MUSC
Medical University of South Carolina

Harvey and Marcia Schiller Surgical Innovation Center

Progress Report 2024

Message from the Director

Arman Kilic, M.D.
Director

We are pleased to provide you with our second annual progress report for The Harvey and Marcia Schiller Surgical Innovation Center at the Medical University of South Carolina. The Center was formed with a generous gift from Brigadier General Harvey Schiller, USAF Ret. Ph.D., and his wife Marcia. This year, there has been substantial progress in our three pillars: artificial intelligence (AI), investigator-initiated clinical trials, and human-centered design (HCD).

We have considerably grown our AI team and portfolio of AI projects. Ruoyu (Michael) Zhang, M.S., joined us from Carnegie Mellon University as a senior research associate, and Andrew Wright, Ph.D. candidate, joined us as a senior database administrator. The Center helped support obtaining a major $1.9 million NIH grant that aims to use AI to better optimize heart transplantation in the United States. We were proud to announce the winners of our inaugural Schiller Innovation Awards. These awards are meant to provide internal funding to surgical faculty to develop the necessary preliminary data to support extramural grant applications and/or commercialization efforts. We received 13 exceptionally innovative scientific proposals and four projects were awarded.

Under the leadership of director David Taber, Pharm.D., MS, our clinical trials pillar has had a remarkable year, conducting 57 clinical trials in the Department of Surgery. We are pleased to welcome Deanna DeHoff as the program manager of clinical trials and Saylor Hardin as the program coordinator for qualitative research. Morgan Overstreet, MS, has been appointed the Director of Research Administration. Our clinical trials span a wide range of surgical domains, including transplant, cardiothoracic, vascular, GI, burn, and pediatric surgery, reflecting our commitment to advancing surgical research.

Our HCD program has made significant strides. Douglas Hamilton has joined the HCD group as a Program Architect. David Mahvi, M.D., Director of the HCD Program, and his team have launched an accelerator program that harnesses the expertise of industry professionals to support surgical faculty. This includes experts in intellectual property, venture capital and funding, digital needs, Food and Drug Administration strategy, clinical trial design, hardware prototyping, and medical device consulting.

The HCD accelerator program currently supports seven member companies in the Department of Surgery, spanning diverse clinical domains such as cancer, cardiovascular, laparoscopic surgery, and transplant. HCD also continues to facilitate the education of interdisciplinary MUSC students and surgical residents in collaboration with the Baker Business School at the Citadel, having supported over 40 students, 20 projects, and over 12 awards since its inception. You will read about these and many more accomplishments in this progress report.

The Harvey and Marcia Schiller Surgical Innovation Center continues to be well poised to help shape the future of surgery and healthcare through AI, clinical trials, and human-centered design.

Arman Kilic, M.D.
John M. Kratz, M.D. Endowed Chair in Cardiac Surgery
Director of The Harvey and Marcia Schiller Surgical Innovation Center

Harvey and Marcia Schiller Surgical Innovation Center

SCHEDULED TO OPEN IN 2025

It's incredible how far we've come since the Center's inception – farther than we could have ever expected. Our Center's research teams work on a diverse set of projects that support every facet of healthcare and are advancing surgical science aimed to improve countless lives. With our unprecedented growth has come the realization of the importance of co-locating our growing team of researchers and physicians.

The vision of the new physical space is defined as a place dedicated to stimulating the creativity of its core teams, including AI and Data Managers, Clinical Trialists, and Human-Centered Designers, all dedicated to advancing surgical care through innovation and collaboration.

The open floor plan is a fluid effort to enhance collaboration and productivity through office space design. The concept encourages team members to take advantage of the availability of adapted environments and resources and allows for prototyping and creativity.

Architectural rendering of proposed innovation center space. Final design may vary.

Architectural rendering of proposed innovation center space. Final design may vary.

The new space is intended to be flexible and adaptable, with private workspaces and open meeting areas equipped with powerful computational hardware designed to accelerate deep learning and artificial intelligence, prototyping tools for human-centered designers, and office equipment that teams can reconfigure to meet new project needs.

It will also serve as an incubator that will support new ideas and ventures and provide resources such as workspace, mentorship, and training.

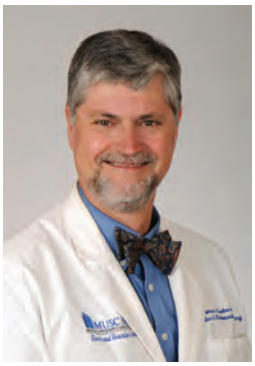
With the open floor concept, team members can tune in to each other and offer solutions and skills. Ideally, this speeds up the problem-solving process and results in a better product or solution.

If you are interested in learning more about how you can support the new surgical innovation space, please contact ***Heather Parrish****, College of Medicine Development Director, at 843-792-4342 or parrishh@musc.edu.*

Meet the Team

AI, MACHINE LEARNING & NATURAL LANGUAGE PROCESSING SURGEON-SCIENTISTS AND RESEARCHERS

Arman Kilic, M.D.
Cardiothoracic Surgeon



Thomas Brothers, M.D.
Vascular Surgeon

Mary Kate Bryant, M.D., MSCR
Metabolic Surgeon

Thomas Curran, M.D., MPH
Colorectal Surgeon

Evert Eriksson, M.D.
Acute Care Surgeon

Kate Engelhardt, M.D., MS
Thoracic Surgeon

Heather Evans, M.D., MS
Acute Care Surgeon

Kevin Hughes, M.D.
Surgical Oncologist

Aaron Lesher, M.D., MSCR
Pediatric Surgeon

Rupak Mukherjee, Ph.D.
Cardiothoracic Surgery Researcher

Deepak Ozhathil, M.D.
Burn Surgeon

Chris Streck, M.D.
Pediatric Surgeon

David J. Taber, Pharm.D., MS
Transplant Surgery Researcher

Ravi Veeraswamy, M.D.
Vascular Surgeon

Sanford Zeigler, M.D.
CardiothoracicSurgeon

Meet the Team

AI SCIENTISTS AND DATA ANALYSTS

John Del Gaizo, Ph.D.
Lead AI Researcher

Brett Welch, MBA, MHA
Program Manager

Ruoyu (Michael) Zhang, MS
Senior Research Associate

Andrew Wright, MS
Senior Database Administrator

Ahmed Alameldin
AI Researcher

Akinwale Famotire
AI Researcher

Roshan Mathi, MS
AI Researcher

Sheldon Sutton
AI Researcher

Atsukko Ueharra
AI Researcher

Will Zielke
AI Researcher

A Sampling of our Current Research Portfolio

With more than thirty ongoing AI/ML/NLP trials, listed below is a sampling of the breadth of our portfolio.

- Developing a more efficient AI-driven system for matching heart transplant donors and recipients.
- Creating risk models to guide decision-making that leads to improved outcomes for patients with peripheral vascular disease.
- Using AI to develop a Cancer Genetics KnowledgeBase and build Clinical Decision Support Tools.
- Developing risk tools to better stratify which pediatric trauma patients benefit from CT scans.
- Creating risk models to predict responders to bariatric surgery.
- Evaluating the potential association between neuropsychiatric disorders and thoracic aortic aneurysms.
- Automating extraction and features of a multimodal cancer data lake.
- Developing AI algorithms to predict mortality in a cardiovascular intensive care unit.
- Applying AI to single clinical notes to predict outcomes of coronary artery bypass grafting.

Schiller Surgical Innovation Awards

THE NEXT STEP IN ADVANCING CARE THROUGH AI AND ML

(left to right) Jeffrey Jones, Ph.D., Sanford Zeigler, M.D., Heather Holman, M.D., Aaron Lesher, M.D., Harvey Schiller, Ph.D., Prabhakar Baliga, M.D., Marcia Schiller, Mary Kate Bryant, M.D., Arman Kilic, M.D., Chris Streck, M.D., Brett Welch, MBA, MHA, Michael Zhang, M.S., Andrew Wright, M.S.

In January 2024, with the support from our benevolent donors, department leadership, and the College of Medicine, the Department of Surgery held a Surgical Innovation Awards Competition. Four research teams were each awarded $25,000 through the utilization of the expertise and computing services provided in the AI pillar of the Surgical Innovation Center.

"Within our department, we had interest from surgical faculty in every division and received 13 exceptionally innovative scientific proposals during the inaugural Harvey and Marcia Schiller Surgical Innovation Center Award Competition," said Arman Kilic, M.D., director of the Center. "We are grateful for the Schiller's support, which allowed us to award three projects and through funding from the College of Medicine, we were able to award one more research team than initially planned."

SURGICAL INNOVATION CENTER AWARD WINNERS

Good Planning for Better Scanning: Evaluation of Pediatric Blunt Abdominal Trauma

Christian Streck, M.D., Pediatric Surgeon

Dr. Streck's research aims to develop a machine learning model to predict which pediatric trauma patients are at low risk for complications, with the potential to improve the current model to avoid unnecessary CT scans nationally in this population.

Incidence of Thoracic Aortic Aneurysms and Neurogenic Hypertension in PTSD Patients

Jeffrey Jones, Ph.D., Sanford Zeigler, M.D., and Heather Holman, M.D., Ph.D. candidate

The cardiothoracic research team's project aims to identify biomarkers or neurogenic hypertension and explore the role of social determinants of health in cardiovascular disease progression, with the goal to potentially delay thoracic aortic aneurysm progression in patients with neuropsychiatric disorders.

Rescuing non-responders after bariatric surgery in an adolescent and young adult population

Aaron Lesher, M.D., MSCR, Pediatric Bariatric Surgeon

Dr. Lesher's research is a computational project that uses existing EMR resources to generate an EARLY warning algorithm that identifies poor responders to weight loss surgery in the postoperative period (between 3-12 months) with the ultimate goal to identify which mHealth interventions are most effective and appropriate for young individuals.

Utility of Visceral Adiposity on Abdominal CT for Prediction of Bariatric Surgery Outcomes

Mary Kate Bryant, M.D., MSCR, Adult Bariatric Surgeon

Dr. Bryant's research aims to analyze data from bariatric surgery patients to investigate the relationship between visceral adiposity and total body weight loss after bariatric surgery with the hope to identify preoperative predictors that will improve surgical type selection such as malabsorptive surgery for patients with high visceral adiposity or T 2 diabetes patients.

Schiller Surgical Innovation Awards

THE NEXT STEP IN ADVANCING CARE THROUGH AI AND ML

IMPROVING HEART TRANSPLANT PROCESS WITH ARTIFICIAL INTELLIGENCE

Arman Kilic, M.D., surgical director of MUSC's Heart Failure and Heart Transplant Program and director of the Harvey and Marcia Schiller Surgical Innovation Center, has been awarded a $1.9M NIH R01 grant for his proposed work to help shrink the chasm between transplant demand and transplant supply.

Kilic and his team, including Angel Jordan University Professor of Computer Science at Carnegie Mellon University Tuomas Sandholm, Ph.D., plan to use AI and machine learning to help optimize heart transplantation, hopefully saving lives in the process. "We're aiming to change how organs are allocated," said Kilic. "And once they are allocated, to optimize the decision making that's involved in accepting or rejecting those organs."

USING NEXT-GENERATION SEQUENCING AND MACHINE LEARNING TO RESHAPE BURN CARE

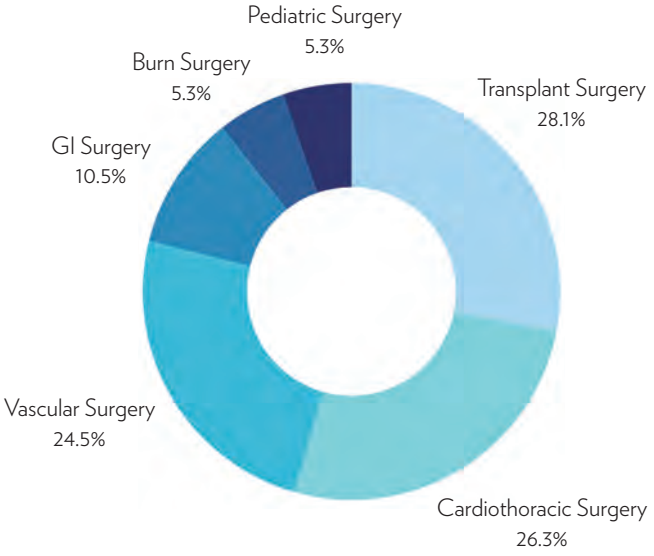
Burn surgeon Deepak Ozhathil, M.D., cardiothoracic surgeon Arman Kilic, M.D., and regenerative medicine researcher, Mindy Engevik, Ph.D., received the MUSC College of Medicine Translational Team Science award for their research *Using Next Generation Sequencing Technology, Machine Learning and Skin Organoids to Reshape Burn Care*. The award funding is $100,000 for two years, with the long-term goal of successfully competing for R01 support and proposals.

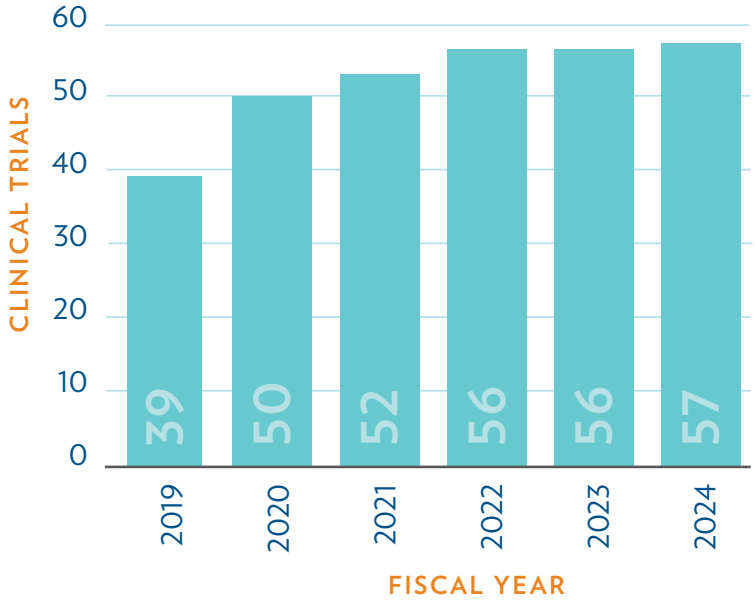
The College's Translational Team Science Program is designed to foster new collaborations between basic and practicing physician scientists by supporting new research teams to conduct initial studies and establish funded translational research programs. The expected outcome from the selected team is the submission of one competitive NIH R01 proposal (or equivalent), in two years and two publications.

If you are interested in learning more about how you can join our innovation acceleration by supporting a short or long term research fellowship, please contact ***Heather Parrish****, College of Medicine Development Director, at 843-792-4342 or parrishh@musc.edu.*

Surgical Outcomes Research and Innovation Nucleus (SORIN)

SORIN serves to foster the development, testing and implementation of innovative therapeutic and health services interventions aimed at improving outcomes in patients undergoing surgery at MUSC. The Department of Surgery has seen a steady increase in clinical trials over the past several years, with significant growth in industry-sponsored research and investigator-initiated clinical trials. We have a diverse and active portfolio that spans across most surgical disciplines housed within the Department of Surgery.





Meet the Leadership Team

David Taber, Pharm.D., MS
Director, SORIN

Morgan Overstreet, MS
Director, Research Administration

Deanna DeHoff
Program Manager, Clinical Trials

Saylor Hardin, MPH
Program Coordinator, Qualitative Research

With a major focus on expanding our industry-led and investigator-initiated clinical trials, we now have a new qualitative division, led by Saylor Hardin. She joined us upon completion of her MPH and has a robust background in public health, biostatistics and qualitative research. She is working closely with the thoracic oncology division to improve patient outcomes and optimize shared decision making. Deanna DeHoff now leads the clinical trials. She has been crucial to the growth over the past four years and brings a deep understanding of clinical trial management to the team.

Surgical Outcomes Research and Innovation Nucleus (SORIN)

MUSC RESEARCHERS AWARDED $3.1M FOR RESEARCH TO IMPROVE GRAFT SURVIVAL FOR AFRICAN AMERICAN KIDNEY TRANSPLANT RECIPIENTS

David Taber, Pharm.D., MS is the principal investigator on a $3.1M National Institutes of Health/ National Institute of Diabetes and Digestive and Kidney Diseases (NIH/NIDDK) study that aims to demonstrate an effective and efficient multimodal approach to improve long-term outcomes in African American kidney recipients while reducing health disparities.

The new study builds on two previous studies led by Taber. The first study assessed a technology-enabled, pharmacist-led intervention aimed at improving medication safety outcomes in kidney transplant recipients. A mobile health app and a comprehensive kidney transplant medication-monitoring dashboard were developed, tested, and found to be feasible and acceptable to patients. Once the proof of concept was developed and tested, Taber and his team conducted a single-center, 12-month, randomized controlled clinical trial funded by an AHRQ R18 grant. The study demonstrated that the pharmacist-led, mobile health-based intervention improved medication safety and reduced hospitalizations in kidney transplant recipients.

EXAMPLES OF CURRENT, HIGH-IMPACT CLINICAL TRIALS

David Taber, Pharm.D., MS	Multifaceted Intervention To Improve Graft outcome disparities in African American Kidney Transplants (MITIGAAT)
Mathew Wooster, M.D.	Zenith® Fenestrated+ Endovascular Graft Clinical Study
Sanford Zeigler, M.D.	A ProspEctive, Single ARm, Multi-center Clinical InveStigation to EValuatE the Safety and Effectiveness of AMDS in the TREatment of Acute DeBakey Type I Dissection: PERSEVERE
Thomas Curran, M.D., MPH	An Equity Focused Intervention to Improve Utilization in Guideline Concordant Extended Venous Thromboembolism Prophylaxis After Major Cancer Surgery

Our Services

We offer a full range of services from start to finish of your clinical trial. From trial feasibility assessment to study close-out, we can provide a detailed and comprehensive array of support to conduct your clinical trial in a safe and efficient manner. We also offer support in protocol development and post-trial publications for investigator-initiated, funded clinical trials.

Please contact **Morgan Overstreet, MS** at overstrm@musc.edu to learn more about how the Surgical Innovation Center can connect you with the appropriate resources.

Human-Centered Design

The Human-Centered Design (HCD) Program at MUSC creates novel solutions in the healthcare space to solve unmet medical needs for users such as patients and physicians. The Program engages with department surgeons, researchers, and trainees to understand gaps & support device innovation through the utilization of HCD principles.

The HCD Program trains surgical residents and medical students in design thinking, equipping them with the skillsets and tools to become medical innovators. Through collaboration with the Baker School of Business at the Citadel, the HCD Program integrates business development into the innovation workflow at MUSC. Each semester a new cohort of interdisciplinary MUSC students and surgical residents interested in human centered design principles have an opportunity to shadow surgical faculty, understand their pain points, and find a human-centered design solution. Working in collaboration with the Baker Business School at the Citadel, they learn how to make sure their solution is viable and sustainable from a business perspective and write a business plan and go-to-market strategy. Department of Surgery mentorship is a cornerstone of the program. This year's mentors and coaches included David Mahvi, M.D., Joshua Kim, MS, Mike Mallah, M.D., Adam Tanious, M.D., MMSc, Aaron Cunningham, M.D., Sarah VanNortwick, M.D., Bernice Huang, M.D., and Kristen Quinn, M.D., PGY-4.

HCD Programmatic Growth

In healthcare, design thinking and business development are crucial for innovation.

New this year, the HCD Program is building on the strong education platform that Joshua Kim, MS, the design director, has built. While the fall semester focuses on the ideation process, the spring semester now focuses on accelerators, which, in simplest terms, are resources to help startup companies reach their objective efficiently. Incorporating an accelerator program is paramount to the success of startups interested in engaging with medical technology companies and venture capitalists.

Doug Hamilton, an expert in business accelerators, joined MUSC as a program architect to lead the acceleration phase. Upon completion of the discovery phase for 13 ongoing and new projects, Hamilton successfully linked the teams and their intellectual property with industry professionals who can address their specific needs, regardless of the project's stage.

The professionals they are connected with, such as IP experts, legal advisors, prototypers, or FDA planning consultants, depend on the company's stage of development. This summer, the HCD program is hosting their inaugural demo day for six startup companies, all generated through the HCD Program. During the demo day, each company will have an opportunity to pitch their product to a team of venture capitalists and entrepreneurs who will give feedback to the teams and offer suggestions for funding these startups.

Our Services

We provide expertise in HCD thinking to support your innovative ideas.

Please contact **Joshua Kim, MS** at kimjos@musc.edu to learn more about how the Surgical Innovation Center can connect you with the appropriate resources.

BY THE NUMBERS

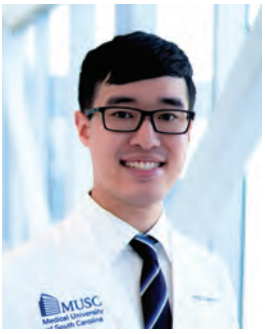
40+ Students since 2019

20 Projects

12+ Awards

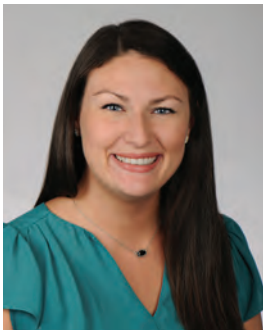
Meet the Leadership Team

David Mahvi, M.D.
Founder and Director



Joshua Kim, MS
Founder and Design Director

Doug Hamilton
Program Architect



Kristen Quinn, M.D.
MUSC Resident, HCD Champion

INNOVATIONS IN HEALTHCARE – HEARTBEAT TECH

HEARTBEAT TECHNOLOGIES

One of the first start-ups created through the HCD Program, Heartbeat Tech, has gained widespread recognition for The SAVER, a non-invasive vascular occlusion device aimed at improving CPR outcomes.

Heartbeat Tech has completed preliminary clinical trials on healthy controls, a large mammal study demonstrating efficacy, and is being funded through grant awards and private investors, with almost $200,000 raised. In FY23, CEO Kristen Quinn, M.D., PGY-4, received the MUSC Office of Innovation & Zucker Institute for Innovation Commercialization IDEA Technology Grant of $25,000 for The SAVER.

DESIGN PROGRAM DIRECTOR RECEIVES FUTURE MEDICAL LEADER AWARD

Joshua Kim, MS, was named the Future Medical Leader among the SC Biz News' 2023 Health Care Heroes. Kim, a second-year medical student, has served as Design Director for MUSC's Human-Centered Design Program, housed in the Department of Surgery's Harvey and Marcia Schiller Surgical Innovation Center, since 2019.

An innovator and designer, he has led the development of two dozen healthcare improvement projects that aim to boost the healthcare experiences of both patients and physicians.

MUSC
Medical University
of South Carolina

Thank You

The establishment of the Harvey and Marcia Schiller Surgical Innovation Center is made possible through a generous gift from sports executive and retired U.S. Air Force Brigadier General Harvey Schiller and his wife, Marcia.

Our ability to facilitate the creation of both personalized treatment plans and usable and innovative products that make healthcare better and more efficient can only be made possible through the support of our partners and donors.

Because of you, we will transform how surgery is performed, improve clinical care, and decrease costs for patients in South Carolina and across the United States.

To learn more about how you can help change what's possible for patient care through supporting surgical innovation, please contact Heather Parrish, College of Medicine Development Director at 843-792-4342 or parrishh@musc.edu.