In our submission, we performed a clinical trial on porcine models for obtaining lung tidal volumes using wearable near-field radio-frequency (NFRF) sensors. The procedure was performed under the approved protocols of Cornell University IACUC Protocol #2021-0066 and #2018-0034. Theoretical results on the backscatter electromagnetic field behavior for near-field radio antennas guided the design of our sensing system. Measurement capabilities of NFRF were demonstrated by validating performance using spirometry reference during a mechanically ventilated stepwise tidal volume intervention. System robustness was enhanced by proposed adaptive algorithms, for deriving tidal volume using NFRF sensors, whose performance was benchmarked against a non-adaptive algorithm. A novel method for detecting one-lung obstruction was proposed. NFRF-derived results were demonstrated to agree with clinical observations.

Our work is highly relevant to the areas of wearable health sensing and continuous vital monitoring. Proposed NFRF sensors may be packaged into wearable devices for at-home health monitoring, assisting in early detection of adverse pulmonary conditions and improved tele-health outcomes. NFRF sensors may also improve clinical outcomes by reducing the need for unnecessary intubation for measuring lung function. Proposed novel lung obstruction detection method may be utilized during surgical procedures where one-lung ventilation is necessary.

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