Differentiating Cough Origins in Non-Contact AI Monitoring: Analyzing 'Non-User Coughs' with the Hyfe CoughMonitor Smartwatch

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Rationale

The Hyfe CoughMonitor Suite allows for continuous, non-intrusive acoustic cough monitoring that can last for months. This allows the interpretation of longitudinal signals providing important insights for clinicians, researchers, drug developers and regulators. There were however concerns that coughs from non-user bystanders may contaminate the acoustic environment and skew the estimated cough rates.

Methods

A group of non-coughing healthy volunteers were asked to wear a Hyfe CoughMonitor watch (Figure 1) during their daily routines. Participants were instructed to precisely record any instances of their own coughing across various sound environments should this occur. Properly detected coughs emanating from the user were removed from analysis, and the remaining detections of non-user coughs were quantified.

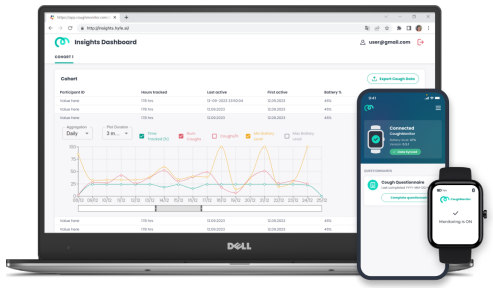

Figure 1. Hyfe CoughMonitor Suite used in the study
CoughMonitor watch was worn by healthy non-coughing individuals. It monitored their everyday environments in a fully privacy-preserving manner, with no internet connection required. The smartwatch synced the data with a companion app on their smartphones via Bluetooth. The data was then uploaded to the cloud.

Results

We analysed 223 hours (almost 10 days) of monitoring submitted by non-coughing volunteers across ten different everyday environments. Acoustic contamination by non-participant coughs ranged from 0 coughs per hour in a restaurant/bar outdoors to 1.04 coughs per hour in a dense, indoor space (symposium) and the same rate for periods of grocery shopping (Figure 2).

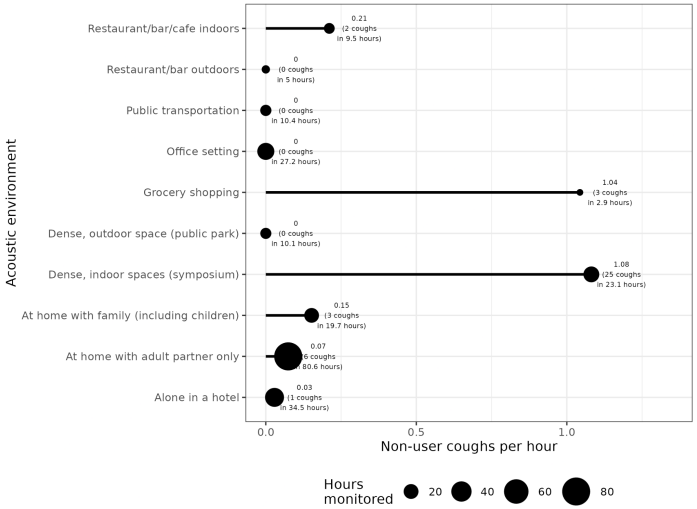

Figure 2. Acoustic contamination by non-user coughs across different everyday environments

Real World Scenarios

Scenario 1 - office worker with a family
Spends 8 hours sleeping at home with their partner, 8 hours in the office, 1 hour grocery shopping, 1 hour on public transportation, 1 hour in a restaurant, and 5 hours at home with family.
They pick up 2.6 coughs from others in 24 hours.

Scenario 2 - business traveler
Spends 7 hours sleeping at home with their partner, 5 hours on public transportation, 1 hour in a restaurant indoors, 1 hour in a bar outdoors, 5 hours at a symposium, 2 hours at home with family, and 3 hours alone in a hotel.
They pick up 4.61 coughs from others in 24 hours.

Take-Home Points

This pilot work clarifies a methodology for quantifying this phenomenon and provides preliminary evidence that non-user coughs have a negligible effect on the cough estimates of the Hyfe CoughMonitor Watch in real-world settings.

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