University of Illinois Faculty—supported by Jump Partnership—Develops Simple N95 Respirator Mask Decontamination Technology with Microwave Oven Plasmas

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(Peoria, IL) July 31, 2020 — In the early days of the pandemic, hospitals faced a shortage of personal protective equipment (PPE), especially N95 respirator masks. As COVID-19 cases rebound across the nation and we face another potential shortage, the question of how to decontaminate N95 respirator masks remains. Fortunately, a team led by nuclear, plasma, and radiological engineering professor David Ruzic has proven results of a solution that could be used to decontaminate respirator masks using a microwave oven, funded by a $30,000 grant from the Jump ARCHES endowment. Jump Applied Research in Community Health through Engineering and Simulation (ARCHES) is a partnership between Jump Simulation and Education Center at OSF HealthCare and the Health Care Engineering Systems Center in The Grainger College of Engineering.

Professor Ruzic's strategy consists of creating a plasma inside the microwave oven using common household supplies including ceramic coffee cups, wire, hydrogen peroxide, and saline solution. The combination of these materials allows for creation of an intense plasma, which can decontaminate the mask within approximately 30 seconds. View this video on Professor Ruzic's "Illinois EnergyProf" YouTube channel to learn about the process.

"This technology would enable hospitals, nursing homes, and first responders to use a microwave oven to decontaminate masks with materials they already have on hand," Ruzic said. "We have shown that 30 seconds of plasma exposure is sufficient to kill viruses and have submitted our findings to the CDC's Journal of Emerging Infectious Diseases. We have also sent treated masks to the CDC for testing and passed their filtration and fit standards, even after three cycles of decontamination." A preprint of the work is available in MedRXiv.

Professor Ruzic's team includes Illinois civil and environmental engineering Professor Helen Nguyen and Jump Simulation and Education Center engineer Brent Cross. Professor Nguyen's research group specializes in environmental engineering with an emphasis on pathogen transmission and control. They have the facilities to test and expertise to determine the extent exposure to the plasma can inactivate the viruses on N95 respirator masks. University of Illinois civil and environmental engineering Professor Vishal Verma's group also assisted with measurement to ensure the treatment did not compromise the integrity and filtration efficiency of the respirator masks.

"Professors Helen Nguyen, Vishal Verma, and their students have been fantastic co-workers," Ruzic said. "Without them, we would have had no idea if this technology was useful. I'd like to note also that some of the initial ideas came from Starfire Industries, and its help is also very much appreciated. I look forward to working with OSF HealthCare Heart of Mary Medical Center in Urbana and greatly appreciate the funding from Jump ARCHES. We recently demonstrated this technique to OSF, and their leaders were extremely impressed, and were excited they could easily replicate the process themselves."

Ruzic and his team hope that this technology will prove useful as conservation efforts continue for N95 respirator masks. Knowing there is a potential solution could provide peace of mind for medical providers.

“In case of real shortages, we would consider this technique a key tool in keeping our staff and patients safe,” John Kreckman, M.D., Chief Medical Officer of OSF HealthCare Heart of Mary Medical Center in Urbana said.

In March 2020, the Jump ARCHES program sent out an emergency request for proposals addressing the pandemic, and Ruzic’s proposal was one of 17 accepted for funding. View the other 16 research projects here. This partnership provides direct access and competitive grants to engineers and physicians from OSF HealthCare and the University of Illinois system working together to combat problems in health care.

Next steps for Professor Ruzic and his team include introducing the technology to OSF HealthCare leaders and waiting acceptance to the CDC’s Journal of Emerging Infectious Diseases. This strategy should not be applied for use by individuals seeking to decontaminate cloth masks or N95 masks at home. This information is designed for use by health care and supporting agencies.

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OSF HealthCare is an integrated health system owned and operated by The Sisters of the Third Order of St. Francis, Peoria, Illinois. OSF HealthCare employs more than 23,600 Mission Partners in 147 locations, including 14 hospitals – 10 acute care, four critical access – with 2,097 licensed beds, and two colleges of nursing throughout Illinois and Michigan. The OSF HealthCare physician network employs more than 1,500 primary care, specialists and advanced practice providers, who are part of the OSF Medical Group . OSF HealthCare, through OSF Home Care Services, operates an extensive network of home health and hospice services. It also owns Pointcore Inc., comprised of health care-related businesses; OSF HealthCare Foundation, the philanthropic arm for the organization; and OSF Ventures, which provides investment capital for promising health care innovation startups.

Jump Simulation, a part of OSF Innovation, is a collaboration between University of Illinois College of Medicine at Peoria and OSF HealthCare. The Jump center replicates a variety of patient care settings to ensure novice and seasoned clinicians can practice handling medical situations in a life-like environment. Boasting six floors and 168,000 square feet, the center is one of the largest of its kind and provides space for conferences, anatomic training, virtual reality and innovation. For more information, visit www.jumpsimulation.org.

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The Health Care Engineering Systems Center (HCESC) of the U of I College of Engineering provides clinical immersion and fosters collaboration between engineers and physicians. The goal is to use our expertise in the broad areas of simulation technologies, smart health systems, data analytics, human factors, and medical robotics to design and develop collaborative solutions that improve health care outcomes. HCESC partners with Jump Simulation of OSF HealthCare at Peoria, Illinois, in this innovative relationship of Applied Research for Community Health through Engineering and Simulation (ARCHES). Learn more about HCESC at https://healtheng.illinois.edu/

The University of Illinois College of Medicine Peoria (UICOMP) educates 244 medical students and nearly 300 physician residents annually. The College of Medicine is home to the Cancer Research Center, the Center for Outcomes Research, and a collaborator in Jump Simulation. Learn more about UICOMP at http://peoria.medicine.uic.edu.