

Feasibility Of Using Smartwatches And Smartphones To Monitor Patients With COPD

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Background

Acute exacerbations of COPD decrease patients' quality of life, accelerate decline in lung function and are associated with significant mortality. These outcomes may be avoided with early detection and treatment. Detection of patient physiologic signs such as heart rate, activity, wheeze and cough could occur through mobile and wearable devices, such as smartphones and smartwatches. We aimed to develop a mobile sensing device that detects early exacerbations of COPD. The current study was conducted to determine the feasibility to obtain consistent, useful physiologic data from smartwatches and smartphones used by older, sicker COPD patients who would need to keep them charged and functioning.

Methods

Hospitalized patients with acute exacerbations of COPD were recruited from University Health Network, Toronto, Canada. They were asked to use an application developed to sense and record physiologic signs on Android smartwatches while in hospital. Signs included heart rate, step count, raw acceleration measurements as an indication of physical activity, and audio recordings to detect cough, breathlessness and wheezing. Data was relayed to paired smartphones for storage. In order to capture clear audio signals such as coughing, wheezing, or breathlessness, audio recordings did not have any filtering or elimination of speech. Smartphones were also used to administer daily questionnaires to patients about their COPD symptoms. Other than answering this questionnaire, the application was designed to require minimal patient interaction.

Results

Of ten hospitalized patients approached, one has been recruited to date for a total of two days of recordings. The most common reason for not participating was concern about recorded conversations. The smartwatch was worn and both devices were charged appropriately. We were able to obtain 5h:10m of audio recording, heart rate (mean 83.3 beats/min, range 46-142), accelerometer data, and step count (168 steps/day) from the patient. Heart rate was sampled at 7.8 recordings per minute. Symptom questionnaires were completed for both days.

Conclusion

Using a smartphone and smartwatch to record physiologic and audio data in hospitalized patients with acute exacerbations of COPD appears feasible. Future work should include continued patient enrolment as well as analysis of sounds to detect coughing, wheezing and breathlessness. The latter analysis will allow us to develop software so that conversations can be muffled making the device more acceptable to patients. Finally, correlation of sensing data to daily symptoms will be performed to determine if we can identify early acute exacerbations of COPD.

Figure 1: COPD mobile sensing application



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