-end voice recorders, smart phones and tablet computers. The devices are used alone or in combination with medium and high-end headsets as well as omnidirectional and noise-cancelling lapel microphones. The *sample* consists of four student nurses and four experienced academics from diverse clinical specialties and speaking styles, including accents and voice qualities. To simulate

realistic nursing clinical handovers, twenty *handover scenarios* have been scripted. Derived from existing clinical handover data, these fictitious and de-identified scenarios reflect the full range of possible handover situations including structured handover, unstructured handover, group presentation and individual presentation. Each handover scenario includes the use of proper English, jargon terms, fragmented language, atypical abbreviations and clinical terminology. In a second phase, the shortlisted 3–5 recording devices are tested in clinical practice with the sample of 180 *authentic handover situations* (i.e., thirty situations in six hospitals). We have chosen this two-phase approach to minimize the evaluation bias caused by the burden of wearing multiple devices in clinical practice when compared with the final goal of having one device only.

3 Results and Discussion

Evaluation of accuracy: To enable systematic comparison of recorder-microphone combinations across all participants, professional-level recording devices are used to record each participant. The recordings are subsequently replayed using professional-level speakers across all recorder-microphone combinations to achieve equivalency in voice input. Statistical accuracy in speech-to-text conversion is used to determine the most accurate combination. This use of pre-recorded sound files also enables systematic manipulation and experimentation of a wide range of noise levels and types (e.g., ambient, intrusive, continuous, intermittent, and other people in group presentation). Minimally two speech-to-text systems are compared against transcription by hand.

Personalisation to clinical context: An eighteen-item pre-experimental survey addresses initial perceptions of using the proposed automated approach in clinical settings, prior to the introduction of experimental recording devices. This includes participants' opinion on the improvement of clinical handover with the proposed automated approach, their understanding of the related technologies and perceived problems with the clinical application. In addition to assessing the perceived benefits and problems of recording devices, an eleven-item post-experimental survey examines device usability with reference to the specific experimental devices. Each participant is asked to complete both surveys and participate in a one-to-one interview or focus group discussion. Our survey templates are available at `http://bit.ly/JB0yHR`.

4 Conclusion

We are seeking additional *partners* to further develop and evaluate the approach and setting in order to gain understanding across specialties, jargons, genres, and languages.

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References

1. Joint Commission on Accreditation of Healthcare Organisations: *Health Care at the Crossroads: Strategies for Improving the Medical Liability System and Preventing Patient Injury*, 2005, http://bit.ly/KJ8ylN.
2. Australian Commission on Safety and Quality in Health Care: *Windows into Safety and Quality in Health Care 2008*, 2008, http://bit.ly/JwlxXz.
3. Australian Commission on Safety and Quality in Health Care: *The OSSIE Guide to Clinical Handover Improvement*, 2009, http://bit.ly/JWZ5vb.
4. Pothier D, Monteiro P, Mooktiar M, Shaw A: Pilot study to show the loss of important data in nursing handover. *Br J Nurs.* 2005;14(20):1090-3.
5. Matic J, Davidson PM, Salamonson Y: Review: bringing patient safety to the forefront through structured computerisation during clinical handover. *J Clin Nurs.* 2011;20(1-2):184-9
6. Johnson M, Jefferies D, Nicholls D: Exploring the structure and content of nursing clinical handovers. *Int J Nurs Pract.* 2012, in press.
7. Johnson M, Jefferies D, Nicholls D: Developing and testing a minimum data set for electronic handover in nursing. *J Clin Nurs.* 2012;21(3-4):3331-43.