

My name is Sairam Parthasarathy and I am a Professor of Medicine and Chief of the Division of Pulmonary Allergy Critical Care and Sleep Medicine at the University of Arizona in Tucson AZ. I have previously served at two VA Hospitals -- Edward J. Hines VA Hospital in Hines, Illinois as well as the Southern Arizona VA Healthcare System -- for a total of 11 years of service as a Pulmonary-Critical Care-and-Sleep physician. I have also served as Section Chief for Pulmonary, Critical Care, and Sleep Medicine from 2004 to 2007 and subsequently as the Associate Chief of Staff for Research at the Southern Arizona VA Healthcare System in Tucson, Arizona. Currently, I serve as one of the Directors on the Board of Directors for the VA Non-Profit Foundation affiliated with the Southern Arizona VA Healthcare System called the Biomedical Research and Education Foundation of Southern Arizona, Tucson, AZ. I am board certified in Pulmonary, Critical Care and Sleep Medicine.

I have a broad area of research expertise with a special focus on **implementation science in the area of sleep medicine**. The approach of implementation science entails harnessing new biomedical innovations to the bedside and clinics to benefit patients everywhere – including veterans. Hence, I believe that I can speak to the topic in hand, which is regarding, *“Harnessing Biomedical Innovation: Modernizing VA Healthcare for the Future.”*

A wealth of scientific knowledge is being generated by biomedical research, especially in the area of sleep and circadian science that has cross-cutting benefits to veterans health. In order for us to realize the return on investment for such scientific knowledge and to improve the health of the veterans and the nation, especially with the extent to which chronic diseases afflict our people, there is a dire need to disseminate and implement – or simply put, **“harness”** – these research findings into day-to-day clinical practice. It is frequently reported that a time lag of 17 years transpires before 15% of medical research reaches day-to-day clinical practice in order to benefit both veterans and civilians. Such harnessing has evolved into the science of implementation and the Veterans healthcare System and affiliated University partnerships are well poised to thoughtfully harness and implement these innovations into the real-world. Implementation science takes into account the healthcare providers’ work-related burden in a busy clinic or hospital and the validity and applicability of the scientific findings to that context. The ability to get clinics to adopt these approaches and maintain them over time is another crucial aspect that needs to be taken into thoughtful consideration. We need to carefully assess metrics that will measure the process of implementation and the return on investment for us to exercise proper financial stewardship. We need to identify barriers for implementing these medical innovations and identify facilitators to enable the successful implementation and return on investments. Enabling artificial intelligence (AI/ML) approaches to assist with such implementation (or harnessing efforts) will be in keeping with dissemination and implementation science while shifting the task from the busy healthcare providers to machines that can work hand in hand with them.

One such example is in the area of obstructive sleep apnea. Sleep apnea is very common in Veterans and is characterized by repetitive obstruction of the throat, snoring and temporary cessation of breathing that are associated with low oxygen counts during sleep. Sleep apnea – and insomnia – has been associated with heart attacks, strokes, high blood pressure, road traffic accidents, poor outcomes in individuals with traumatic brain injury/PTSD, depression/suicidality, and even death. However only 1 in 4 individuals with sleep apnea are diagnosed and the remaining 75% are left undiagnosed. We have refined a machine learned algorithm developed by researchers at MIT and embedded it into the electronic medical records system of our University of Arizona healthcare system that can identify individuals with high likelihood of sleep apnea and alert the healthcare provider to that fact and enable them to, in a facile manner, place an order for a diagnostic test or sleep study. Moreover, treatment of sleep apnea with CPAP machine that delivers pressurized air to keep the throat open has been associated with reduction of motor vehicle accidents, improvements in blood pressure, reduction of cardiovascular mortality, however, only 2/3rds

of patients with sleep apnea are adherent. There are not enough providers or caregivers to support an CPAP adherence promotion program. This unmet need is being addressed by us as we are in the process of developing an AI/ML approach for algorithms – developed previously through funding from VA HSR&D portfolio and PCORI -- to help veterans and civilians to be adherent to CPAP therapy. There are similar machine-based approaches that can deliver cognitive behavioral therapy for insomnia – another common sleep disorder with huge implications to mental health. Researchers at the University of Arizona are also testing a Department of Defense supported Virtual Reality Military Operational Neuropsychological Assessment system that can use deep neural network learning and AI approaches to identify individuals with neuropsychological issues that include PTSD.

In summary, there are numerous approaches to successfully identify and treat patients with chronic medical conditions such as sleep apnea using implementation science and AIML approaches. The time is now to harness the biomedical advances to benefit health of veterans using AI/ML and targeting sleep would enable us to touch many organ systems and thereby improve overall physical and even mental health.