

ARAS Workshop Schedule

Safeguarding Public Health During Infectious Disease Pandemics Using Medical Robotics, Wearable Technology, and AI

30-minute talks including Q & A (Preview):

- Pilot Study of Trans-oral Robotics to Meet the Minimal Exposure Needs During Infectious Disease Pandemics, Dr. Hongliang Ren.
- Towards Autonomous Sampling of Distal Lung in Critically ill Patients in ICUs, Dr. Mohsen Khadem.
- Telemedicine for Parkinson's Disease (PD) during the pandemic and beyond, Dr. Ravi Vaidyanathan.
- Addressing the COVID-19 clinical needs through haptics-enabled telerobotic systems, Dr. Javad Dargahi.
- Reforming Rehabilitation Services in Respond to COVID-19 Outbreak, the requirement and future direction, Dr. Ehsan Tarkesh Esfahani.
- RoboEthics in COVID-19: A Case Study in Dentistry, Dr. Yaser Maddahi.
- Wearable sensors can enable remote health monitoring and telerehabilitation during a pandemic, Dr. Hossein Rouhani.
- Delivery of healthcare while physically distancing using robotics and AI, Dr. Mahdi Tavakoli.

Eight 30-minute talks including Q & A (all times are Eastern Daylight Time):

- (8:30-9:00 AM) Pilot Study of Trans-oral Robotics to Meet the Minimal Exposure Needs During Infectious Disease Pandemics, Dr. Hongliang Ren
 - **Abstract:** Swabbing tests have proved to be an effective method of diagnosis for a wide range of diseases. There are high risks of infection for surgeons during the face-to-face COVID-19 swab sampling due to the novel coronavirus's infectivity. Teleoperated or self-administered swabs can mitigate potential occupational health hazards and reliance on healthcare workers during traditional swabbing procedures. We present some pilot studies on flexible transoral robotic approaches and mechanisms for swab sampling. One prospective robot comprises a flexible manipulator, an endoscope with a monitor, and a master device. A 3-prismatic-universal flexible parallel mechanism with 3 degrees of freedom (DOF) is used to realize the manipulator's movements. The flexibility of the manipulator improves the safety of testees. Under the vision guidance from the endoscope, a master device can control the swab's motion attached to the manipulator for sampling. We will also discuss other possible methods to apply closed kinematic chain theory to develop a self-administered viral swab to collect respiratory specimens. The proposed sensorized swab models utilizing hollow polypropylene tubes possess mechanical compliance, simple construction, and inexpensive components. These foldable telescopic structures with multiple kirigami cuts minimize components involved in the system as the characteristics are built directly into the material.
 - Reading material: [Paper 1](#), [Paper 2](#), [Paper 3](#)
- **(9:00-9:30 AM)** Towards Autonomous Sampling of Distal Lung in Critically ill Patients in ICUs, Dr. Mohsen Khadem
- **(9:30-10:00 AM)** Telemedicine for Stroke and Parkinson's Disease During the Pandemic and Beyond: Mechanical-Muscle Activity and Real-time Kinematics (M-MARK), Dr. Ravi Vaidyanathan
 - Reading material: [Paper 1](#), [Paper 2](#), [Paper 3](#), [Video](#)
- **(10:00-10:30 AM)** Addressing the COVID-19 clinical needs through haptics-enabled telerobotic systems, Dr. Javad Dargahi
- **(10:30-11:00 AM)** Reforming Rehabilitation Services in Respond to COVID-19 Outbreak, the requirement and future direction, Dr. Ehsan Tarkesh Esfahani
 - **Abstract:** This talk will discuss the necessity and requirements of rapid reshaping of the rehabilitation services in response to COVID-19 outbreak. These services include the rehabilitation of patients recovering from severe COVID-19 with post-intensive care syndromes, including physical deconditioning and cognitive impairments, and other patients requiring physical therapy during the outbreak with no or limited access to hospital and rehabilitation centers. Considering the

access barriers to quality rehabilitation settings and services imposed by social distancing and stay-at-home orders, these patients can be benefitted from access to affordable and good quality care through home-based rehabilitation. The success of such treatment will depend highly on the intensity of the therapy and effort invested by the patient. Monitoring patients' compliance and designing a home-based rehabilitation that can mentally engage them are the key elements in home-based therapy's success. The suggested structure of the new services includes both home-based solutions for enhancing the activities of daily living and an on-demand ambulatory rehabilitation unit for extensive training where it is possible to monitor both cognitive and motor performance of the patients remotely.

- **(11:00-11:30 AM)** RoboEthics in COVID-19: A Case Study in Dentistry, Dr. Yaser Maddahi
 - **Abstract:** The COVID-19 pandemic has caused dramatic effects on the healthcare system, businesses, and education. In many countries, businesses were shut down, universities and schools had to cancel in-person classes, and many workers had to work remotely and socially distance in order to prevent the spread of the virus. These measures opened the door for technologies such as robotics and artificial intelligence to play an important role in minimizing the negative effects of such closures. There have been many efforts in the design and development of robotic systems for applications such as disinfection and eldercare. Healthcare education has seen a lot of potential in simulation robots, which offer valuable opportunities for remote learning during the pandemic. However, there are ethical considerations that need to be deliberated in the design and development of such systems. In this paper, we discuss the principles of roboethics and how these can be applied in the new era of COVID-19. We focus on identifying the most relevant ethical principles and apply them to a case study in dentistry education. DenTeach was developed as a portable device that uses sensors and computer simulation to make dental education more efficient. DenTeach makes remote instruction possible by allowing students to learn and practice dental procedures from home. We evaluate DenTeach on the principles of data, common good, and safety, and highlight the importance of roboethics in Canada. The principles identified in this paper can inform researchers and educational institutions considering implementing robots in their curriculum.
 - Reading material: [Paper](#).
- **(11:30 AM-12:00 PM)** Wearable sensors can enable remote health monitoring and telerehabilitation during a pandemic, Dr. Hossein Rouhani
- **(12:00 PM-12:30 PM)** Delivery of healthcare while physically distancing using robotics and AI, Dr. Mahdi Tavakoli