

## 2020 Jump ARCHES Grant Recipients Announced

*Several projects focus on artificial intelligence to advance diagnosis and treatment*

### For Immediate Release

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Fourteen research projects are sharing \$1.9 million in funding through the [Jump ARCHES research and development program](#). The Jump Applied Research for Community Health through Engineering and Simulation (Jump ARCHES), is a partnership between OSF HealthCare and the University of Illinois at Urbana-Champaign.

The ARCHES program supports research involving clinicians, engineers, and social scientists to develop technologies and devices that could revolutionize medical training and health care delivery. Faculty at the U of I College of Medicine at Peoria (UICOMP) also participate.

Since its inception in 2014, the Jump ARCHES initiative has directed more than \$3.7 million for 39 projects.

The 14 new awards for 2020, range from \$50,000 to \$75,000, and include:

### **A Human Factors Approach to Food Security**

*Dr. Sarah Stewart de Ramirez-OSF HealthCare and Abigail R. Wooldridge-U of I's Grainger College of Engineering*

Thirty-seven million Americans have food insecurity which results in poor health and increases health care costs. This project will use a human-centered approach to identify barriers for individuals who are food insecure and challenges for service providers who are trying to meet needs in rural communities. That research will support design of technology-based solutions to reduce food insecurity in rural areas.

### **A-Eye: Automated Retinopathy of Prematurity Detection and Analysis**

*Dr. C. Reddy-OSF HealthCare and Thomas Huang-U of I's Beckman Institute for Advanced Science and Technology*

Early detection of retinopathy in premature infants is important for early interventions to prevent blindness. With a shortage of specialists, it's critically important to develop an AI diagnostic system that autonomously analyzes images of the retina to detect retinopathy. The team will also consider how to integrate the tool into portable, user-friendly equipment with the possibility future expanded uses for such a medical device.

### **Activate Capture and Digital Counting (AC+DC) Technology for Ultrasensitive and Rapid Characterization of miRNA Blood borne Biomarkers for ALS**

*Dr. Vahid Tohidi-OSF HealthCare and Brian Cunningham-U of I's Grainger College of Engineering*

ALS is a devastating condition that leads to gradual muscle decline caused by loss of motor neurons in the brain and spinal cord. It's in urgent need of new treatments. The goal of this proposal is to develop and validate nanoparticle technology that can use a small amount of blood plasma to identify miRNA biomarkers of ALS. The team will also develop an instrument using just a drop of blood to detect statistically significant circulating biomarkers to identify genetic indicators of ALS.

### **Artificial intelligence augmented portable photoacoustic imaging system for early diagnosis of breast cancer**

*Dr. Kent Hoskins-OSF HealthCare and Yun-Sheng Chen-U of I's Beckman Institute for Advanced Science and Technology*

This research aims to harness artificial intelligence (AI) to develop an affordable, portable imaging solution for breast cancer screening and diagnosis that could be more accessible to residents in rural communities. The

team proposing using Photoacoustic (PA) imaging techniques that combine optical (photo) and ultrasound (acoustic) approaches to produce high-contrast, molecular images of breast blood vessel and lymphatic systems for early breast cancer diagnosis.

### **Autonomous Morphing Bed Mattress for ALS patients with Limited Movement Ability**

*Dr. Christopher Zallek-OSF HealthCare/U of I College of Medicine, Peoria and Elizabeth Hsiao-Weckslers-U of I's Grainger College of Engineering*

This project will address complications from limited to no movement ability of adults while lying in bed, including patients with ALS who have weak muscles and loss of ability to control them. The team will develop an innovative bed mattress consisting of an array of soft air cells that will autonomously pressurize and depressurize specific areas to provide site-specific pressure relief, tilted repositioning, and assistance with transferring while the patient is lying flat or has their head elevated.

### **Automated Aneurysm Segmentation and Measurement**

*Dr. Jeff Klopfenstein-OSF HealthCare and Thomas Huang-U of I's Beckman Institute for Advanced Science and Technology*

Cerebral aneurysms are among the most deadly types. This group will build a large-scale dataset to create an algorithm to identify and segment the bulging blood vessels based on size and blood flow. This will be used for future medical imaging instruction and to develop computer programs to help with treatment decisions.

### **Design and Validation of a Soft Robotic Cardiac Transseptal Puncture Simulator**

*Dr. Abraham Kocheril-OSF HealthCare and Girish Krishnan-U of I's Grainger College of Engineering*

This project continues work on a realistic soft heart simulator that allows early-career cardiologists and surgeons to feel what it's like to poke and prod cardiac tissues during a common surgery for patients with an irregular heartbeat. Phase II will enhance the level of realism by fine-tuning the materials used and incorporating image-based guidance.

### **Development of a Digital Fall Risk Assessment and Prevention Tool for Rural Older Adults**

*Dr. Sarah Stewart de Ramirez-OSF HealthCare and Jacob Sosnoff-U of I's Beckman Institute for Advanced Science and Engineering*

Falls are the number one cause of accidental injury in older adults. This project will use a machine learning algorithm for a fall risk assessment and prevention strategy application as part of a community health worker's digital toolkit. Researchers will also assess the usability of the "Steady" tool.

### **Digitizing the Neurological Screening Examination**

*Dr. Christopher Zallek-OSF HealthCare/U of I College of Medicine, Peoria and George Heintz-U of I's Health Care Engineering Systems Center*

There's a projected 19% shortage of neurologists nationally by 2025 and yet nine percent of primary care visits are with patients who have neurological issues. This project will pilot an integrated Digital Neurological Examination (DNE) system and develop a platform using data for an AI-informed decision support assistant. The assistant will help physicians triage and care for patients with neurological symptoms regardless of exam location.

### **Improving Feedback and Efficiency: Automated Grading of Post Simulation Written Chart Notes**

*Dr. William Bond-OSF HealthCare and Suma Bhat-U of I's Grainger College of Engineering*

Immediate feedback fosters the best learning and this project aims to improve Automated Short Answer Grading (ASAG) using Natural Language Processing (NLP) methods from previously collected and graded chart notes following simulations using standard participants (actor-based simulations). The tools developed will also reduce faculty grading demands and can be applied to trainings for other topics including use of opiates, telehealth use, patient counseling.

### **Improving Outcomes and Training of Pectus Excavatum**

*Dr. Paul Jeziorczak-OSF HealthCare and Inki Kim-U of I's Grainger College of Engineering*

This team will develop a process using virtual and augmented reality to improve patient education, resident training, and placement of an internal metal chest brace for patients with pectus excavatum or sunken chest which can impact the function of the heart and lungs. The team will build on work already done with pediatric hearts and build a training model using 3D printed chest walls as well as a virtual reality module for self-study as well as pre-operative planning.

### **Optimizing Deployment of Community Health Workers**

*Dr. Sarah Stewart de Ramirez-OSF HealthCare and Hyojung Kang-U of I's College of Applied Health Sciences*

Community Health Workers are effective for improving health and lowering healthcare costs for vulnerable populations, such as those living in rural areas where access to healthcare is limited and health outcomes are poor. The project will create data-driven algorithms to support optimal deployment of precision guided, digitally enabled CHWs in rural settings.

### **Skill Assessment in Surgery and Microsurgery**

*Dr. Heidi Phillips-U of I's College of Veterinary Medicine and T. Kesavadas-U of I's Health Care Engineering Systems Center*

We propose applying advanced engineering and data science to develop a high-fidelity virtual simulator to provide thorough and validated microsurgical training and assessment. The team will develop an evidence-supported, automated, robust, real-time, comprehensive, quantitative (ARRCQ) assessment system by building data sets and creating algorithms for optimum learning including accuracy and cost.

### **Virtual Reality to Deliver Psychotherapy to Lung Cancer Patients with Depression**

*Dr. Rhonda L. Johnson-OSF HealthCare and Rosalba Hernandez-U of I's School of Social Work*

More than half of all lung patients experience depression which impacts their compliance with treatment, increases hospitalization and ultimately decreases survival rates. With a shortage of psychotherapists across the country, especially in rural areas, this project's virtual reality (VR) platform could fill the void. For example, VR programs could transport users to relaxing environments with guided meditation. If successful, this treatment could be used as patients receive chemotherapy or before/after radiation.

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**OSF HealthCare**, headquartered in Peoria, is owned and operated by [The Sisters of the Third Order of St. Francis](#), and consists of nearly 21,000 employees in 126 locations, including 13 hospitals, 11 Centers for Health and 15 OSF PromptCares throughout Illinois and Michigan. OSF Innovation, ranked among the top 10 innovation centers in the country, is located in Jump Trading Simulation & Education Center. Launched in 2016, OSF Innovation is a multidisciplinary innovation center focused on internal and external innovation to solve the largest health care challenges. More at [www.osfinnovation.org](http://www.osfinnovation.org) and [www.osfhealthcare.org](http://www.osfhealthcare.org).

**Jump Simulation**, a part of [OSF Innovation](#), is a collaboration between University of Illinois College of Medicine at Peoria and OSF HealthCare. The 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](http://www.jumpsimulation.org).

**University of Illinois Grainger College of Engineering:** As one of the world's top ranked engineering programs, their students, faculty, and alumni set the standard for excellence. The College is focused on driving the economy, reimagining engineering education, and bringing revolutionary ideas to the world. They work to solve the world's greatest challenges and look toward the future to find ways to make it a reality. Learn more about the College of Engineering at <https://engineering.illinois.edu/>.

**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>.

