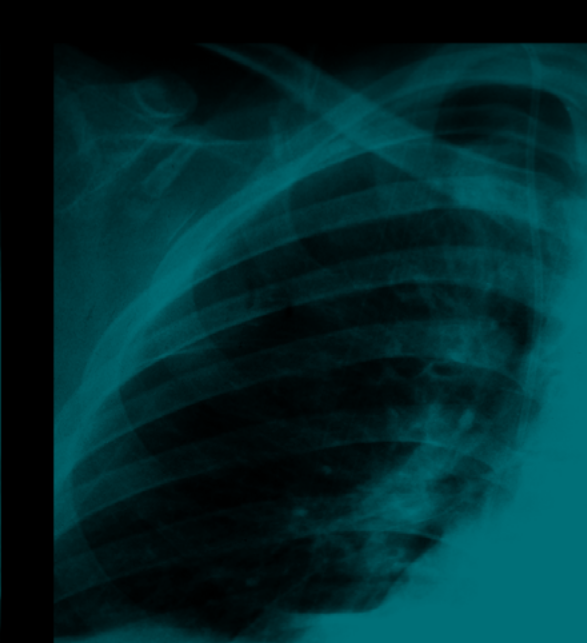
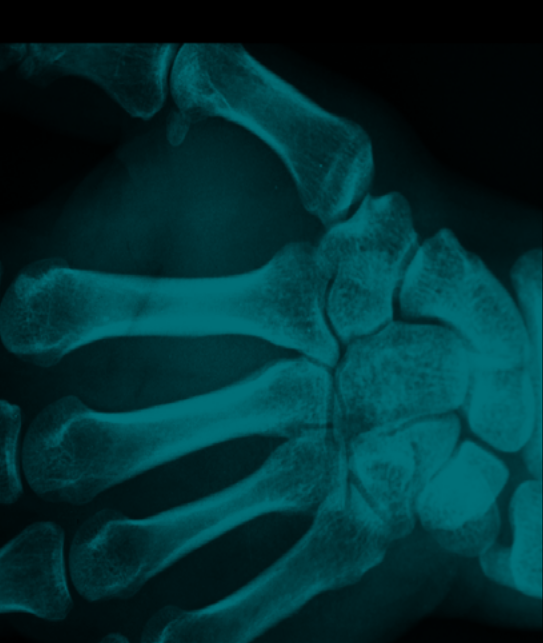
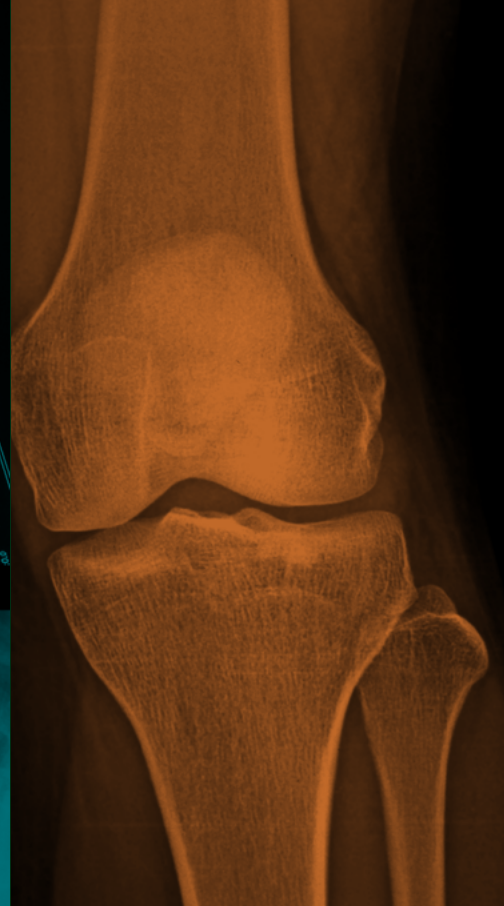




Atrium Health
Musculoskeletal Institute



Highlights Report

2020

President's Report



Claude T.
Moorman, III, MD

DEAR COLLEAGUES,

While this past year brought extraordinary challenges, there have been many silver linings as we've progressed toward our vision of being the first and best choice for musculoskeletal care in the Southeast and nationwide.

When we opened Atrium Health Musculoskeletal Institute (MSKI) in 2018, it represented an innovative new model of integrated care. We brought together more than 200 renowned physicians across 3 world-class organizations – Atrium Health, Carolina Neurosurgery & Spine Associates and OrthoCarolina – in a unique collaboration that enables patients to get fast, quality, comprehensive, multidisciplinary care. We've seen tremendous growth thus far, and we're pleased to update you on our progress in 3 core areas.

Clinical Care: We have continued recording high patient satisfaction scores and our outcomes are on par with other top musculoskeletal centers. US News & World Report rated us as the best orthopaedic program in the region, and a recent consumer study shows that consumers prefer us.

This year, we took another step forward when we moved into MSKI's new headquarters at Atrium Health Mercy, a facility of Atrium Health Carolinas Medical Center. This move is part of a \$121 million investment that is transforming Atrium Health Mercy into the Southeast's premier destination for musculoskeletal care. The new facility will enable seamless care and collaboration across disciplines, and we are extraordinarily grateful to Atrium Health for making this investment and supporting our vision.

Education: Our orthopaedic surgery and neurosurgery residency programs remain among the nation's most sought-after training programs. This past year, residents in these programs collectively published more than 50 peer-reviewed publications and delivered 48 presentations at regional and national conferences.



Research: In 2020, our investigators were awarded \$6 million in new grants. And we achieved key milestones that illustrate how our research enterprise continues to expand and prosper.

MSKI and OrthoCarolina researchers are now involved in 40 active studies in hip and knee reconstruction. We established a new Periprosthetic Joint Infection Center that is launching high-quality clinical research and developing evidence-based protocols. And we made progress toward mitigating opioid abuse, by developing tools that are integrated with electronic health records to detect evidence-based risk factors.

Our advances in these areas is especially remarkable given the challenges posed by COVID-19. MSKI staff, residents and physicians all found innovative ways to continue collaborating and providing exceptional care. What's more, fully 100% of MSKI providers and staff volunteered to be redeployed to assist Atrium Health's COVID-19 work as MSKI took the lead in facilitating

testing and vaccinations. It has been enormously gratifying and humbling to witness our team's resilience and commitment to patients.

We couldn't be more proud of our achievements and we're eager for you to learn more about them in the pages ahead.

Claude "T." Moorman III, MD
President, Atrium Health Musculoskeletal Institute

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By the Numbers



Atrium Health Musculoskeletal Institute
(MSKI) practice visits in 2020

97,014

2020 surgical volumes at MSKI facilities

Ambulatory surgery center:

12,115

Hospital:

21,227

Total procedures

33,342

MSKI, Carolina Neurosurgery & Spine Associates, OrthoCarolina Research Institute (OCRI)

68 Prospective research studies

50+ Presentations at scientific meetings

190+ Peer-reviewed publications
(30% increase over 2019)

Neurological Surgery Residency Program

2014 First year of Atrium Health Carolinas
Medical Center Neurological
Surgery Residency Program

3 Book chapters co-authored by
residents

7 Residents in the program

13 Conference presentations by
residents in 2020

1 Each resident has published 1 peer-
reviewed paper in 2020

1 Work room completed to create
space for resident academic
and clinical productivity

8 Peer-reviewed publications
authored by residents in 2020

1 Resident recognized at the White
House for COVID-response efforts
(see page 32)

Orthopaedic Surgery Residency Program

26 Residents

35 Conference presentations

43 Peer-reviewed publications
authored by residents

1 Grant, received by Olivia Rice,
MD, (PGY-2) for her project "Use
of Noninvasive Technologies in the
Diagnosis of Surgical Site Infection
After Musculoskeletal Trauma" (see
page 27)

2 Book chapters co-authored by
residents

New Hires, Appointments & Retirement Recognition

Meet Our Newest Faculty Members

Atrium Health Musculoskeletal Institute (MSKI)

PHYSICIANS:



Eric T. Warren, MD
Sports Medicine in
Waxhaw, NC



Luke S. Harmer, MD
Orthopaedic Surgery in
Concord, NC

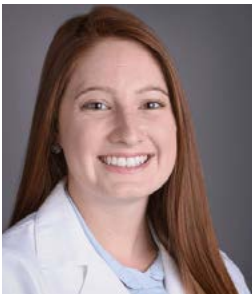


Laura E. Blum, MD
Orthopaedic Surgery in
Concord, NC



Kevin S. Weiss, DO
Orthopaedic Surgery in
Rock Hill, SC

ADVANCED PRACTICE PROVIDERS:



Cara L. Longietti, PA
Orthopaedic Surgery in
Charlotte, NC



Rebecca Haug, PA
Orthopaedic Surgery in
Charlotte, NC



Elizabeth S. McLean, PA
Orthopaedic Surgery in
Charlotte, NC



**Kaitlyn G. Muldoon, PA-C,
ATC**
Orthopaedic Surgery in
Concord, NC



Victoria S. Cleveland, PA
Orthopaedic Surgery in
Concord, NC

Carolina Neurosurgery & Spine Associates



Daniel P. Leas, MD
Orthopaedic Spine in
Charlotte and Lake
Norman region, NC



Michael Bohl, MD
Neurosurgery & Spine in
Charlotte, NC



**Jonathan G.
Thomas, MD,
FAANS**
Neurosurgery & Spine in
Greensboro, NC



**Thomas
Ostergard,
MD, MS**
Neurosurgery & Spine in
Greensboro, NC

OrthoCarolina



**Anthony
J. Kwon, MD**
Orthopaedic Spine
in Charlotte and Pineville,
NC



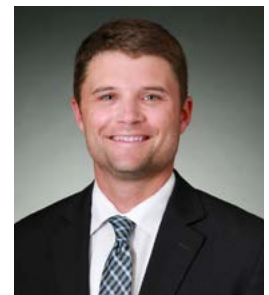
**Matthew C.
Wendt, MD**
Orthopaedic Surgery in
Rock Hill, SC



**Samuel
E. Ford, MD**
Foot & Ankle Institute in
Charlotte, NC



**Jonathan
C. Riboh, MD**
Sports Medicine in
Charlotte, NC



**Michael
O'Connell, DO**
Physiatry in
Concord, NC



**Benjamin M.
Wooster, MD**
Hip and Knee in Charlotte,
NC



**Briggs
M. Ahearn, MD**
Sports Medicine in
Pineville, NC



Mark A. Katz, MD
Hand, Upper Extremity in
Hickory, NC



**Alex V. Boiwka,
MD, MS**
Hip and Knee in Concord,
NC



Honoring Michael Bosse, MD, for an Outstanding Career

In June, Michael Bosse, MD, received the Edward N. Hanley Award for excellence in resident education. Dr. Bosse retired from MSKI at the end of July and was appointed professor emeritus of Orthopaedic Surgery. He enjoyed a distinguished career serving the orthopaedic trauma team, patients and learners for nearly 30 years.

His success in research is almost unsurpassed in our system's history – Dr. Bosse's work led to just under

200 publications, 17 book chapters, over \$130 million in grant funding, 2 patents and 1 patent pending. Perhaps most impressive was his role in assembling a research network of the nation's top trauma centers, which led to collaborative efforts on the Lower Extremity Assessment Project (LEAP) and the Major Extremity Trauma and Rehabilitation Consortium (METRC).

Dr. Bosse will continue his grant activity at MSKI. We thank him for his numerous contributions!

Celebrating Jerry Petty, MD, for Extraordinary Achievements

A true pioneer and foundational member of Charlotte's modern medical community, as well as one of the nation's most distinguished neurosurgeons, Jerry Petty, MD, was retiring. After positively impacting tens of thousands of patients, Dr. Petty was stepping away from the role he has had since 1968 at Carolina Neurosurgery & Spine Associates.

Dr. Petty's 53-year career spanned the evolution of medicine's most technology-driven specialty. Just 50 years ago, no direct imaging of the brain was available. That reality necessitated Dr. Petty and his colleagues to rely primarily on detailed neurological examinations, intuition, experience and rudimentary techniques to make diagnoses.

In 1974, Dr. Petty successfully led a program to obtain CT (computed tomography) technology for

both Charlotte Memorial Hospital (now Atrium Health Carolinas Medical Center) and Charlotte Neurosurgical (now Carolina Neurosurgery & Spine Associates). He catalyzed the spirit of innovation that has allowed thousands of patients to access the world's most advanced care.

Dr. Petty developed a well-earned reputation as a skilled diagnostician, a technically gifted surgeon, a consummate professional, a tireless advocate for underserved healthcare populations and a champion for fairness, perspective and reason. He received numerous awards, including the Southern Neurosurgical Society Distinguished Practitioner Award and the Bill France NASCAR Award of Excellence.

His daily presence within our medical community will be sorely missed.



Quality & Operations Report

A Letter From Our Vice Chair

Fueling New Quality Improvements



Joseph Hsu, MD

Atrium Health Musculoskeletal Institute (MSKI), Carolina Neurosurgery & Spine Associates and OrthoCarolina understand that every patient deserves care that helps them get back to normal life as quickly as possible and minimizes complications and readmissions. That's why we built one of the nation's most robust quality improvement programs. We are extraordinarily excited about this program's potential to continue improving care for patients.

Our quality improvement efforts include:

- **Comprehensive registry work:** Our faculty are national leaders in establishing quality registries and in registry enrollment. We have dedicated registry teams that help collect data from patient-reported outcome measures.
- **A detailed readmission registry:** This captures nuanced, detailed data that helps us understand what causes readmissions and has enabled us to achieve readmission rates that are far below the national average.

- **A database of 60 million patient encounters:** This includes patient-reported outcome measures for patients undergoing a wide variety of surgeries. A data set this large enables us to pinpoint patterns and insights that fuel improvement.
- **Dedicated pathways for hip, knee and spine patients:** These help us decrease variance in care, uncover potential patient risks, improve patient experience and make care more cost-effective.
- **A new concierge pathway:** This supports patients who want to travel to MSKI facilities. We also partner with commercial insurance groups to bring patients here for optimized surgeries.

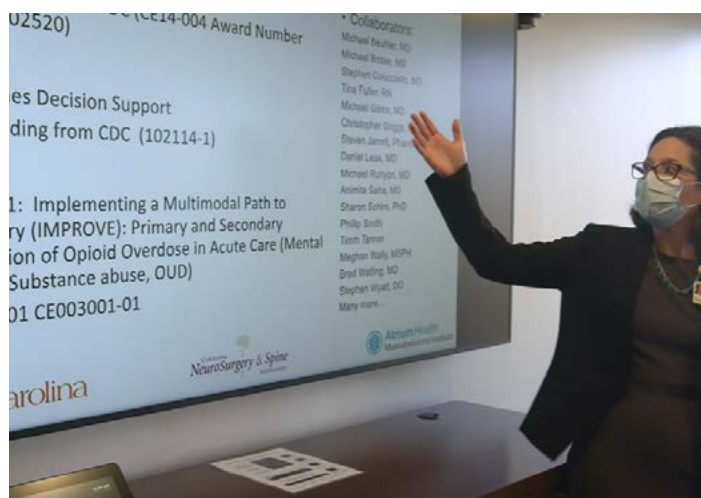
A handwritten signature in black ink, appearing to read 'J. Hsu'.

Joseph Hsu, MD
Vice Chair of Quality
Atrium Health Musculoskeletal Institute

Digital Tools to Address the Opioid Crisis

Researchers in the Department of Orthopaedic Surgery have developed 2 tools that are integrated with electronic health records and monitor evidence-based risk factors for opioid or benzodiazepine abuse. The tools, which run silently in the background, alert clinicians if a patient is at risk. The development of these platforms – Prescription Reporting with Immediate Medication Utilization Mapping (PRIMUM) and Implementing a Multimodal Path to Recovery (IMPROVE) – was funded by CDC grants.

“We wanted to create useable tools, not just for orthopaedic surgeons but for clinicians in many areas who help patients manage pain,” says co-developer Joseph Hsu, MD, MSKI’s vice chair of quality. “PRIMUM runs logic in the background when a prescriber starts an opioid or benzodiazepine prescription. Opioids have gotten all the headlines, but my colleagues and I could tell from the numbers back in 2013-14 that benzodiazepines were going to be a problem, and that’s proven true.”



PRIMUM monitors for 5 risk factors that may indicate misuse, abuse or diversion of prescription opioids and benzodiazepines:

- Early refill of a current prescription (i.e., with >50% remaining)
- 2 or more emergency or urgent care visits with on-site opioid treatment within the past 30 days
- 3 or more opioid/benzodiazepine prescriptions within the past 30 days
- Past opioid or benzodiazepine overdose
- A positive toxicology screen for blood alcohol, cocaine or marijuana

The platform is fully integrated into a normal workflow, so there’s nothing extra the physician has to do. If a patient does not have any risk factors, the doctor won’t even know it’s running. If there are risk factors, an alert pops up when a prescription is started. In response, prescribers have the option to continue, modify or cancel the prescription.

IMPROVE

According to Atrium Health data, PRIMUM generates alerts in nearly 25% of patient encounters where an opioid or benzodiazepine is prescribed – and physician decision-making is affected in about 20% of those alerts. The system prevented 43,000 high-risk prescriptions in the first 6 months of its rollout.

“Any doctor in any location can benefit – outpatient, emergency departments, rehabilitation, inpatient care, and hybrid facilities in urban, suburban and rural settings,” says co-developer Rachel Seymour, PhD, vice chair of research at MSKI.

Atrium Health received additional CDC funding to develop IMPROVE for use in acute care. The aim is to identify risk factors for opioid dependence, including alcohol use and mental health issues, and provide doctors with actionable information regarding pain management alternatives.

“Patients who are taking prescription opioids 2 weeks after they’re prescribed are at the greatest risk for still taking them 5 years later,” says Dr. Seymour. “This entry into pain management is a critical time.”

The IMPROVE platform offers thorough guidance for physicians on alternative strategies, including non-opioid medications, cryotherapy and cognitive therapy. The goal is not only to reduce reliance on opioid monotherapy but also to measure whether such an intervention will reduce the number, dose and duration of opioid prescriptions on a larger scale.

“The challenge is that people don’t realize there are non-pharmacological options because we’re a pill-centered country,” Dr. Hsu says. “My colleagues and I have dug deep into the strategies that are safe and effective. With IMPROVE, we didn’t just want to call out a patient’s risk and not do anything about it – we wanted to offer effective alternatives.”

The team hopes more facilities will take advantage of these platforms as they accrue data and expand capabilities.

“Our goal has always been to give them away for free,” Dr. Hsu says. “This is not an Atrium Health thing, it’s a public health thing.”





Carolina Neurosurgery & Spine Associates: Innovative Spine Outcomes Registry

Carolina Neurosurgery & Spine Associates continues leading outcomes research through the American Spine Registry (ASR), a combined effort of the AANS (American Association of Neurological Surgeons) and the AAOS (American Academy of Orthopaedic Surgeons). Anthony Asher, MD, FACS, neurosurgeon at Carolina Neurosurgery & Spine Associates, serves as the ASR's co-director, and Dom Coric, MD, neurosurgeon at Carolina Neurosurgery & Spine Associates, serves on the ASR Data Use Committee.

The ASR offers a variety of data reuse opportunities. These include requirements for quality initiatives and state collaboratives such as the Joint Commission's Advanced Certification in Spine Surgery.

The registry drives improvements in outcomes data and will now include COVID-19 information. Through this work, Carolina Neurosurgery & Spine Associates is helping lead the nation in developing standards for spine surgery.

World-Class Recognition & Clinical Innovation

Transformative Limb Deformity Care

Through multidisciplinary care and research, Atrium Health Musculoskeletal Institute's (MSKI) Limb Deformity Program helps patients with severe injuries and congenital abnormalities achieve their goals – often by translating military medical advances to the civilian sector. Our program includes:

Return to Performance Pathway Program

Many patients can't resume normal activities after either severe lower extremity injuries or less severe injuries that result in ankle fusion or ankle arthritis. Our Return to Performance Pathway Program is designed to help these patients resume pre-injury activities and to prevent late amputations.

Based on a military pathway, the Return to Performance Pathway Program's rehabilitation element focuses on self-efficacy by helping patients build confidence. As patients move through rehabilitation, we match them with an innovative carbon-fiber brace that was pioneered by the military and refined by our team. The brace is highly effective, and we make it accessible to patients regardless of socioeconomic status.

“Our collaboration with OrthoCarolina’s foot and ankle team was pivotal in creating this program, and we’re seeing patients travel here just for it,”

Dr. Hsu says.





Osseointegration for Upper and Lower Extremities

MSKI's Osseointegration Limb Replacement Program has emerged as a national leader since being launched in 2019.

Dr. Hsu spearheaded this program after learning osseointegration during his military service, and he is one of the nation's most experienced osseointegration experts. Osseointegration can help patients even after bilateral, triple and quadruple amputations.

Dr. Hsu and his colleagues offer some of the world's most advanced prosthetics, including the latest technologies available under the FDA humanitarian device exemption. They also work closely with the Department of Defense to evaluate promising new devices.

The program will reach another milestone in 2021 by becoming one of only a handful of programs offering upper and lower extremity osseointegration.

“We also offer world-class nerve management care and osseointegration in a way that’s covered by insurance, which can prevent tremendous out-of-pocket expenses,”

Dr. Hsu says.

Comprehensive Care Via Cross-Disciplinary Collaboration

Whether patients need support getting used to their new prosthetic or help navigating moral injury and burnout, we're here for them.

Our team includes:

Joseph Hsu, MD
Orthopaedic Surgeon

Angela Abernethy, PT, CBIS
Physical Therapist

Amber Stanley, BSPH
Patient Navigator

Patricia (Tricia) Azra, RDN, CSSD, LDN
Registered Dietitian Nutritionist

Doug Thommen, MD
Physical Medicine and Rehabilitation

Patricia (Tricia) Azra, RDN, CSSD, LDN
Registered Dietitian Nutritionist

Michael Jenks, CPO
Lead Prosthetist

Erica Grochowski, MSPH
Health Education

Deborah Cordell, MS, LCMHCS
Psychotherapist





MSKI: How Innovative Treatment Saved a Patient's Leg

Matthew Eaker underwent 23 surgeries after a tragic motorcycle accident in 2015 – but his right leg wasn't functional and amputation was likely. That's when Matthew came to see Dr. Hsu.

"Before he came to me, he had surgery by good surgeons, but complications led to a significant bone and soft tissue defect," Dr. Hsu says. "More challenging than that, the skin scarred into the bone gap – a secondary intention granulation – so there was no soft tissue coverage besides the scar at the bottom half of Matthew's leg."

Dr. Hsu and Matthew embarked on an innovative, 2-year treatment journey that generated new bone by

gradual distraction to Matthew's leg and bent his bone to help close the wound. Matthew had to live with a curved leg for months as the bone straightened and the wound healed. His persistence paid off: He is using both legs, walking with a single crutch and getting stronger every day.

"This was a huge team effort," says Dr. Hsu. "People like Matthew motivate us to keep going. What they don't realize is that their motivation and resilience and perseverance does more for us than we possibly could have done for them."

OrthoCarolina: Restoring Hand Function to an Active-Duty Soldier

When U.S. Army Private Jackson Schroeder suffered a partial hand amputation, OrthoCarolina's Glen Gaston, MD, and Bryan Loeffler, MD, partnered on treatment with the U.S. Army's Regional Health Command. Drs. Gaston and Loeffler used the starfish procedure – which they pioneered – to help this soldier re-establish digital control and regain hand function.

“This procedure offers hope after traumatic extremity injuries, and it’s an honor to help soldiers serve our country,” Dr. Loeffler says.



OrthoCarolina Study: People Born Without Hands Can Control Prosthetics Without Surgery

OrthoCarolina's Michael Gart, MD, and Drs. Loeffler and Gaston have discovered that people born without a hand can control a prosthetic device using only their mind.

Targeted muscle reinnervation (TMR) is a surgery that's extensively performed and researched at OrthoCarolina. It transplants nerves and allows them to reinnervate another muscle.

“We wanted to find out if children and adults born without a hand need to have TMR surgery to operate a prosthetic hand,” Dr. Loeffler says.

The team's research – done in conjunction with Brian Kaluf, a prosthetist from Ability Prosthetics & Orthotics – concluded that the upper extremities in both children and adults could reliably reproduce unique muscle contraction patterns that correspond to a variety of wrist and hand movements.

“We found that patients born without a hand can be highly functional with a myoelectric prosthetic hand and don't require TMR since they possess the ability to control a myoelectric prosthesis,” Dr. Gart says.

The study was presented at the American Society for Surgery of the Hand meeting in 2019.

Carolina Neurosurgery & Spine Associates: Pioneering Minimally Invasive, Single-Position Spinal Surgery

Some patients with complex lumbar spinal problems have historically needed surgery from multiple approaches to achieve lower back stability. These procedures typically require longer operation times, significant muscle cutting and larger incisions – often leading to significant side effects and slow recoveries.

Paul Kim, MD, chief of neurosurgery at Atrium Health Carolinas Medical Center and Carolina Neurosurgery & Spine Associates neurosurgeon, has been at the forefront of utilizing a single-position approach for complex lumbar surgery, using minimally invasive techniques and next-generation spinal navigation, all in a single procedure.

“This is leading to reduced operating time, faster recovery and better outcomes,” says Dr. Kim.

Dr. Kim and Frank Arko, MD, chief of vascular surgery at Atrium Health Sanger Heart & Vascular Institute, have used advanced spinal navigation technology to enable doing anterior lumbar interbody fusion surgery and other lumbar spine surgeries from a lateral approach, using minimally invasive techniques and spinal navigation with robotic technology.

“A lateral approach means we don’t have to reposition and re-drape the patient – which nearly cuts operating time in half,” Dr. Kim says.

Spinal navigation and robotics allow surgeons to make tiny incisions and navigate to exactly where screws need to be placed.

“We can pinpoint the location down to the millimeter and place screws more safely,” Dr. Kim says. “We have been able to incorporate novel spinal approaches with skilled colleagues and cutting-edge technology to significantly reduce surgery time and improve patient outcomes.”

Key Benefits

- Eliminates the challenges and risks of repositioning a patient
- Lowers infection risk
- Requires smaller dissection window
- Reduces radiation exposure by using spinal navigation instead of live fluoroscopy to place screws
- Reduces need for EMG monitoring
- Reduces surgery cost and blood loss

A Path to a Pain-Free Life

For years, Peggy Nelson endured severe lower back pain that made it hard to walk, stand or sit. Multiple spine injections didn’t help. She was eventually referred to Dr. Kim for surgery.

Peggy had minimally invasive anterior/posterior surgery. She was sitting up the next day – and felt so good that she drove herself back to South Carolina a few days later.

“Surgery wasn’t really that hard for me. Dr. Kim and his staff were remarkable. After just a few months, I’m fully recovered and have no pain!”

shared Peggy, patient of Dr. Kim’s.

Another Successful Year of Co-Management

MSKI, Carolina Neurosurgery & Spine Associates and OrthoCarolina completed a second year of co-management focusing on hip/knee and spine care across Atrium Health metro Charlotte hospitals. Physician leaders from all 3 organizations continued their focus on clinical standardization, resulting in improved quality outcomes and significant efficiencies across 6 hospitals for spine and 8 hospitals for hip/knee. This year's milestones include:

- **Patient education:** Providers developed materials that support comprehensive education that starts in the ambulatory clinic and carries through to a safe discharge home. The teams also successfully created discharge instructions tailored to hip/knee and spine care to ensure patients have consistent messaging from before surgery until they get home.
 - This is particularly significant during the COVID-19 pandemic, when education and patient outreach has been limited to virtual teaching. The spine surgeon team developed updated virtual education materials to help prepare patients for a strong recovery.
- **Best practices for hip/knee discharge disposition and anesthesia techniques:** A team led by John Masonis, MD, developed a pre-operative discharge disposition predictor tool. This assists in creating a shared, patient-specific discharge goal for multidisciplinary teams as patients recover from surgery.
 - Another hip/knee team, led by Walter Beaver Jr., MD, worked closely with anesthesia colleagues to review anesthetic technique research and create best practice standards.
 - Other hip/knee teams, led by Bo Mason, MD, Bryan Springer, MD, Michael Bates, MD, and Ryan Bunch, MD, drove continued improvement in readmission reduction, adherence to patient optimization expectations and utilization of standardized power plans.
- **Optimizing post-surgical outcomes:** A spine team directed by Anthony Asher, MD, and Brad Segebarth, MD, defined and piloted pre-surgical optimization criteria – including BMI, smoking cessation, diabetic management, osteopenia and nutritional care. Paul Kim, MD, led another team that identified key criteria for enhanced recovery after spine surgery.
- **Defining outcome criteria:** Dr. Kim led a multidisciplinary workgroup with partners in anesthesia and surgery on a pilot project to define key criteria for successful surgical outcomes for spine patients at Atrium Health Mercy, a facility of Carolinas Medical Center. These criteria include multimodal pain control, minimized blood loss and early mobility. This work leverages strong Enhanced Recovery After Surgery (ERAS®) work in the orthopaedic total joint space and translates to our spine patient population.
- **Identifying value-based initiatives:** A committee led by Matt McGirt, MD, is identifying value-based initiatives within spine care. This team is using billing data to identify the number of levels involved in surgery to understand spine surgery complexity.

New Bone Health Center Established

Atrium Health's Department of Orthopaedic Surgery has established the Atrium Health MSKI Bone Health Center (BHC) under the guidance of trauma surgeon Madhav Karunakar, MD, after he recognized the need for post-fracture osteoporosis care in our region.

"Patients who sustain a fragility fracture have up to 50% increased risk for future fragility fractures, yet fewer than 20% receive evaluation or treatment," he says.

The new BHC provides an integrated follow-up program focused on treatment and management through identification of patients, investigation of pathology, and initiation of lifestyle changes or medication. The center will be managed by Jo-Ann Holzinger, FNP, who sees this initiative as essential to improving care and reducing secondary fractures.

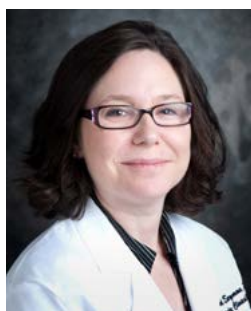
The BHC staff will provide a comprehensive evaluation to identify each patient's risk factors, utilizing detailed history and laboratory tests. These findings will be used to develop personalized, multidisciplinary bone health treatment programs that include education, lifestyle modification recommendations and physical therapy.

"Every fragility fracture provides an important teaching moment for our patients," Holzinger says. "Our treatment and education will help them live their best life."



Research Report

A Letter From Our Vice Chair



Rachel Seymour, PhD

Key Research Advances Over the Past Year

Research is best as a team sport, and Atrium Health Musculoskeletal Institute (MSKI), Carolina Neurosurgery & Spine Associates and OrthoCarolina demonstrated that yet again this past year. We made significant progress by leveraging the tremendous opportunity of having leaders and learners collaborate across our organizations.

Our investigators were excited to publish over 190 peer-reviewed manuscripts this year; approximately 40% included at least 1 learner. Although this year's scientific meetings were conducted virtually, our teams were still able to have over 60 presentations at international, national and regional conferences. Along the way, our team:

- Contributed to emerging knowledge on COVID-19 by publishing over 5 peer-reviewed papers examining unique care models launched to serve patients during the pandemic.
- Leveraged the opportunity to formally launch “tiered-team research.” This collaborative model involving investigators, research staff and trainees is employed to maximize

academic productivity. We established teams to focus on nonunion, infection, pelvic fractures, calcaneus fractures, falls prevention and the COVID-19 response.

- Made great strides in scaling high-impact clinical research topic areas of pain management, limb lengthening and deformity, and periprosthetic joint infection throughout our system. Notably, we made significant progress on a registry of 20 years of periprosthetic joint infection care.
- Launched collaborative translational research programs in spine, infection and sports medicine.

Looking forward, we see that our research infrastructure provides the foundation and leadership to answer critical questions for improving care delivery and outcomes.

Rachel Seymour, PhD
Vice Chair of Research
Atrium Health Musculoskeletal Institute

MSKI: Investigating Ways to Optimize Performance and Prevent Injury

Timothy C. Sell, PT, PhD, recently joined MSKI from Duke University. He will be a director within MSKI, focusing his work on athletes and with the Carolina Panthers.



Timothy C. Sell,
PT, PhD

Dr. Sell and his team have begun supporting the Panthers through player testing of eccentric hamstring strength, lower extremity power and jump height performance. This data can be utilized for individualized injury prevention, performance optimization and return-to-sport testing.

Much of Dr. Sell's work is dedicated to his Department of Defense-funded project examining effects of head-supported mass on cervical spine biomechanics and injury risk in special forces operators. This

3-year, \$2.15 million grant is a partnership with Duke University, the U.S. Army Aeromedical Research Laboratory and a unit of special forces combat soldiers. The objectives are to determine the chronic effects of repeated loading from head-supported mass and assess intervertebral stresses through biomechanics modeling. This will help provide mitigation strategies, injury prevention programs, equipment design guidelines and other injury countermeasures.

MSKI: Welcoming Dr. Lu and the McColl-Lockwood Lab Team

We are pleased to announce that the McColl-Lockwood Laboratory for Muscular Dystrophy Research has joined MSKI.

The lab is supported by the Carolinas Muscular Dystrophy Research Endowment. This endowment was initiated by a donation from Hugh McColl Jr. and his family. It supports research for select types of muscular dystrophy, particularly limb girdle. The McColl-Lockwood lab is pursuing this research and is directed by Qi Long Lu, MD, PhD, who is known internationally for his work in this area.

The lab's mission is to develop experimental therapies for muscular dystrophies and to facilitate translation of experimental therapies to clinical trials. The lab has established unique cell culture and animal models representing FKR mutations. These models help researchers understand disease mechanisms and progression and help develop experimental therapies. The lab is collaborating with biotech companies to move these therapies to clinical trials.



New Muscular Dystrophy Association Grant

The McColl-Lockwood Laboratory for Muscular Dystrophy Research and Anthony Blaeser, PhD, research assistant professor in Atrium Health's Department of Orthopaedic Surgery, received a 2-year, \$350,000 grant from the Muscular Dystrophy Association to examine cardiac regeneration in the lab's FKRP mutant mouse model.

The roadblocks to cardiac muscle repair are the muscle's limited regeneration capacity and inclination to fibrosis. The FKRP mutant mice are defective in glycosylated alpha-dystroglycan (G- α -DG). The lab previously demonstrated that G- α -DG is only detected in regenerating cardiac muscle cells. This makes it a useful tool in examining therapeutics targeting cardiac muscle regeneration.

The study's first aim is to establish the FKRP mutant mouse as an in vivo model to study cardiomyocyte regeneration. This builds on the lab's recent findings that ribitol strongly targets cardiac muscle with reduced fibrosis and has a positive effect on proliferation in vitro. This latest study will examine whether ribitol could improve recovery by increasing cardiomyocyte proliferation while also potentially reducing cardiac degeneration and fibrosis.

Carolina Neurosurgery & Spine Associates: A Motion-Preserving Alternative to Lumbar Fusion

Historically, fusion surgery is the only option for patients with stenosis and spondylolisthesis – but this eliminates motion from that area of the spine.

“Eliminating motion defeats the purpose of having a disc to begin with – and some folks who initially do well after fusion experience adjacent level degeneration and need another operation,” says Dr. Coric.

Dr. Coric is testing a potential solution as the lead investigator for the Total Posterior Spine System (TOPS™) clinical trial. Under an investigational device exemption, his team is examining a mechanical implant that mimics the motion of a healthy facet joint.

Carolina Neurosurgery & Spine Associates is the study's largest enroller.

“With tops, you can accomplish a similar decompression of the nerves to relieve the stenosis, but you have the artificial joint that provides motion,” Dr. Coric says. “We hypothesize that this will lead to fewer problems with adjacent level degeneration and subsequent operations.”



Orthopaedic Investigators Receive Grant Awards

OrthoCarolina: Peripheral Nerve Injuries

Glenn Gaston, MD, has partnered with the Major Extremity Trauma and Rehabilitation Consortium (METRC) over the last several years on a study of peripheral nerve injuries. The preliminary data reveal trends in managing these devastating injuries, including regional variations. The research aims in part to identify outcomes differences in primary nerve repair, nerve autografts, nerve allografts and nerve transfers.

Recent bench research has found polyethylene glycol (PEG) mediated cell fusion as a novel way to treat acute nerve injury. Typically, when a nerve is cut it undergoes Wallerian degeneration. With PEG fusion, an acutely severed nerve can fuse nerves back together and thus prevent Wallerian degeneration and halt the nerve damage. This has tremendous potential to revolutionize peripheral nerve injury management.

The team has been awarded a \$3 million grant from the Department of Defense for the first major clinical trial of PEG fusion. The trial will span 6 sites with Jamie Shores, MD, of Johns Hopkins University as principal investigator. Dr. Gaston is co-principal investigator and will lead enrollment in Charlotte.

MSKI: Non-Invasive Diagnosis of Surgical Site Infection

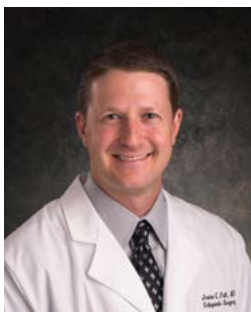
Olivia Rice, MD, (PGY-R), was awarded a resident research grant of \$9,500 by the Orthopaedic Trauma Association (OTA) for a study titled “Use of Non-invasive Technologies in the Diagnosis of Surgical Site Infection (SSI) after Musculoskeletal Trauma.” Co-investigators include Joseph Hsu, MD, Madhav Karunakar, MD, and Rachel Seymour, PhD. This grant is highly competitive: 36 applications were reviewed and only 5 were funded.

This prospective observational study will enroll patients undergoing operative treatment of lower extremity fractures (knee and below) at high risk for infection. Subjects’ surgical incisions will be evaluated using ultrasound and infrared thermography. The study aims to determine whether these non-invasive, non-radiating technologies help diagnose SSI.

Dr. Rice was also selected by the Limb Lengthening and Reconstruction Society as their 2020 participant in the Clinician Scholar Career Development Program. Dr. Hsu nominated Dr. Rice for this program.

Education Report

A Letter From Our Vice Chair



**Joshua C. Patt,
MD, MPH, FAOA**

Providing World-Class Education Throughout the Pandemic

We are incredibly proud of how Atrium Health Musculoskeletal Institute (MSKI) residents, fellows and educators have responded to the challenges posed by the past year – we can't say enough about their amazing sacrifices and efforts.

When the medical center was closed for elective surgery, the residents were reassigned to rotating teams that provided uninterrupted acute inpatient care and necessary outpatient care, including virtual care for trauma patients. The subspecialty services were supported by MSKI, Carolina Neurosurgery & Spine Associates and OrthoCarolina fellows and attendings as they shifted to more urgent and emergent care.

Our educators and learners rapidly assimilated to a new remote world – virtual learning is now an integral part of our education. All of our regularly scheduled

educational conferences were moved to a virtual platform, and our faculty stepped up and provided an endless number of educational opportunities.

Some were offered at a national level. For example, Bryan Springer, MD, and other hip and knee team leaders participated in the American Association of Hip and Knee Surgeons' Fellows Online COVID-19 learning initiative.

As an example of our residents' innovative ideas, Nick Johnson, MD, and Aaron Brandt, MD, organized an evening Zoom call with 18 faculty members for a panel discussion on how to pick a fellowship and build a satisfying career.

We have continued to engage and learn with an online lecture series each Thursday morning. Our lectures are viewable on Zoom, and we record and publish the conferences on our YouTube channel.



We also hosted our first virtual visiting professor: The legendary Augustus White, MD, PhD, joined us from Boston to give a lecture titled “What Dr. Martin Luther King, Jr. Would Want Us to Know About Healthcare Disparities.” His talk was well-received and generated much discussion.

Despite the pandemic’s challenges, we graduated 4 excellent chief residents and 20 fellows. And in the spirit of “the show must go on,” July and August saw the on-boarding of 6 new orthopaedic residents and 20 fellows. The new academic year also saw our Neurological Surgery Residency Program welcome its seventh resident, giving them their first full resident

complement as they will have their first graduate, Tyler Atkins, MD, this summer.

As 2021 marks a gradual return to normalcy, we look forward to continuing to provide the highest level of education and patient care.

A handwritten signature in black ink, appearing to read 'J. C. Patt'.

Joshua C. Patt, MD, MPH, FAOA
Vice Chair of Education

Atrium Health Musculoskeletal Institute



Atrium Health Neurological Surgery Residency Program Highlights

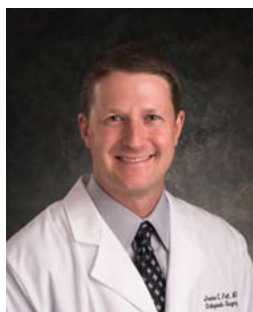
Neurosurgery faculty from Carolina Neurosurgery & Spine Associates continue to develop one of the nation's premier neurosurgery residency training programs in Charlotte, NC.

- We welcomed Rebecca DeCarlo, MD, to the residency program in July – completing the 7-year, 1-resident annual complement. Dr. DeCarlo was honored at the White House in May for her work in COVID-19 contact tracing in Georgia.
 - In March, Graham Mulvaney, MD, was presented an award by University of North Carolina School of Medicine for excellence in teaching medical students.
 - Tyler Atkins, MD, completed a 1-year international rotation in July after learning surgical techniques in Switzerland and Australia.
 - John Parish, MD, kicked off his 1-year enfolded endovascular fellowship training with Carolina Neurosurgery & Spine Associates neurosurgeons specializing in the most critical cerebrovascular interventions.
- Dr. Parish also stepped up to be a resident leader – serving as 1 of 2 residents on the Atrium Health Carolinas Medical Center Medical Executive Committee.
- Graham Mulvaney, MD, Olivia Rice, MD, Vincent Rossi, MD, and David Peters, MD, were awarded for writing the top paper at the North American Spine Society conference last year.

Atrium Health Musculoskeletal Institute (MSKI) Orthopaedic Surgery Residency Highlights

Orthopaedic faculty from MSKI, Carolina Neurosurgery & Spine Associates and OrthoCarolina continue to offer one of the most sought-after training programs in the nation.

Dr. Patt is currently serving as chair of the American Orthopaedic Association – Council of Orthopaedic Residency Directors (AOA/CORD). In this capacity, Dr. Patt has led the orthopaedic program directors from all the Accreditation Council for Graduate Medical Education (ACGME)-accredited residency programs since 2018.



**Joshua C. Patt,
MD, MPH, FAOA**

In this leadership role, Dr. Patt was instrumental in converting the spring and summer meetings to a virtual format, adding COVID-19 content and providing guidance as residency programs navigated uncharted waters. To improve consistency and communication among programs and applicants, Dr. Patt also created a series

of virtual town halls that began with programming focused on student rotations, virtual experiences and best practices for virtual interviews.

Medical student applicants are a vulnerable population in the residency application process, particularly from groups underrepresented in orthopaedic surgery. CORD remained aligned with the recommendations of the Association of American

Medical Colleges and ACGME and created guidelines focused on maintaining a fair and equal playing field.

Orthopaedic surgery has the unfortunate distinction of being the least diverse specialty in medicine. Amid heightened awareness of inequities, Dr. Patt assembled a panel of thought leaders to engage the orthopaedics educational leaders to better understand how to become more inclusive. Using the acronym of JEDI (Just, Equitable, Diverse and Inclusive), a final town hall was held to engage leaders and provide tools to affect meaningful change.

Neurological Surgery Resident Honored at the White House

Neurological surgery resident Rebecca DeCarlo, MD was recognized at an exclusive event hosted by the United States president for her COVID-19 contact tracing work at the Georgia Department of Public Health.

“It was a humbling and amazing experience to be the only medical student and only graduate student in attendance for the ceremony,” says Dr. DeCarlo. She was 1 of only 20 students hand-picked from across the nation to participate in a special ceremony at the White House.

And now Atrium Health offers Dr. DeCarlo another valuable experience: joining a very select group of physicians-in-training this summer as the seventh and final member of the neurological surgery residency team. Through a unique partnership between Atrium Health and Carolina Neurosurgery & Spine Associates, these highly skilled neurosurgeons serve as the faculty for the Neurological Surgery Residency Program at Atrium Health Carolinas Medical Center.

Dr. DeCarlo will also be making history of her own at Atrium Health – **she will be the first female resident in the neurological surgery program.**

“Both Atrium Health and Carolina Neurosurgery & Spine Associates believe that neurosurgery, and the profession of medicine more broadly, benefit from the promotion and participation of individuals from a diverse demography. We are particularly committed to fostering greater female representation in our traditionally male-dominated specialty,”

Dr. Anthony Asher says.



Residency and Fellowship Programs Welcome 31 New Trainees for 2020-21 Academic Year

Seven new residents and 24 fellows entered training across our residency and fellowship programs. Our esteemed clinical faculty from MSKI, Carolina Neurosurgery & Spine Associates and OrthoCarolina

have fostered an academic mentorship model to educate and provide career development for future clinical leaders – and do so by recruiting and retaining top candidates each year. Welcome to the team!

Residents

ORTHOPAEDIC SURGERY

(Atrium Health)



Benjamin Averkamp, MD
University of South Carolina



Alexander Dombrowski, MD
University of Alabama



Bryce Haynes, MD
Emory University



Michael Schallmo, MD
Wake Forest University



Julia Mastracci, MD
University of Virginia



Virgenal Owens, MD
Medical College of Georgia

NEUROLOGICAL SURGERY

(Atrium Health and Carolina Neurosurgery & Spine Associates)



Rebecca DeCarlo, MD
Medical College of Georgia

Primary Care Sports Medicine

(Atrium Health Elizabeth Family Medicine)



Jacquelyne Murray, MD

Southern Illinois University
Atrium Health Carolinas Medical Center Family Medicine

Primary Care Sports Medicine

(Atrium Health Cabarrus Family Medicine)



Kerry Fincher, DO

Edward Via College of Osteopathic Medicine
AnMed Health Family Medicine Center



Paul Henson, MD

Texas Tech University
Atrium Health Cabarrus Family Medicine



Adult Reconstruction (OrthoCarolina)



Cory Green, MD
Wright State University
Orlando Health
Orthopaedic Surgery



Omar Behery, MD
Rush Medical College
NYU Langone
Orthopaedic Surgery



Mark Hood, MD
Indiana University
Indiana University
Orthopaedic Surgery



**Murillo
Adrados, MD**
NYU Medical School
Yale-New Haven
Orthopaedic Surgery

Foot and Ankle (OrthoCarolina)



**Victor
Anciano, MD**
Harvard University
University of Virginia
Orthopaedic Surgery



**Theodora
Dworak, MD**
Uniformed Services
University
Walter Reed Orthopaedic
Surgery



**Patrick
Grimm, MD**
Uniformed Services
University
Walter Reed Orthopaedic
Surgery



David Vier, MD
Texas A&M University
Baylor University
Orthopaedic Surgery

Physiatry (OrthoCarolina)



**Nicholas
Horan, MD**
University of Nebraska
Atrium Health Carolinas
Medical Center

Hand (OrthoCarolina)



Nicholas Lake, MD

Tulane University
Naval Medical Center -
San Diego Orthopaedic
Surgery



**Steven
Niedermeier, MD**

Ohio State University
Ohio State University
Orthopaedic Surgery



**Evan
Guerrero, MD**

Tulane University
Duke University
Orthopaedic Surgery



Andrew Grier, MD

Duke University
Duke University
Orthopaedic Surgery

Sports Medicine (OrthoCarolina)



**Alexander
Bitzer, MD**

University of Virginia
Johns Hopkins
Orthopaedic Surgery



Daniel Hurwit, MD

Stanford University
Hospital for Special
Surgery Orthopaedic
Surgery



**Julian
Sonnenfeld, MD**

Tufts University
New York Presbyterian/
Columbia University -
Orthopaedic Surgery

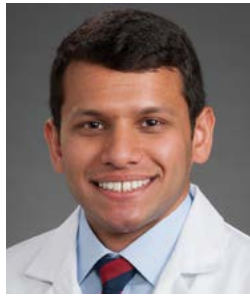
Orthopaedic Trauma (Atrium Health Carolinas Medical Center)



Jana Davis, MD
University of Texas -
San Antonio
SAUSHEC Brooke
Army Medical Center
Orthopaedic Surgery



**Givenchy
Manzano, MD**
University
of California - Irvine
Case Western Reserve
University/University
Hospitals Cleveland
Orthopaedic Surgery



**Suman
Medda, MD**
University of North
Carolina
Wake Forest Baptist
Medical Center
Orthopaedic Surgery

Spine (OrthoCarolina)



**Brandon
Huggins, MD**
Indiana University
Prisma Health - Greenville
Orthopaedic Surgery



Ryan Berger, MD
Florida State University
Cleveland Clinic
Orthopaedic Surgery



Subspecialty Reports

Atrium Health Musculoskeletal Institute (MSKI) Orthopaedic Trauma

The 2020-21 academic year marks the 30th anniversary of the Atrium Health Carolinas Medical Center (CMC) Orthopaedic Trauma Fellowship Program. Throughout its history, the program has led in educational innovation, research and clinical volume. The program has 64 graduates to date, the majority of whom have gone on to successful academic careers and leadership roles, nationally and internationally. The program has been ACGME-accredited since 1991 and has grown from training 1 fellow per year to its current complement of 3 fellows per year. Program highlights include:

- The fellowship program is staffed by 5 full-time faculty who are active in national orthopaedic trauma societies:
 - **Division Chief Stephen H. Sims, MD**, serves on the AO Trauma North America board of directors and is the organization's past chair.
 - **Madhav A. Karunakar, MD**, (CMC alumnus 1998-1999) has been the fellowship program director since 2013 and is the current chair of the Orthopaedic Trauma Association (OTA) fellowship committee.
 - **Joseph R. Hsu, MD**, is a member-at-large for the OTA board of directors and a past member of the Limb Lengthening and Reconstruction Society.
 - **Laurence B. Kempton, MD**, (CMC Alumnus 2010-2011) is on the OTA research committee.
 - **Kevin D. Phelps, MD**, joined the faculty in 2018 after completing his fellowship at the University of Texas - Houston.
- Our clinical volume and expertise provide an unsurpassed surgical experience for orthopaedic trauma fellows. The hospital is home to the nation's 6th busiest Level 1 trauma center and North Carolina's busiest emergency department. Annually, the institution has 7,300 trauma admissions, with more than 1,200 having an Injury Severity Score of ≥ 15 . The orthopaedic trauma team performs more than 1,500 surgeries each year.
- Our unique mentorship model pairs fellows and faculty in one-on-one clinical rotations. The program's 5 traumatologists come from varied backgrounds and training. This exposes fellows to a wide range of practice and surgical techniques.
- Fellows perform clinical research with support from the Division of Orthopaedic Clinical Research. This offers access to a research infrastructure that has obtained over \$1 million in extramural funding per year and provides fellows with exposure to a multicenter clinical research program. The division



also continues supporting fellows as they establish their own research programs after graduation.

- Faculty and alumni provide a strong network. Alumni are academic leaders, professional society leaders and thought leaders with hundreds of peer-reviewed publications and textbooks. Sonny Konda, MD, (CMC alumnus 2009-2010) director of orthopaedic trauma at Jamaica Hospital Medical Center in Queens, NY, described his experience with our mentorship model as “living the life of a trauma surgeon on a daily basis – a modality that is

far superior than what you will see elsewhere in the country.”

- Orthopaedic Trauma Fellowship Program Director Madhav A. Karunakar, MD, and Associate Program Director Kevin D. Phelps, MD, have recently made numerous educational updates, including a fellow-level conference and core curriculum, cadaveric simulation labs emphasizing pelvic and acetabular fracture approaches and percutaneous fixation techniques, dry labs, and a “business of orthopaedic trauma” curriculum.

Atrium Health Cabarrus Orthopaedic Trauma Program

In September 2020, MSKI expanded our orthopaedic trauma services to Atrium Health Cabarrus. Luke Harmer, MD, is a fellowship-trained orthopaedic traumatologist and is the new chief at Atrium Health Cabarrus. He has been joined by another fellowship-trained traumatologist, Laura Blum, MD. The program is also supported by Kaitlyn Muldoon, PA-C, and Victoria Cleveland, PA-C.

The program was launched in partnership with Atrium Health Piedmont Orthopaedics and OrthoCarolina -

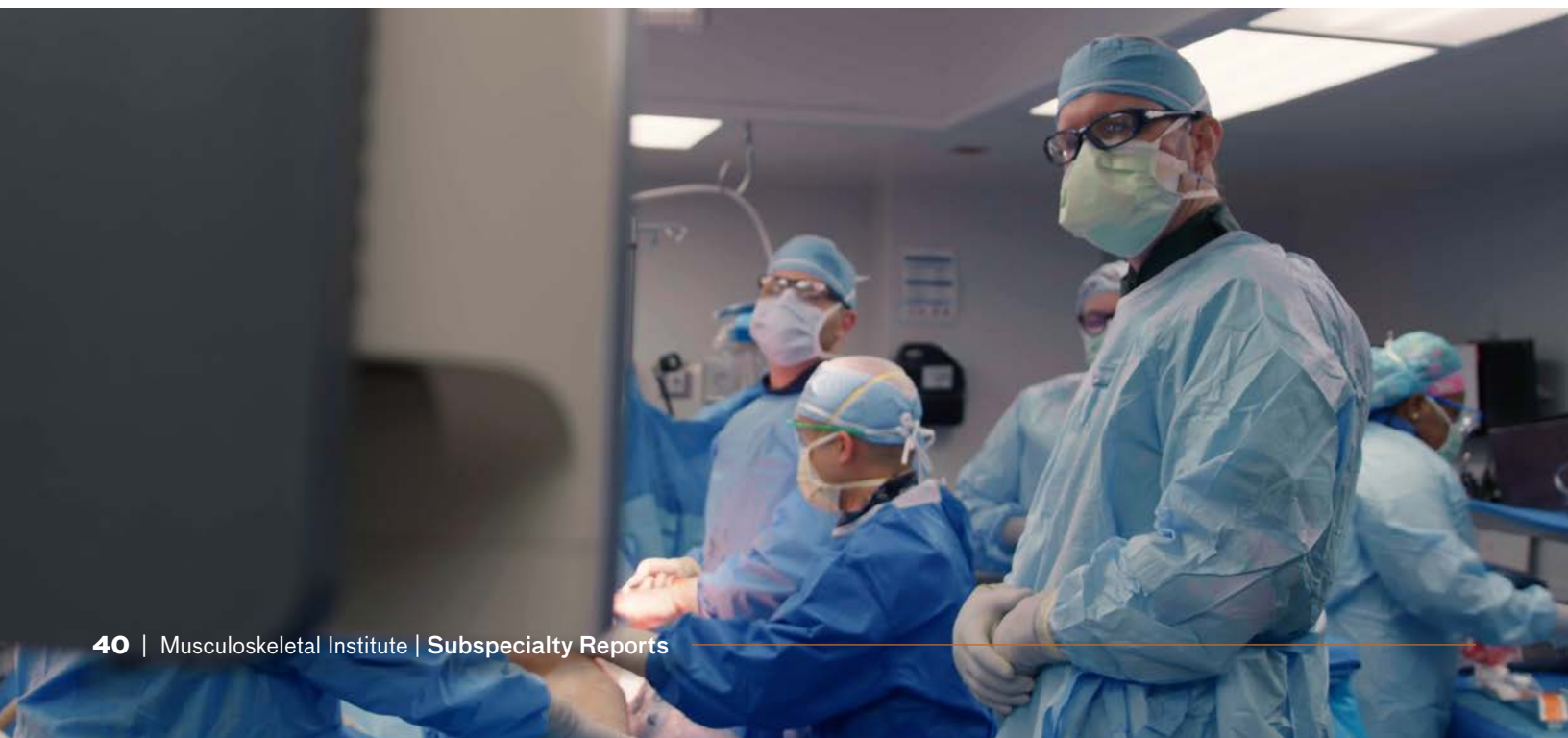
Concord to enhance the region’s orthopaedic services. The program launched with huge success, with the new trauma team performing more than 100 surgeries in its first 3 months.

The trauma team covers the hospital 5 days per week. Their outpatient clinic, supported by the Cannon Foundation, is located in the medical arts building on the Atrium Health Cabarrus campus. Dr. Harmer is proud to help the community by keeping orthopaedic care options closer to home.

Atrium Health Orthopaedic Oncology

Despite the pandemic, Atrium Health orthopaedic oncology maintained a busy flow of patients at Atrium Health Levine Cancer Institute (LCI). Through careful planning and coordination, we maintained the highest level of care through in-person visits, virtual care and remote consults. Remarkably, patient volume increased from 2019 to 2020, with care provided by Joshua C. Patt, MD, MPH; Jeffrey S. Kneisl, MD; Colin J. Anderson, MD; and Glenna Fox, PA-C. Recent highlights include:

- Dr. Kneisl was central to the systemwide COVID-19 response. As chief surgical officer, he dedicated most of each day to helping the emergency response team ensure safe hospital operations.
- The Atrium Health approach developed to address surgical re-entry was published by Dr. Kneisl and one of our residents, Andrew Wohler, MD, in the March 2021 edition of *Medical Care*. It cited authorship contributions and credits from 19 physicians and administrative members of the Atrium Health COVID-19 Surge and Re-Entry Team.
- Dr. Anderson joined the section in 2019 after a clinical and research fellowship at the University of Florida. His arrival helped expand orthopaedic oncology clinical care and research offerings. Dr. Anderson has embedded himself within LCI and has been central to several new grants and studies looking at molecular signatures and targets in liposarcoma and synovial sarcoma. Along with his medical oncology counterpart, LCI's Megan Jagosky, MD, Dr. Anderson will investigate a novel liquid biopsy technique designed for sarcoma patients.
- Dr. Anderson has brought a complementary skill set to Charlotte with his interest in pelvic tumors and rotationplasty for lower extremity bone sarcomas. Rotationplasty is a technique for resecting bone tumors that otherwise might require an above-knee amputation. While the patients still require a prosthesis, the resultant limb is highly durable and allows for more activity than many traditional internal prostheses. In 2020, Dr. Anderson performed Charlotte's first rotationplasty.





A Young Cancer Patient, Inspired by Music Therapy

When Lily Knecht was 18, an MRI revealed a tumor in her leg. She was referred to Dr. Kneisl at LCI and Jennifer Pope, MD, a pediatric oncologist at Atrium Health Levine Children's Hospital. After they diagnosed Lily with osteosarcoma, she started chemotherapy. Then Dr. Kneisl removed the tumor and reconstructed her knee by implanting a tumor-specific knee prosthesis.

Soon after Lily was admitted to LCI, she was having a rough day – until Anneliese LoVullo walked into her room and explained that she was a music therapist.

“My mom and I just looked at each other because something really clicked at that moment,” Lily remembers.

In thinking about her career, Lily knew she wanted to do something with music or with helping people. She realized music therapy was a natural fit.

“When Lily told me she wanted to be a music therapist, I nearly fell out of my chair,” says Dr. Kneisl. That’s because 15 years prior, he had another teenage osteosarcoma patient, Mason Swimmer, who also expressed interest in becoming a music therapist. Mason is now a music therapist at Atrium Health Mercy, a facility of Carolinas Medical Center.

Dr. Kneisl quickly introduced Mason and Lily. As Mason told Lily about music therapy, Lily was excited.

“I was thinking: I can’t believe that’s a job I could do!” she says.

Lily recently celebrated her 19th birthday and is feeling great.

“I felt like music therapy – coupled with LCI’s care – saved my life,” she says.

Foot and Ankle

OrthoCarolina Foot & Ankle Institute is a destination referral center for minimally invasive surgery, Charcot arthropathy treatment, total ankle reconstruction, and foot and ankle trauma and deformity. We receive nationwide referrals for lower extremity care, and we're committed to national leadership, educating the next generation and engaging in research that has an impact far beyond the Carolinas.

Leading the AOFAS in 2020-21

Bruce Cohen, MD, CEO of OrthoCarolina and member of the Foot & Ankle Institute, is the 2020-21 president of the American Orthopaedic Foot & Ankle Society (AOFAS), and we're excited to take the lead in organizing its annual meeting. Carroll Jones, MD,

will be the overall program chair with Kent Ellington, MD, directing the pre-meeting program. Our team is actively planning symposia and selecting the research that will be presented in September in Vancouver, BC.

Training Future Leaders

One of our top priorities is to provide some of the world's best training and education. Our milestones in this area include:

- **Having a nationwide impact:** To date, more than 60 physicians have completed our fellowship program and gone on to practice in more than 20 states. Many of these graduates are in leadership positions.
- **Developing a top fellowship program:** Dr. Jones directs the program, which currently has 4 fellows. We attract the best applicants, as they are drawn to our surgical volume and breadth of cases.
- **Training 2 military fellows:** OrthoCarolina and MSKI physicians regularly partner with the military, and we are currently training 1 fellow from the Army and 1 from the Navy. We offer expert mentorship as well as broad exposure to care for everything from ankle fractures to deformity and amputee care.
- **Attracting chief residents:** In the past 2 years, 5 of the 10 chief residents in our orthopaedic residency program selected foot and ankle as their subspecialty.
- **Adding top physicians:** We're excited to welcome Samuel Ford, MD, back to our team. Dr. Ford completed the orthopaedic residency program at Atrium Health Carolinas Medical Center in 2019, followed by a fellowship in foot and ankle orthopaedic surgery at Baylor Scott & White Orthopaedic Associates of Dallas.

Pursuing Clinical and Research Advances

Recent foot and ankle research highlights include:

- W. Hodges Davis, MD, is an international leader in ankle replacement surgery. While contributing to instrumental research on treating Charcot neuropathy and ankle arthritis, Dr. Davis has developed a high-volume surgical practice, training not only fellows in our programs but also doctors across the country and the world.
- Todd Irwin, MD, directs our research effort. We are currently involved in more than 25 active research projects, as well as 4 registries that prospectively collect data on multiple clinical entities, including total ankle arthroplasty and Charcot arthropathy.
- Scott Shawen, MD, currently participates annually in the Congressionally Directed Medical Research Program and is on the selection board for the Peer-Reviewed Orthopaedic Research Program.
- We have published multiple articles in top journals, including *Foot & Ankle International*; *Journal of Orthopaedic Trauma*; *Injury*; *Foot and Ankle Clinics* and *Clinics in Sports Medicine*.
- We also regularly present at conferences and meetings. We presented multiple abstracts and were involved in numerous symposia at the 2020 AOFAS meeting.



MSKI Primary Care Sports Medicine

Expanding Orthobiologics Offerings

MSKI's primary care sports medicine team is successfully expanding its outpatient orthobiologics offerings. In addition to platelet-rich therapy (PRP) and prolotherapy, they now offer lipoaspirate and bone marrow aspirate concentrate. The team has committed to offering these services as a cost-effective alternative to surgery. We also contribute to research for these treatment alternatives.



“When I first met with Dr. Anthony Martin, I was unable to even walk from the pain in my knee. Less than 6 months later, I’m back to spin class, cycling, yoga and golf. PRP and bone marrow aspirate concentrate injections have given me back my mobility and active lifestyle. With a few more months of physical therapy, I expect to be essentially pain-free,”
a patient says.

Acknowledging Dr. Lutz's Incredible Contributions



**Robert H. Lutz,
MD, FAAEM,
COL (ret)**

Robert H. Lutz, MD, FAAEM, COL (ret), earned Atrium Health's Teal Acorn Rookie of the Year Award after incredible contributions to sports medicine and beyond. The Teal Acorn is one of the highest honors awarded by Atrium Health, as part of our effort to recognize and reward important contributions at all levels of the organization.

Dr. Lutz came to MSKI after 30 years of service in the Army, serving 14 deployments. He worked with the most elite military athletes and provided emergency medicine to our troops. Upon retirement, he completed a fellowship in sports medicine at Duke University with Claude Moorman, MD. When Dr. Moorman came to MSKI, he seized the opportunity to recruit Dr. Lutz.

"I had the privilege of working with Dr. Lutz when he was in charge of medical care for one of the elite special forces units," Dr. Moorman says. "We shared patient encounters with some of America's true heroes. In the process, I realized that Dr. Lutz was no less of a hero than the operators he served."

Dr. Lutz – a Davidson College graduate – was hired to bring sports medicine to the Davidson community and to serve as medical director for Davidson athletes. Dr. Lutz and Davidson have been leading their conference with their COVID-19 sports protocols. Dr. Lutz is also overseeing COVID-19 protocols for Davidson's entire student population.

Dr. Lutz and his wife, Suzy, have also continued their volunteer work via their Continuing the Mission organization, where they train and pair dogs with veterans suffering from post-traumatic stress disorder.

At the pandemic's outset, Thomas Batchelor, MD, an internist with Atrium Health North Charlotte Medical Specialists - Huntersville, asked Dr. Lutz to apply his military field hospital expertise to Atrium Health's COVID-19 response and virtual hospital. Dr. Lutz initially moved to the advanced urgent care model to provide a place for patients seeking more advanced care and to keep the hospitals and emergency rooms decompressed and available for COVID-19 care.

"Dr. Lutz is an absolute asset to our organization, our patients and the human race," Dr. Batchelor says. "It is an honor and privilege to call him a teammate and a friend."



Welcoming 2 New Sports Medicine Physicians



Eric Kropf, MD

We are excited to welcome Eric Kropf, MD, and Eric Warren, MD.

Dr. Kropf is an orthopedic surgeon with a focus in sports medicine at two locations: Atrium Health Musculoskeletal Institute Orthopedics & Sports Medicine - Indian Trail and Rea Village.

Dr. Kropf attended the School of Medicine at Georgetown University, where he received his medical degree. He then completed both his residency in orthopedic surgery and fellowship in sports medicine and shoulder surgery at the University of Pittsburgh Medical Center.

Bringing extensive knowledge and medical experience to Atrium Health, Dr. Kropf has worked with

athletes at all levels – from professional sports teams to collegiate and high school student-athletes, as well as weekend warriors. Before joining Atrium Health, he spent the last 12 years at Temple Health system in North Philadelphia and held multiple leadership positions, including chief of sports medicine and chair of the orthopedic department.

Dr. Warren is a fellowship-trained primary care sports medicine physician who graduated from our fellowship program under David Price, MD. He has since been working with the Union County schools and another hospital for the past 13 years. He has had great success and built an excellent reputation in the southern Charlotte market. He will support MSKI's exciting growth in South Charlotte, including a new Rea Village site.



Eric Warren, MD

Kevin Weiss, DO, Draws Inspiration as a Cancer Survivor



Kevin Weiss, DO

For Kevin Weiss, DO, the path toward becoming an orthopaedic surgeon started at age 15, when an X-ray revealed he had osteosarcoma. As he went through treatment, one thought took hold: He wanted a career helping others like the doctors who were treating him. Today, he's one of our newest surgeons specializing in hip and knee replacements at Atrium Health Carolina Orthopaedic Surgery Associates - Rock Hill. He helps patients regain the limb functionality they fear is lost for good.

When some patients first consult with Dr. Weiss, they're in so much pain that they've practically given up the idea of returning to a fully functioning life. Fortunately, adult reconstructive surgery offers real hope.

"Implant design is the best it's ever been," Dr. Weiss says.

This is particularly true with anterior hip replacements.

"This procedure's minimally invasive approach allows my patients to recover much faster because I don't have to cut through their muscle," Dr. Weiss says.

Dr. Weiss joined our team in August, not long after U.S. News & World Report ranked Atrium Health as a top 10% in the nation, high-performing orthopaedic program. Our level of care will rise even higher as Atrium Health and Wake Forest Baptist Health combine.

The contrast between the patient's life before and after surgery is what motivates Dr. Weiss.

"I've had patients arrive for their surgery in a wheelchair because they literally can't walk on their own," he says. "To be able to rid them of their pain and have them walk again – something they didn't think possible – is really rewarding."



Sports Cardiology

The new Sports Cardiology Center at Atrium Health Sanger Heart & Vascular Institute specializes in evaluating and treating competitive athletes and highly active individuals for a wide range of known or suspected cardiovascular conditions, in order to safely allow them to return to their favorite sports and activities.

Our program emphasizes a comprehensive and individualized cardiovascular assessment using advanced imaging and stress testing techniques to ensure accurate diagnosis and treatment strategies. We also provide personalized and sport-specific counseling on prevention, nutrition, lifestyle and training programs.

The Sports Cardiology Center is overseen by Dermot Phelan, MD, a national leader in sports cardiology who holds a prominent position as a member of the National Basketball Association and National Football League (NFL) Cardiology Advisory Committees. He also serves as a cardiologist for professional teams such as the Carolina Panthers and as the cardiologist for the NFL Combine.

We see athletes of all ages, from high schoolers with abnormal cardiac screenings to older athletes with known cardiac conditions.

Our care includes:

State-of-the-art screening and diagnostic tools, including 3D CT and advanced echocardiographic imaging, cardiac MRI with parametric mapping, and other technologies. We tailor each patient's testing to their particular sport.

Team care by cardiologists, pulmonologists, geneticists and exercise physiologists at Sanger and Atrium Health Musculoskeletal Institute. These specialists collaborate to deliver expert insight into every aspect of a patient's heart and performance. Our team goes to great lengths to understand each patient's athletic lifestyle and ambitions, and we work with them to develop a plan that gets them back to their favorite activities. We provide individualized exercise prescriptions or plans based on the underlying condition and stress testing so that people with cardiac conditions can continue to enjoy their sport in as safe a manner as possible.

Lifestyle and nutrition coaching, offering access to sports nutritionists who provide disease and sport-specific counseling on prevention, nutrition, lifestyle and training.



Guidelines for Returning to Sports After COVID

Initially, there was no standard of care for athletes who have been infected with COVID-19 and want to resume playing sports. Dr. Phelan was the lead author on the paper A Game Plan for the Resumption of Sport and Exercise After Coronavirus Disease 2019 (COVID-19) Infection, which was published in JAMA Cardiology. It includes a detailed return-to-play algorithm to help cardiologists and other physicians make key decisions about how and when athletes can resume activity.

Hand

OrthoCarolina Reconstructive Center for Lost Limbs

We've continued expanding one of the nation's busiest amputee care clinics. Novel advancements were made in targeted muscle reinnervation (TMR), a procedure that transfers nerves cut during amputations into other muscles in the arm. TMR serves a dual purpose of helping eliminate neuroma and phantom pain while enabling patients to better control myoelectric prosthetics.

Applying similar principles to partial hand amputees, Glenn Gaston, MD, and Bryan Loeffler, MD, developed the starfish procedure – the first procedure to enable individual finger control of a prosthetic hand. Immediately following surgery, patients work with our therapists to learn how to use their new hand through virtual reality.

These surgical and technological advancements give patients unparalleled prosthetic function and pain relief. This work earned Drs. Gaston and Loeffler the 2019 J.E. Hanger Award for Innovation.

The hand team recently started a nonprofit called Arms for All, which gives prosthetic arms to patients who don't have the financial means to obtain them. We will donate our first arm in 2021.

“One benefit of a high-volume clinic like ours is that patients have the opportunity to meet each other and provide invaluable mentorship. Someone who's lost their arm very rarely meets another person who's lost their arm. But in our clinic, you see the ‘older’ amputees gravitating to support those who are new to the clinic. That's really valuable from a psychological standpoint,”

Dr. Gaston says.

Multidisciplinary Hand Clinics and Services

Our comprehensive care extends to several specialized clinics and services, including:

- Our brachial plexus clinic, one of the few in the country serving patients of all ages. We serve around 60 patients per month and average 1 brachial plexus surgery per week. This includes nerve grafting, nerve transfers, tendon transfers, arthroplasty and fusions from the shoulder to the hand.
- Our congenital hand clinic, serving patients with all types of congenital deformities – including radial club hand, duplicate thumbs, absent thumbs and the entire spectrum of upper limb birth anomalies. This 4-physician team also includes a pediatric orthopedist (Brian Scannell, MD) for streamlining care, as many of these patients have concomitant lower extremity and spine issues that can be addressed simultaneously. When surgery is required, this multi-physician team keeps surgeries to a minimum and decreases operating room time by addressing more than one need in the same operative setting.
- Expert soft tissue coverage and plastic surgery care, performed by orthopaedic and plastic surgeons with deep expertise in free tissue transfers, soft tissue coverage, flaps for wound coverage and free muscle transfers.



Innovative Research

Our team is actively involved in research to shape the next generation of devices and therapies. This includes:

- A study examining the ability of individuals to control a prosthetic hand if they were born without one. Researchers found that children could indeed control a prosthetic hand without needing any surgery. Furthermore, this ability was maintained into adulthood. This work is pending publication in the *Journal of Hand Surgery* and could lead to much higher use of prosthetics among this population. (See page 20 for more detail.)
- A multimillion-dollar grant from the Department of Defense to study military and civilian nerve injuries and outcomes of nerve repair and nerve transfers.
- Studies examining depression and PTSD in patients with brachial plexus injuries and in amputees.
- Research on PEG fusion for nerves, a procedure that can prevent cut nerves from dying downstream and allow them to maintain normal function.
- A large multicenter study on distal radius fractures, named 1 of the top 4 studies at the 2019 Annual Meeting of the ASSH (American Society for Surgery of the Hand).

Hip and Knee/Adult Reconstruction

OrthoCarolina's Hip and Knee Center remained academically and clinically productive despite COVID-19. This past year, we published more than 68 peer-reviewed publications and made 75 presentations at national and regional meetings. Recent milestones include:

Advancing Adult Reconstruction Research

Currently there are 40 active research studies in adult reconstruction being conducted with help from MSKI's research team and OCRI.

New Periprosthetic Joint Infection Center

Our new Periprosthetic Joint Infection (PJI) Center treated over 300 referred patients with infected total joints this past year. Establishing this center has allowed us to continue to produce high-quality clinical research in PJI while developing evidence-based protocols.

You can learn more about our approach and our latest advances in [our video on OrthoCarolina's YouTube channel](#).

Education with National Impact

The Hip and Knee Center established OrthoCarolina's first fellowship program and has trained 63 physicians who practice nationwide.

We are also proud that 2 of our current residents have decided on a career in adult reconstruction. Stewart Buck, MD, matched at the University of Utah and Patrick Moody, MD, matched at the London Health Science Center in London, Ontario. Finally, 4 of our fellows in adult reconstruction graduated in July and will practice at the

University of Nebraska, Kaiser Permanente in San Francisco and at practices in South Bend, IN, and Buffalo, NY.

We welcome 4 new fellows. They came from Yale University, New York University, Orlando Health and Indiana University. They will spend a year learning the intricacies of advanced adult reconstructive surgery.





Pediatrics

Atrium Health Levine Children's Hospital was recognized by U.S. News and World Report as having 1 of the nation's top 50 pediatric orthopaedic programs for 2020-21. This ranking (number 29) is the highest we have achieved in pediatric orthopaedics. We have been ranked in 7 consecutive years and in 8 out of 9 years since 2011.

The pediatric orthopaedic team is made up of OrthoCarolina's Brian Brighton, MD, MPH; Virginia Casey, MD; Christian Clark, MD; Michael Paloski, DO, MBA; and Brian Scannell, MD. This past year's achievements include:

- All attendings remained actively involved in resident education for orthopaedic residents, pediatric residents, and physical medicine and rehabilitation residents. This includes regular lectures and subspecialty conferences to facilitate mentorship and in-depth discussions.
- The pediatric orthopaedic attendings continue a pediatric call service to provide 24-hour coverage for Levine Children's Hospital's Level 1 trauma center and for children across the region. They also participate in Level 1 adult orthopaedic trauma call at Atrium Health Carolinas Medical Center.
- Dr. Casey continues her practice with a subspecialty interest in pediatric hip problems. Dr. Casey is also involved with the Pediatric Trauma Program at Levine Children's Hospital and serves as medical director on OrthoCarolina's leadership committee.

- Dr. Clark continues a general pediatric orthopaedics practice, with an emphasis on caring for young and adolescent athletes.
- Dr. Paloski continues practicing with an interest in general pediatric orthopaedics as well as scoliosis. He has recently become certified to perform the vertebral body tethering procedure to manage juvenile scoliosis.
- Dr. Brighton's practice has an interest across pediatric orthopaedics, including pediatric spinal deformity and limb deformity. Dr. Brighton holds a number of influential national appointments and recently completed his 2-year term on the Pediatric Orthopaedic Society of North America (POSNA) board of directors.
- Dr. Scannell continues growing his practice with interests in general orthopaedics, spinal deformity and trauma. Additionally, he now directs the orthopaedic residency program at Atrium Health

Carolinas Medical Center. Dr. Scannell also serves on the POSNA trauma committee and holds other influential positions.

- Drs. Scannell and Brighton have participated as invited faculty at several meetings, including the Akron Pediatric Orthopaedic Resident Review Course, the Kaye Wilkins Pediatric Fracture Course, and the POSNA/AAOS International Pediatric Orthopaedic Symposium.

OrthoCarolina's fellowship-trained pediatric orthopaedic surgeons provide specialty care at Levine Children's Hospital, the region's only Level 1 pediatric trauma center. In addition, our team has the ability to work with medical and surgical specialists to manage and treat complex conditions, including spinal disorders and limb deformities.



Spine

A Letter From Our Division Chief

SPINE MILESTONES IN A TUMULTUOUS YEAR



Dom Coric, MD

Throughout a tumultuous year, there was much to be proud of in spine surgery. Notably, we continued a strong focus on research and academics – led by clinical faculty at Carolina Neurosurgery & Spine Associates and OrthoCarolina. Other milestones include:

- 2020 started with a tremendous opportunity to host Chris Shaffrey, MD, as a distinguished visiting professor for MSKI grand rounds. Dr. Shaffrey is chief of the Duke University Spine Division and is board certified in neurological surgery and orthopaedic surgery. He shared a talk titled “Can ‘big’ spine surgery principles help do common, smaller spine surgeries better?” Dr. Shaffrey also spent time in case conferences with neurosurgery and orthopaedic surgery residents.
- There were 14 faculty appointments in Atrium Health’s Department of Orthopaedic Surgery from the spine service in early 2020. These appointments reflect each physician’s talent and hard work. The appointments include:

Byron C. Branch, MD
Assistant Professor

Vinay Deshmukh, MD
Assistant Professor

Andrew T. Healy, MD
Assistant Professor

Christopher M. Holland, MD, PhD
Assistant Professor

Daniel J. Leas, MD
Assistant Professor

Sarah C. Jernigan, MD, MPH
Assistant Professor

Mark D. Smith, MD
Assistant Professor

Mark D. Van Poppel, MD
Assistant Professor

Joe D. Bernard Jr., MD
Associate Professor

Paul K. Kim, MD
Associate Professor

Scott D. Wait, MD
Associate Professor

Anthony L. Asher, MD
Professor

Dom Coric, MD
Professor

Matthew J. McGirt, MD
Professor

- The spine service initiated the first combined spine conference between orthopaedic and neurological surgery residents in September. This virtual multidisciplinary conference complements existing education opportunities like bioskills labs, resident lectures and MSKI grand rounds. The monthly conference has been a wonderful opportunity for residents to learn alongside Carolina Neurosurgery & Spine Associates and OrthoCarolina faculty. Eric Laxer, MD, and Paul Kim, MD, serve as education leaders and facilitate the cooperative spine education programming for residents and faculty.
- Daniel Leas, MD, joined Carolina Neurosurgery & Spine Associates after completing the orthopaedic residency program at Atrium Health Carolinas Medical Center in 2019, followed by a fellowship in adult spinal surgery at Indiana Spine Group.
- Spine leaders delivered 2 MSKI grand rounds presentations:
 - The first was by Dr. Coric titled “Cervical Arthroplasty: State of the Art.” Dr. Coric is a national leader in this procedure.
 - The second was by Bruce Darden, MD, who shared his experience in cervical spine surgery via a talk titled “Update on Cervical Myelopathy.” This aligns with Dr. Darden’s leadership in the Cervical Spine Research Society, where he is a past president.
- The spine section’s academic productivity continues, with over 10 spine publications co-authored by resident physicians, including the top paper at the North American Spine Society.
- Outcomes research continues to be an area of focus, led through Atrium Health and Carolina Neurosurgery & Spine Associates. Dr. Asher serves as co-director of the American Spine Registry (ASR) and Dr. Coric serves on the ASR Data Use Committee. The ASR is a collaborative

effort of the AANS and the AAOS on a national quality improvement registry. Starting in July 2021, the ASR will be a key component in reviewing outcomes necessary for the Joint Commission Advanced Certification in Spine Surgery.

- Year 2 of spine co-management has led to key achievements, with a focus on patient education and improved outcomes:
 - Leo Spector, MD, directed development of standardized spine surgery education materials that provided consistent messaging and clinical support for patients.
 - Drs. Asher and Segebarth defined and disseminated key modifiable risk factors for surgical prehabilitation directly related to improved clinical outcomes.
 - Dr. Kim led an interdisciplinary team to develop and launch an ERAS® pilot for lumbar spine fusion patients at Atrium Health Mercy, a facility of Carolinas Medical Center.
 - Dr. McGirt directed a committee focused on clinical value analysis, investigating opportunities to use billing data to create clinical use criteria in bone morphogenetic protein bone graft materials.

Our spine surgery leaders continue to distinguish us nationally, and we are grateful to our partners and colleagues who have sustained clinical excellence throughout the pandemic.



Dom Coric, MD,

Spine Division Chief, Atrium Health Musculoskeletal Institute
 Professor, Department of Orthopaedic Surgery, Atrium Health
 Neurosurgeon, Carolina Neurosurgery & Spine Associates

Community Outreach & Partnerships

Atrium Health Musculoskeletal Institute Community Outreach & Partnerships

Jennifer Gardner Recognized for COVID-19 Leadership



Jennifer Gardner

Before the coronavirus pandemic, Jennifer Gardner's main focus as director of outreach at Atrium Health Musculoskeletal Institute (MSKI) was on sports medicine and event medicine. Her team traditionally provided leadership and clinical care coordination for school systems, colleges and universities, and sports partners, including the Carolina Panthers and Charlotte Motor Speedway. But their role changed dramatically in response to COVID-19.

Jennifer and her 30-member team of EMTs, paramedics, nurses and athletic trainers took on new duties to help the community. Many have been conducting entrance screenings at Atrium Health facilities as well as screenings and tests at mobile testing sites.

Jennifer has also led the way with our sports re-entry efforts. When NASCAR started discussions about bringing racing back to Charlotte Motor Speedway, she and her team were ready to shift gears again. MSKI

helped create an atmosphere that kept drivers, crew, employees and broadcasters safe during 4 Memorial Day weekend races, including the Coca-Cola 600.

"Having race day at Charlotte Motor Speedway was a sign of hope and healing as we all looked to return to normalcy," says MSKI Vice President Brian Middleton.

Jennifer and her team knew the eyes of the sporting world were on Charlotte to see what the return to professional sports might look like. Now her team is ready for whatever comes next. Jennifer was awarded a "Tree of Life" coin for her amazing efforts. This coin is one of the highest honors given by Atrium Health, as part of our effort to recognize team members at all levels of the organization who go above and beyond to help our community and advance our mission.

"This is what we do for our community," she says. "This is why we are Atrium Health proud."

Highlights: Return to Play Leadership

- MSKI developed return to play protocols for North Carolina high school sports. The North Carolina High School Athletic Association's 12-person sports medicine advisory committee includes 3 Atrium Health representatives: Dr. Claude Moorman, Dr. Kevin Burroughs and Scott Barringer.
- MSKI's outreach team provides COVID-19 testing for Davidson College, Winthrop University, University of North Carolina - Charlotte, Johnson C. Smith University and Charlotte Motor Speedway.
- MSKI athletic trainers have been building school safety plans while following NCHSAA, NCISAA and SCHSAA guidelines.



Professional Team & Organization Partnerships

Dr. Hsu Joins Carolina Panthers' 'Salute to Service'

Joseph Hsu, MD, has a keen understanding of our veterans' contributions to society. He graduated from the United States Military Academy at West Point. He went on to serve in Iraq during some of American troops' fiercest encounters. He has used his training and skill to help veterans recover from injuries. He was even awarded the Bronze Star Medal – the fourth highest-ranking award a service member can receive.

Dr. Hsu was honored as part of this year's National Football League Salute to Service campaign and celebrated by the Carolina Panthers at a November game.

"I couldn't be more honored to be part of Salute to Service," says Dr. Hsu. "The Panthers are very committed to helping veterans and I've been fortunate to be part of that."

Dr. Hsu says he wanted to be in medicine since he was a child, an interest based on his passion for science and service. That partly explains his decision to attend West Point and Tulane University of Medicine.

Dr. Hsu's military service included being deployed to Iraq in 2006. This was during an era of sectarian violence that produced some of the war's highest casualty rates.

"No amount of training in the civilian sector gets you ready for what happens in war," he says. "Some of these things you carry with you forever. For me, they were transformative. They're things that really push and challenge you to innovate, develop and get techniques going. Many important protocols, rehab and pathways that now are incorporated in the civilian world were borne out of wounded warriors."

Stories of Resilience

OrthoCarolina regularly features stories of resilience on our YouTube channel. One [recent video](#) featured Carolina Panthers legend Jake Delhomme and OrthoCarolina's Patrick Connor, MD, who served as the Panthers' team physician. The video tells the story of how Dr. Connor and his OrthoCarolina colleagues used Tommy John surgery to help Delhomme get back on the field after a severe elbow injury.

Sports Partnerships

We are privileged to provide orthopaedic and sports medicine care for many teams and sports organizations in our community. Our patients include athletes at all levels, from recreational sports to professionals, throughout the Carolinas and beyond. From the sideline to the training room to the clinic, these athletes rely on us to provide them with the best sports medicine and injury care.

Atrium Health Sports Partnerships

Atrium Health is the official healthcare provider for:





Carolina Neurosurgery & Spine Associates Sports Partnerships

We are privileged to continue to provide orthopaedic and sports medicine care for the following teams and sports organizations in our community:



OrthoCarolina Sports Partnerships





