# Utility of a Novel Mobile Lip-Reading Application for Patients After Total Laryngectomy

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## INTRODUCTION

- Total laryngectomy (TL), or complete removal of the voice box, remains an important treatment option for patients who present with locally advanced laryngeal cancer[1]

- The loss of natural voice from TL can worsen a patient's quality of life and lead to significant psychosocial discomfort.[2] It is estimated that 22-30% of laryngectomy patients experience depression and anxiety[3,4] and 40% withdraw socially.[5]

- Methods for voice rehabilitation following TL include esophageal speech, tracheoesophageal speech, and electrolaryngeal speech.

- Voice rehabilitation options are not available immediately following TL as they require either sufficient healing or a significant learning curve until intelligible speech is obtained. **In summary, there is an urgent need for novel mechanisms of communication in the postoperative TL patient.**

- The Speech Recognition App for the Voice Impaired (SRAVI) developed by Liopa (Lancashire, UK). Figure 1 shows the app's workflow and Figure 2 shows the user interface

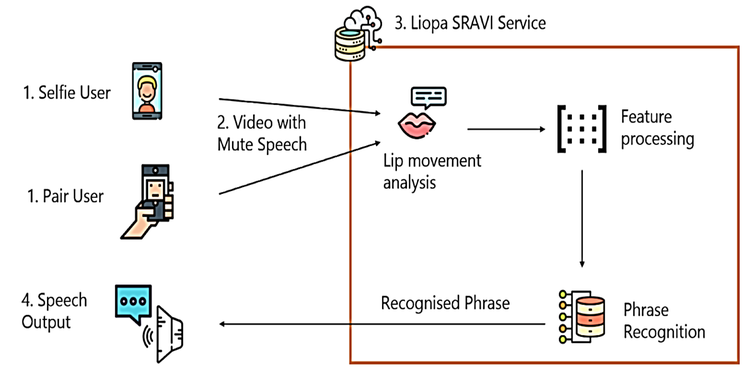


**Figure 1:** SRAVI workflow

## AIMS and HYPOTHESIS

- **Aim 1: Determine the Rank 1 accuracy and total recognition accuracy of SRAVI in the postoperative TL patient.** We hypothesize that Rank 1 accuracy and total recognition accuracy of SRAVI will exceed 80% and 90% respectively based on prior data in tracheotomized ICU patients (86%).

- **Aim 2: Investigate the potential benefit of SRAVI on postoperative care and communication of total laryngectomy patients.** We hypothesize that a majority of patients will prefer SRAVI over written communication

## METHODS

- English-speaking and literate patients scheduled to receive a total laryngectomy starting October 2022 at VUMC
- Informed consent was obtained on postoperative day 1.
- At the conclusion of their inpatient stay, patients were surveyed using the following surveys (calculating mean and standard deviation):
  - a modified version of the 35-item Self-Evaluation of Communication Experiences After Laryngectomy (SECEL) questionnaire
  - SRAVI experience survey
  - Ease of Communication Scale questionnaire (10-question scale out of 40).

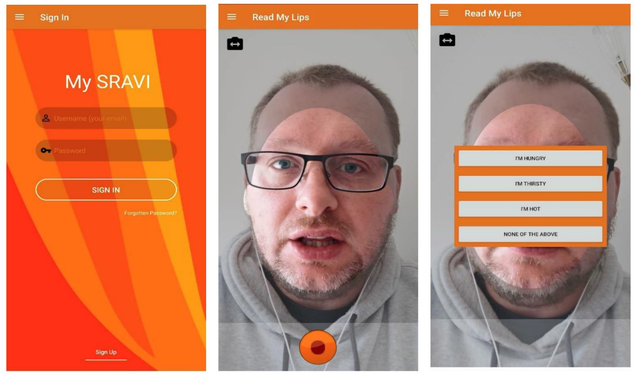


**Figure 2:** User interface in the SRAVI app

## RESULTS

- 10 patients were enrolled (one withdrew due to difficulty coping with surgery)

- Mean (SD) age was 64.2 (5.9) with 6 male and 4 female patients

**Table 1:** Summary of Accuracy data for all Patients

| | |
|---|---|
| Total Valid Transactions | 285 |
| Accurate on 1st Response | 120 |
| Rank-1 Accuracy | 42% |
| Total Accuracy | 70% |

**Table 2:** Accuracy data broken down by patient

| Patient ID number | Number of Eligible Samples | Recognition Accuracy |
|---|---|---|
| 1 | 7 | 100% |
| 2 | 49 | 55% |
| 3 | 37 | 78% |
| 4 | 29 | 45% |
| 5 | 73 | 67% |
| 6 | 68 | 80% |
| 7 | 1 | 100% |
| 8 | 10 | 90% |
| 9 | 11 | 82% |

## RESULTS CON'T

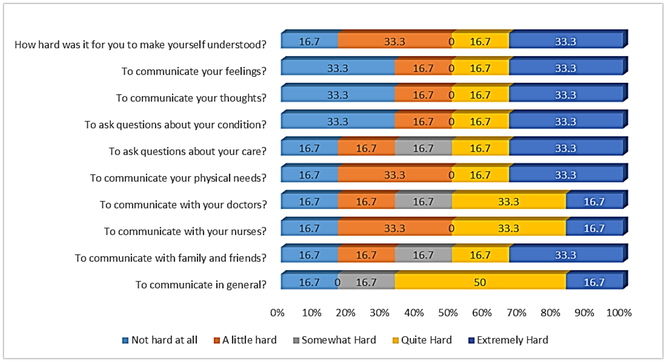


**Figure 3:** Ease of Communication survey results broken down by question, demonstrating communication challenges faced by TL patients

**Table 3:** Patient-reported experience with SRAVI

| | Subject Number | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| How helpful do you find SRAVI (1-10)? | 10 | 10 | 8 | 8 | 10 | 10 | 10 | 10 | 6 |
| How easy do you find SRAVI to use (1-10)? | 10 | 10 | 8 | 8 | 10 | 10 | 8 | 10 | 7 |
| How strongly do you prefer SRAVI over written communication (1-10)? | 10 | 10 | 4 | 5 | 10 | 10 | 6 | 9 | 5 |
| Using SRAVI positively impacted your experience (1-10)? | 10 | 10 | 5 | 5 | 10 | 10 | 6 | 8 | 5 |

## DISCUSSION

- Patients enjoyed using SRAVI and a majority preferred SRAVI over written communication
- Data shows a lower overall accuracy of 70% when compared to prior validation studies of 86% (however, prior studies involved providers using the app with the patients rather than giving patients full autonomy).
- Improvements made to the app: larger "record" button, a "try again" option, and the option to manually select the phrase you were trying to say after two incorrect attempts (manual validation).
- **Limitations:** incomplete patient accrual (target: 20 patients) and lack of control group as this is an initial feasibility study
- **Future directions:** continued accrual, multi-institutional expansion to Augusta Medical Center, impact of the application on quality of life/social isolation, working with Liopa on voice-banking integration, and a future randomized controlled study

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## REFERENCES

1. Network NCC. Head and Neck Cancers Version 1.2022. https://www.nccn.org/professionals/physician_gls/pdf/head-and-neck.pdf. Accessed January 26, 2022.
2. Babin E, Beynier D, Le Gall D, Hitier M. Psychosocial quality of life in patients after total laryngectomy. Rev Laryngol Otol Rhinol (Bord). 2009;130(1):29-34.
3. Keszte J, Danker H, Dietz A, et al. Mental disorders and psychosocial support during the first year after total laryngectomy: a prospective cohort study. Clin Otolaryngol. 2013;38(6):494- 501.
4. Perry A, Casey E, Cotton S. Quality of life after total laryngectomy: functioning, psychological well-being and self-efficacy. Int J Lang Commun Disord. 2015;50(4):467-475.
5. Danker H, Wollbruck D, Singer S, Fuchs M, Brahler E, Meyer A. Social withdrawal after laryngectomy. Eur Arch Otorhinolaryngol. 2010;267(4):593-600.