Development of Artificial Intelligence Hearing Aid Chatbot 'Smile Snail'

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Introduction

- The combination of **audiology and artificial intelligence** (AI) technology such as **chatbot** is considered as a **powerful solution** to overcome the **challenges faced by individuals with hearing loss.**
- Hearing aid counseling chatbots are designed to **connect the gap** between **patients and hearing healthcare professionals,** providing immediate access to **information, guidance, and recommendations for hearing aids** (Swanepoelet al., 2023).
- **Development** and **fine-tune** of chatbots for specialized medical applications represents a **technological innovation** in the healthcare field (Stephens et al., 2023; Fournier-Tombs & McHardy, 2023; Montastruc et al., 2023).
- AI chatbot could **adapt and learn** from each **interaction between system and user**, continuously improving their ability to address the **diverse needs of patients with hearing loss** (Or et al., 2023).
- Unfortunately, **there is no hearing aid-specific AI chatbot** to provide wide range of issues and **personal problem related to the hearing aid.**
- This paper presents the **process of development, customization, and deployment** of our chatbot, namely '**Smile Snail**', which is designed to duplicate the knowledge and/or expertise of hearing healthcare professionals.
- Smile Snail offers **real-time responses** to queries, suggests appropriate hearing aid solutions, and provides valuable insights into the unique needs of patients.

Results

Accuracy

- The results of experts demonstrated that the distribution of accuracy was significantly differ from ChatGPT and Smile Snail ($2 = 420$, $p < 0.0001$). **The experts in hearing aid** reported that the **Smile Snail was responded more accurately** than ChatGPT in terms of questions related to the hearing aids (see Figure 3).

Preference

- The results of chi-square test showed that there was **significantly different distribution of preference between AI chatbots** ($\chi 2 = 148.59$, $p < 0.0001$).
- That is, **hearing aids users and their guardians** reported that the answer of **Smile Snail was more preferred** than ChatGPT (see Figure 4).

Figure 1. Overview of development, customization, and deployment of Smile Snail.

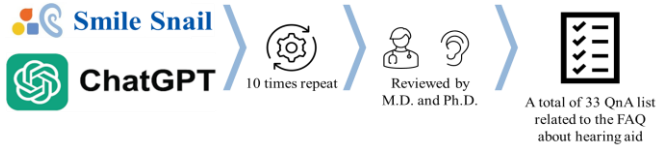

Figure 2. Experimental procedure.

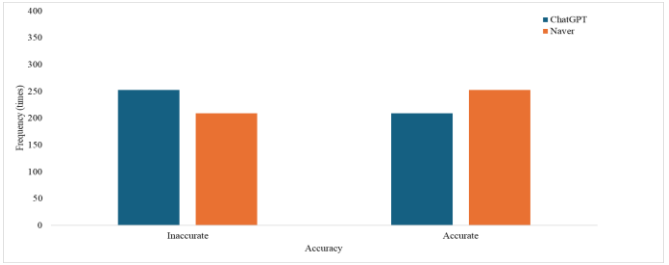

Figure 3. Distribution of accuracy for three different chatbots

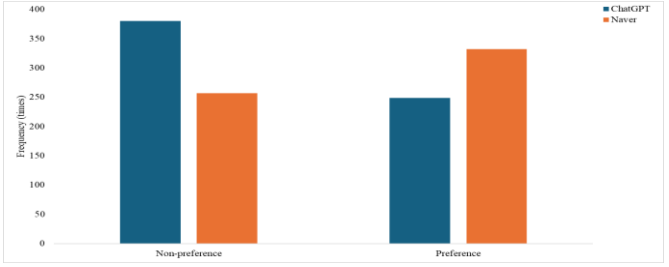

Figure 4. Distribution of preference for three different chatbots

Conclusion

- A customized hearing aids consultation chatbot represents an innovative approach to democratizing hearing healthcare information. Future work aims to expand the chatbot's capabilities, improve natural language understanding, and to foster collaboration between chatbots and human audiologists for more holistic patient care.

Method & Materials

Data collection

- To speculate the frequently asked questions (FAQ) of hearing aids user and/or potential user of hearing aids, the text-based information was gathered through the publicly accessible data in major manufacturers of hearing aid such as Beltone, Oticon, Philips, Phonak, Resound, Rexton, Signia, Starkey, Unitron, Widex.
- That is, a total of 990 answers (33 questions * 3 chatbots * repeated 10 times) were gathered. The gathered answers were screened by the authors to select most accurate and prevalent answer.
- Through this process, the final QnA (question and answer) list of 33 pairs were provided to the experts, patients with hearing loss, and guardians for evaluation.

Procedures

- All procedures for the present study were approved by the Institutional Review Board of the Wonju Severance Christian Hospital (approval number #CR323068).
- For the expert evaluations and patient preferences, 14 experts in the field of otology and audiology, 16 hearing loss patients, and 10 guardians participated. Statistical methods such as **Chi-square test was applied.**
- Two AI chatbots, including ChatGPT, generated answers for 33 questions repeated 10 times each. After review of repeated answers, **final QnA list was used to accuracy and preference analysis**.