

# Monitoring Chronic Cough in Patients at Night: A Pilot Study on Smartphone App Usability

Lauren J. Humpert B.S.,<sup>1</sup> Brittany N. Fletcher M.S., CCC-SLP,<sup>1</sup> Aaron D. Friedman, M.D.,<sup>1</sup> Sudip Vhaduri Ph.D.,<sup>2</sup> & Victoria S. McKenna Ph.D., CCC-SLP<sup>1</sup>

<sup>1</sup> University of Cincinnati, Cincinnati OH; <sup>2</sup> Purdue University, West Lafayette, IN

## Motivation

Chronic cough is a common clinical problem that affects approximately 5% of individuals in the United States [1]; however, there are few objective measurements that assess the frequency and severity of the cough to help track progress.

## Aim

- (1) To gather audio data to assist in future acoustic cough detection algorithm development
- (2) Assess the participants' perceptions of using the app at home



**The long-term goal of our work is to develop a phone app that will monitor a person's cough at home.**

## Methods

### Participants

- Five English speaking adults (4 cisgender female, 1 cisgender male, M= 59.8 years, SD = 12.4) enrolled in the study.
- Participants had a diagnosis of chronic cough for at least 8 weeks that impacted their sleep at night.

**Protocol:** Participants completed two study sessions.

- **Session 1:** demographic information was collected including medical information on their cough and sleep. Secondly, the Leicester Cough Questionnaire, a likert-scale questionnaire assessing the impact of a cough on various aspects of one's life, was given [2]. Lastly, participants were trained how to use a recording app on their mobile device and shown how to log their sleep through a template that was provided for them.
- **Session 2:** data on the comfortability and usability of the app were collected. The sleep recordings were extracted directly from the participant's phone and transferred to our secure research database.
- Between study sessions, participants recorded their sleep at home for up to five nights on their personal smartphones.

Fig. 1: Example of an acoustic cough waveform.



## Results



Average comfortability/usability score:  
**Session 1: 4.32**  
**Session 2: 4.96**  
(5-pt Likert scale)



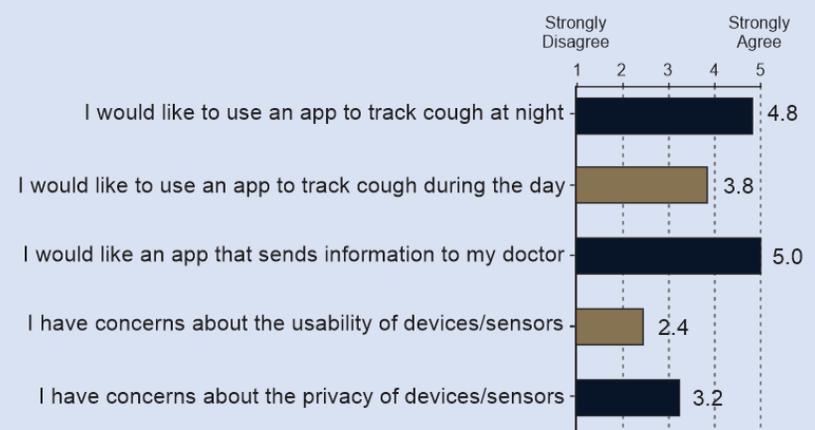
Average of **6.7** hours of sleep, with **1.9 (range = 0-3)** wakeful cough events per night



Average Leicester score of **10.7**, (range = 8.1-16.9) indicating a negative impact on daily life [3]

Fig. 2:

Average Likert ratings on opinions and concerns for future app development.



## Discussion and Future Directions

- Apps are a feasible way to provide quantitative data on chronic cough while asleep.
- A comparison between self-reported cough events and algorithmic detected coughs is needed to determine the accuracy of patient reports.
- More information is needed on how to protect privacy when using recording apps during the day.

## References and Acknowledgements

- [1] Meltzer, E., O., et. al (2021). Prevalence and burden of chronic cough in the United States. *The Journal of Allergy and Clinical Immunology: In Practice*, 9(11), 4037-4044.  
[2] Birring, S. (2003). Development of a symptom specific health status measure for patients with chronic cough: Leicester cough questionnaire (LCQ). *Thorax*, 58(4), 339-343.  
[3] Reynolds, J., Jette, M., Sundar, K., Gillespie, A., & Slovarp, L. (2022). Normative Values for the Leicester Cough Questionnaire in Healthy Individuals. *Annals of Otolaryngology, Rhinology & Laryngology*, in press.

Thank you for the College of Allied Health Sciences at the University of Cincinnati for their support of this research project.