Improving Patient Experience Feedback Collection for Healthcare Providers through Human-centered Chatbot Application

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Patient experience is one of the important factors to determine the clinical outcomes of healthcare providers. Yet the healthcare providers are lacking ways to efficiently glean patients' experiences and feedback. To understand healthcare providers' needs and challenges when working on patient experience feedback and to explore ways chatbots could be used to improve patient experience feedback collection, I proposed a study design, which will conduct interviews with the patient experience team staff members at United Health Services (UHS) and questionnaires with patients. Thematic analysis will be conducted to analyze qualitative data collected from interviews and questionnaires. Moreover, this study will utilize statistical analysis methods, including ANOVA test, to understand metric measurements and human-chatbot interaction performance. Based on thematic analysis of this data, I will further propose a human-centered chatbot design pre-trained with the current patient experience survey questions and constructed by a natural language processing framework for chatbots, such as Google's BERT and OpenAI's GPT. The proposed human-centered chatbot approach has the potential to help healthcare providers to understand patient experience feedback comprehensively. In the future stage, the proposed AI chatbot will be put into hospital settings for widespread use.

CCS CONCEPTS • Health informatics • Human-centered computing • Human-computer interaction

Additional Keywords and Phrases: AI Chatbot, Deep Learning, Natural Language Processing, Patient Experience

1 BACKGROUND

Patient-centered care has emerged as a major area of study in the field of healthcare, with a focus on comprehending and enhancing patient experiences (Khanbhai et al., 2019). Over the past decade healthcare providers have poured significant efforts into improving patient experience, as patient experience is positively associated with clinical effectiveness and patient safety (Doyle et al., 2013) as well as better clinical outcomes (Manary et al., 2013).

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Patient experience can be improved through many aspects. Adhikary et al. (2022) found that room cleanliness was the strongest factor to influence a patient's overall satisfaction in the hospital environment. A study by Le et al. (2020) found that reducing wait time using electronic sign-in and notification in the phlebotomy clinic helped to improve patient experience. Sodexo healthcare (2022) proposed that patient experience can be improved through three main aspects: 1) clinical services, 2) facilities management and estates, and 3) administration – with many sub-aspects within each – as shown in Figure 1. Given the complexities and variability in different clinical contexts, a simple patient experience survey cannot capture all the aspects that contribute to a patients' overall experience. By providing the tools and techniques to analyze huge datasets of patient feedback and outcomes, data science and artificial intelligence present an efficient way to understand patients' needs and feedback during the healthcare services (Sajid et al., 2021).

Figure 1: Patient experience category wheel.

To conduct effective communication with patients, past work has proposed chatbot should have skills similar to those of healthcare staffs, who can ask specific questions to better understand patients' need and feedback (Athota et al., 2020) and meet patients' social needs (Kocielnik et al., 2019). Active listening has shown the advantages of giving human-like responses (Xiao et al., 2020). Natural language processing techniques, such as Python NLTK, lexical analysis, syntactic analysis, etc., have been applied to construct human-like chatbot (Regin et al., 2022).

The proposed study aims to (1) understand the healthcare providers' needs and challenges with collecting patient experience feedback; (2) develop a chatbot that could improve patient experience feedback collection; and (3) explore ways to facilitates caring support for patients as they interact with chatbots to improve patient experience. In the following sections, the proposed study design, the chatbot development, as well as the expected contributions of this work are described.

2 PROPOSED STUDY DESIGN

Three studies are designed to conduct human-centered chatbot development for patient experience collection, as shown in Figure 2. Study I will investigate the methods healthcare service providers currently use to glean patient experiences and feedback as well as any challenges they experience with these methods. A needs assessment will be conducted to understand the current circumstances of the commonly used patient experience survey through interviews with patient experience team staff members at UHS. The insights obtained from study I will provide meaningful guidance to develop the proposed chatbot. The whole interview for each staff member will be audio/video recorded and transcribed. Thematic analysis will be applied to find out the important theme in interviewees' individual stories and common themes across interviews.

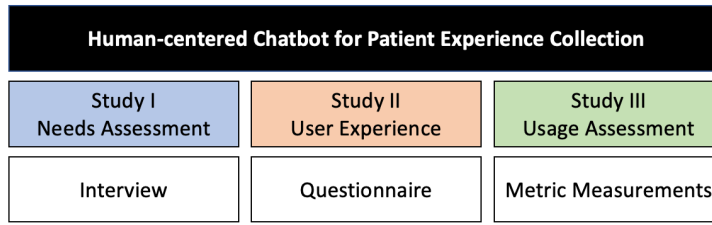| Human-centered Chatbot for Patient Experience Collection		
Study I Needs Assessment	Study II User Experience	Study III Usage Assessment
Interview	Questionnaire	Metric Measurements

Figure 2: Proposed studies.

Study II will be a between-subject study to compare the questionnaire results between the proposed patient experience collection chatbot and the regular patient experience feedback survey. The questionnaire will collect patients' opinions on various evaluation metrics (Lee et al., 2021), as presented in Table 1, and ask the user to rate for each question on a 7-point scale based on their opinions. ANOVA test will be implemented to analyze the questionnaire results quantitatively.

Table 1: Evaluation metrics.

Evaluation metrics	Content
Usefulness	"[Condition X] is useful to report your patient experience feedback."
Richness	"[Condition X] can help me communicate well for my extra request."
Trust	"I can trust to give my real patient experience feedback through [Condition X]."
Effort	"How hard did you have to work to use [Condition X] to give your patient experience feedback."
Frustration	"How bored, discouraged, and stressed were you when using the [Condition X]?"
Usage Intention	"I would use the [Condition X] to give my patient experience feedback."

Study III will be usage assessment to evaluate user-chatbot interaction quantitatively through the defined metric measurements (Xiao et al., 2020). Engagement duration, response length, response information richness, and response quality will be calculated for each user participant.

3 CHATBOT DEVELOPMENT

A patient experience collection chatbot, as a virtual assistant, will be developed and pre-trained with the real patient experience survey questions and answers, so that to be able to ask related questions. Figure 3 shows a concept example of the chatbot that this study will generate. A language model will be applied, such as Google's BERT and OpenAI's GPT

with multidisciplinary functionalities and billions of parameters, which can help chatbots understand human language and give human response in the conversations.
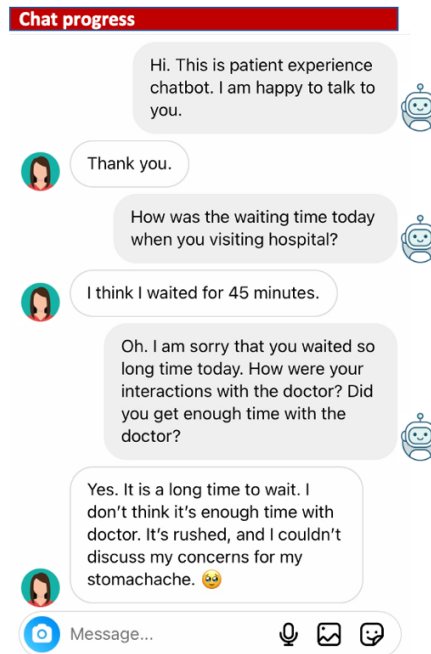

Figure 3: The designed chatbot for patient experience collection.

Patient responses related to a question of patient experience survey will be used as training data for building topic-specific classification models. To identify the patient's intents in conversation, this study will first identify the intents conveyed by training data. Latent Dirichlet Allocation (LDA) model will then be applied for this process to label the data (David et al., 2003). Our team members will evaluate the label results from the LDA model.

4 EXPECTED CONTRIBUTIONS

Different from the regular patient experience survey, the proposed AI chatbot can fulfill a customized patient experience feedback collection by directing the patient to answer the most related questions on the circumstances, for which he/she wants to provide feedback. The proposed AI chatbot can generate patient feedback reports on the back-end side based on question categories and send them to the specific persons in charge (i.e., department leader and physician). Furthermore, the proposed AI chatbot can help patients with language barriers give their feedback easily in their preferred language by switching the language mode of the proposed AI chatbot. The proposed AI chatbot will make patient feedback collection more efficient and help healthcare providers to understand patients' feedback comprehensively. In the future stage, this study will continue to investigate and evaluate how the proposed AI chatbot can assist hospital administration to improve the understanding of patient experience by putting into a wide range of practical applications, such as equipping our proposed AI chatbot into the official website/mobile app of the hospitals.

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