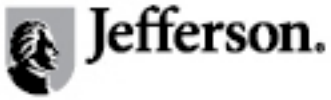

1-2020

Assessment of a Wearable Device for Minute Ventilation in Detecting Different States of Ventilation

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SKMC Class of 2022: SI/DH Abstract

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Assessment of a Wearable Device for Minute Ventilation in Detecting Different States of Ventilation

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Introduction:

Minute ventilation (MV) and breathing status are valuable vital signs to measure in patients clinically such as in detecting opioid induced respiratory depression. However, there are few devices capable of continuously monitoring MV in an accurate fashion. RTM Vital Signs, LLC and TJU are developing a non-invasive wearable Tracheal Sound Sensor to determine if a device can accurately and continuously measure respiratory rate (RR), tidal volume (TV), MV, and changes in ventilation patterns based on sound recordings of breathing.

Methods:

Tracheal breathing sounds were recorded in six researchers using a prototype sensor placed on the skin above the sternal notch. Simultaneously, researcher's RR and MV were recorded in minute long intervals using a pneumotach. Researchers were asked to mimic various breathing patterns by adjusting breathing rate and breathing depth. A

variety of signal processing methods and algorithms were used to analyze the data to produce RR, TV, and breathing pattern estimates.

Results:

Researchers tolerated use of the sensor and breathing apparatus system without difficulty and data was successfully obtained. Initial signal processing and analysis methods applied to this data were able to accurately measure the respiratory rate (~ 98% sensitivity/specificity), and accurately characterize normal breathing from hyperventilation and hypoventilation (~ 98% sensitivity/specificity). The sensor's algorithm estimated tidal volume with ± 100 ml accuracy compared with the commercial pneumotach.

Discussion:

Based on the results, a non-invasive wearable device could obtain accurate measures of RR and classify breathing patterns based solely on measurements of breathing sounds. Although the TV results were not as accurate as we expected, this may be due in part to systematic error from the pneumotach device used for the reference TV. With the satisfactory sensor and data acquisition system, future trials are planned in volunteers and hospitalized patients using this system with more accurate pneumotach devices.