

Surveillance of pulmonary involvement in infectious and acute on chronic cardiopulmonary diseases using remote patient monitoring: Illustrative cases of the use of lung sound monitoring in telemedicine

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Description:

Acute pulmonary involvement of infectious and chronic diseases such as COPD and heart failure leads to significant morbidity and mortality. Remote patient monitoring (RPM) of lung sounds offers a telehealth solution for early recognition of signs and symptoms to enable timely interventions and avoid costly hospital admissions.

Abstract:

We herein described three cases in which remote patient monitoring via the RESP® Biosensor (see figure 1) was used. Cases are drawn from observational studies in three different patient populations:

(1) 30 patients hospitalized for asthma, COPD, or Covid-19 who wore the RESP Biosensor during hospitalization and in the immediate post-discharge period (*clinical trial with Einstein Health Network, Philadelphia, PA from 2020-2021*).

(2) 12 patients hospitalized for acute heart failure who wore the RESP Biosensor during hospitalization and in the immediate post-discharge period (*clinical trial with Mission Hospital, Asheville, NC in 2021*). See figures 2 & 3 for individual patient case study from the study.

(3) 30 healthy adults at risk for respiratory tract infections in the United States who wore the device in daily life (*DETECT study led by Scripps Research, nationwide in 2021*).

In all these cohorts, the RESP Biosensor, an FDA-cleared Class II wearable device used for remote monitoring, was used to capture longitudinal lung sounds in conjunction with standard of care. Trained lung sound analysts classified the lung sounds with validation by certified clinicians.

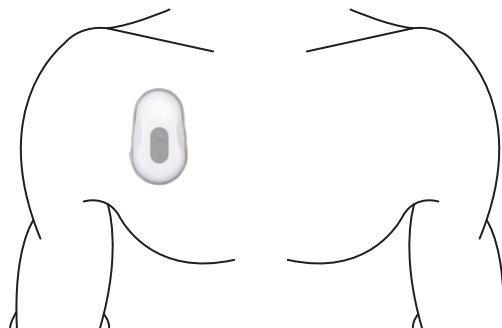


Figure 1: Placement of the RESP Biosensor on patient's chest. Device remotely captures cough and lung sounds.

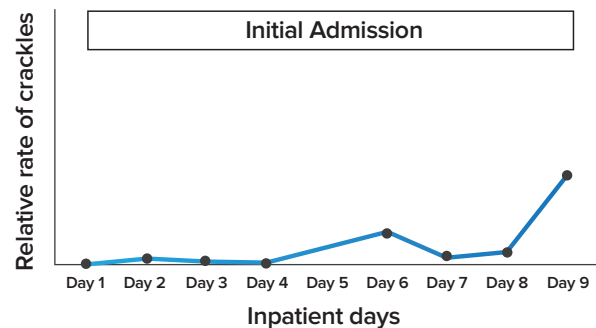


Figure 2: Initial admission of an adult male patient from Mission Hospital 2021 heart failure study. Rate of crackles, an adventitious lung sound associated with worsening CHF, is shown to increase before discharge.

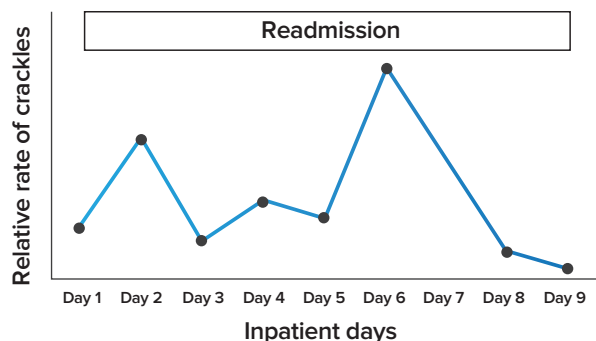


Figure 3: Readmission of same heart failure patient after 9 days. Patient is shown to have progressive increasing crackles before expiring.

Results:

Case 1: A 49-year-old male with AECOPD was noted to have an increase of lung sounds up to 119% from baseline prior to hospital discharge and during the post-discharge period. He was ultimately readmitted 5 days after discharge.

Case 2: A patient hospitalized for acute heart failure had increasing rates without an increase in respiratory rate. The patient was discharged and readmitted 9 days after discharge, with progressive increasing rates detected. The patient subsequently expired.

Case 3: In the infectious disease surveillance cohort, 16 participants self-reported symptoms, of which 11 had coughs captured by RESP™ but did not self-report cough.

Conclusions:

Remote patient monitoring of lung sounds is a promising telehealth approach to infectious disease surveillance as well as detection of acute worsening of cardiopulmonary disease in at risk patients.

In cases 1 and 2, remotely monitoring lung sounds could have guided more aggressive medical intervention during the post-discharge at-risk period to prevent a hospital readmission, and before the disease process became refractory.

In case 3, lung sound monitoring appears to be superior to standard-of-care symptoms reporting in obtaining cough data for disease surveillance. Further studies on the efficacy and cost-effectiveness of remotely monitoring lung sounds are warranted.