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Non-invasive cardio-respiratory sensor to predict clinical respiratory deterioration

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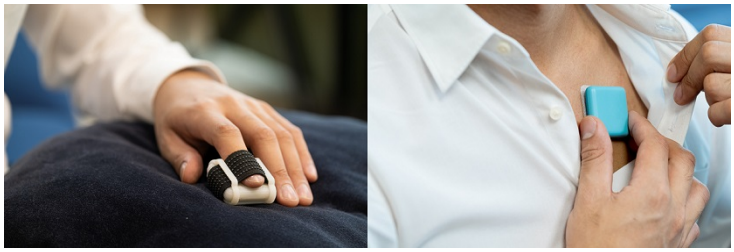
Early identification and therapeutic intervention are key to reducing risk for individuals at risk of acute respiratory failure and pneumonia from COVID-19



The National University Hospital (NUH), NUS Yong Loo Lin School of Medicine (NUS Medicine) and Respiree Pte Ltd announced today that they are collaborating on a research study to develop predictive models using respiratory rate and breathing variability to detect clinical deterioration in patients suffering from acute respiratory failure and pneumonia early and accurately.

Emerging infections such as COVID-19 affect the respiratory system causing pneumonia, pneumonitis, and respiratory failure. The coronavirus (SARS-COV-2) central to the outbreak is highly contagious with over 2 million cases spanning more than 160 countries and 152,000 deaths (as of 19 April 2020). Most were 30-79 years of age (87%) and classified as mild (81%: no and mild pneumonia). However, 14% had severe pneumonia requiring oxygen therapy and 5% critically ill with shock and multi-organ dysfunction. The overall case-fatality rate is 2-3%.

As the virus spreads via respiratory droplets and can survive on contaminated surfaces for days thereby facilitating transmission, patients are kept in isolation rooms and healthcare workers are in full personal protective gear while caring for them. The key is in early identification of individuals at risk of deterioration for transfer to the intensive care unit so that supportive and therapeutic interventions could be instituted while limiting the over-exposure of healthcare professionals to the patients.

Close monitoring of these patients admitted into single rooms can be challenging. The project aims to study if a non-invasive sensor with built-in algorithms that incorporate respiratory variability, pulse oximetry and heart rate could aid the practitioner in early identification of patients at risk of deterioration. In addition, this sensor allows continuous transmission of the patient's vital parameters wirelessly to a central station, thereby facilitating monitoring from outside the isolation rooms.

The core technology behind this sensor was developed at the Agency for Science, Technology and Research (A*STAR). It was commercialised and as a result, Respiree was spun-off to take the product to market.

Together with NUH and NUS Medicine, Respiree now aims to deploy the use of novel respiratory biomarkers to predict worsening conditions in isolated COVID-19 patients.

Associate Professor Lee Pyng, Senior Consultant, Division of Respiratory & Critical Care Medicine at NUH and the Principal Investigator for the study said: "Preliminary results show that prediction of clinical deterioration based on respiratory and cardiac parameters is possible up to 25 hours in advance. The novelty of this project is in the use of respiratory biomarkers

and data to predict clinical deterioration. We anticipate that it will be more sensitive and specific for respiratory diseases."

The study will recruit 80 patients with respiratory diseases of which COVID-19 pneumonia will be of interest. Each patient will have two sensors attached to monitor respiratory rate, breathing pattern variability, heart rate and pulse oximetry. These sensors are reusable with simple wipe down using alcohol for disinfection but will be discarded after use for COVID-19 patients. The predictor variables will be compared and analysed against manual charting, patient's imaging, arterial blood gas, lactate dehydrogenase function (LDH) as per standard of care.

Dr Gurpreet Singh, Co-Principal Investigator of the study and founder of Respiree Pte Ltd said, "Respiree sensors are developed to capture respiratory rate, respiratory variability, hemodynamics, and pulse oximetry where advanced data analytics and algorithms are applied to predict deterioration ahead of time. The collaborative intent of this project is to co-develop and co-deploy a wireless system in an isolation ward setting that enables healthcare workers to monitor these vital parameters in real-time with minimal exposure to the infectious virus, whilst being alert on risk of clinical deterioration of COVID-19 patients."

The project is funded by the National University Health System (NUHS) COVID-19 Seed Grant from NUHS, which aims to support research into developing interdisciplinary and innovative approaches to the detection, treatment and prevention of COVID-19.

Following the research, the project team may evaluate if the respiratory sensor system could be extended and adopted in other areas of care.