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MESSAGE FROM OUR LEADERSHIP

On behalf of the faculty and staff of NYU Langone Orthopedics, we are pleased to present our 2021 Quality and Outcomes Report. Despite the ongoing COVID-19 pandemic, we have steadily increased our procedure volume while launching a range of new initiatives to ensure that we continue to deliver healthcare of the highest quality and value.

Through our successful integration of multiple hospitals, we have led the way in demonstrating how to advance high-quality and high-value care while greatly expanding our patient population. As our system has grown, so too have our efforts to develop infrastructure to ensure the system-wide integration of uniform quality and safety standards. At the same time, we have significantly increased our focus on diversity, equity, and inclusion to reduce health disparities and improve representation and have undertaken research projects focused on enhancing equity and reducing disparities in health access, delivery, care, and outcomes.

NYU Langone Orthopedics continues to blaze new trails in clinical research. Our surgeons are world leaders in an innovative treatment for idiopathic adolescent scoliosis and in a pioneering in-office needle arthroscopy for treating anterior ankle impingement. At our Center for Orthopedic Innovation, we’re developing methods that employ artificial intelligence to improve risk stratification for complex procedures such as total joint arthroplasty. Other research has supported the safety and effectiveness of a new anesthesia option for high-risk hip fracture patients and of tranexamic acid in high-risk total joint arthroplasty patients. Our physician-researchers have demonstrated how to use video-based telemedicine to significantly improve satisfaction with outpatient procedures and have provided important cultural data to aid expectation-setting and decision-making between surgical options after a traumatic hand injury.

We are fortunate to be a part of a great university, and our department is continuing to leverage the entire breadth of talent throughout New York University’s portfolio of specialty schools. Through partnerships with the NYU Tandon School of Engineering, the NYU Wagner Graduate School of Public Service, and the NYU Stern School of Business, we are pursuing multiple projects focused on musculoskeletal health and healing, diagnostic accuracy, and the economic impact of healthcare policy. Together, these exciting efforts have strengthened our commitment to quality as we continue to expand our reach.

JOSEPH D. ZUCKERMAN, MD
Walter A.L. Thompson Professor of Orthopedic Surgery
Chair, Department of Orthopedic Surgery
Surgeon-in-Chief, NYU Langone Orthopedic Hospital

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Professor, Orthopedic Surgery
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Preserving Quality and Outcomes as Health Systems Grow

In a roundtable discussion, NYU Langone leaders in orthopedics describe how a well-integrated healthcare system has helped them advance the shared goal of higher-quality care.
Becoming One Hospital System: The NYU Langone Way

Well-planned growth and consolidation of health systems can drive greater efficiency and care coordination, but recent studies suggest that health system mergers across the United States haven’t always lived up to the ideal of expanding high-quality patient care. Nearly 25 years ago, NYU Langone Health brought a new approach to such mergers, helping to establish a more consistent track record of success in the process.

The 1997 merger of NYU Langone with the Hospital for Joint Diseases, aided by a focused team effort, set the stage for decades of dynamic growth. NYU Langone Orthopedics now includes more than 200 faculty who perform upward of 23,000 procedures every year. The department sponsors the largest orthopedic residency program in the United States and has repeatedly earned a top-five ranking in the annual *U.S. News & World Report* listing of “Best Hospitals” for Orthopedics.

Joseph D. Zuckerman, MD, inaugural chair of the combined department after the 1997 merger, was tasked with fully integrating two residency programs and two faculties providing orthopedic care at five institutions. In 2016, Dr. Zuckerman provided the same leadership, alongside Joseph A. Bosco III, MD (Vice Chair for Clinical Affairs and Quality), and Thomas R. Lyon, MD (Vice Chair, Department of Orthopedic Surgery at NYU Langone Hospital—Brooklyn), for a second full integration with Lutheran Hospital in Brooklyn. In 2019, when NYU Langone Health merged with Winthrop University Hospital to bring NYU Langone Hospital—Long Island into the health system, Dr. Zuckerman and Dr. Bosco worked closely with James D. Capozzi, MD (Chair, Department of Orthopedic Surgery at NYU Langone Hospital—Long Island), to apply the department’s proven approach for the third time.

The 2021 *U.S. News & World Report* listing of “Best Hospitals” for Orthopedics lauded NYU Langone’s “High Performing” hip and knee replacement services.

Joseph D. Zuckerman, MD, Thomas R. Lyon, MD, Joseph A. Bosco III, MD, and James D. Capozzi, MD
A Deliberate Focus on True System Integration

Dr. Lyon, Dr. Capozzi, and Dr. Bosco recently discussed how they have collaborated in NYU Langone’s growing healthcare system to advance the shared goal of high-quality care. One key, Dr. Bosco said, has been understanding the critical difference between acquisition and integration. "Hospital systems are growing by acquiring and horizontally merging with other systems, but in order for patients to reap the benefits, the entities must integrate," he said. “That's why we see, nationally, that as hospital systems grow in size, their quality doesn’t necessarily improve.” Instead, explained Dr. Bosco, NYU Langone has grown “deliberately and strategically” and has spent the time needed to ensure a total integration of service lines.

Part of the deliberate strategy has been recognizing the real-world differences in facilities, personnel, patient populations, and even geography at the Manhattan, Brooklyn, and Long Island sites. The 11220 zip code that includes NYU Langone Hospital—Brooklyn, for example, has a far higher per-capita rate of Medicaid enrollees than the 10003 zip code that includes NYU Langone Orthopedic Hospital in Manhattan. “Trying to impart one way of doing things on all three hospitals would never work,” Dr. Capozzi said. “To achieve a successful system integration, we’ve been in constant communication and have all learned from each other’s practices and hospitals, taking our differences into account.” From the start, Dr. Lyon said, it was clear that the three entities would fully integrate their quality standards, data, and systems. “We established the important goal of providing high-quality care regardless of location, and we have created a metrics-driven system to help us achieve that,” he noted.

The attention to detail is paying off. In 2021, the Leapfrog Hospital Safety Grade awarded “A” grades to all of NYU Langone Health’s hospitals in Manhattan, Brooklyn, and Long Island—a unique honor among hospital systems in the New York Metropolitan region. An obsessive focus on quality, Dr. Bosco said, is the hospital system’s “secret sauce.” In particular, a shared dashboard of metrics for nationally accepted quality indicators can show the collaborators where they are improving. “When you see your efforts come to fruition through better numbers and metrics, it just energizes everyone to work even harder,” he said.

In 2021, the Leapfrog Hospital Safety Grade awarded “A” grades to all of NYU Langone Health’s hospitals in Manhattan, Brooklyn, and Long Island—a unique honor among hospital systems in the New York Metropolitan region.
Tangible Results Through Integrated Records and Metrics

As part of the “huge investment” in providing real-time data, Dr. Lyon said, NYU Langone fully integrated all electronic medical records (EMR) through the Epic system. That means providers across the health system can look at the same numbers on the same quality dashboard. “The EMR system was probably the most important element to our hospital’s successful integration, because if you can’t talk to each other or look at metrics or share patient charts and data, you’re really at a disadvantage,” Dr. Capozzi added. “Our metrics keep improving because we all have numbers to look at, and we know where we need to focus.”

In 2020, for example, providers noticed that hospital-acquired conditions had ticked up over the previous six months across all of NYU Langone’s sites. When they looked more closely, they found that venous thromboembolisms, or blood clots, were driving the increase. “Why was that? Because of COVID-19,” Dr. Bosco said. “Today, everyone knows that COVID-19 causes a hypercoagulable state in patients, but no one knew that early in the pandemic.” Upon the discovery, the health system formulated a strategy and put new deep vein thrombosis (DVT) prophylactic protocols in place. “As a result, we were able to address the increased DVT risk in near-real time and provide our patients with safer, higher quality care,” he said.

NYU Langone’s readmission reduction initiative has similarly benefited from data-sharing. In 2013, the health system was one of the first to volunteer for the Centers for Medicare & Medicaid Services (CMS) Bundled Payments for Care Improvement (BPCI) Initiative. For the total joint bundled payment risk-sharing program, hospitals are financially responsible for all care and readmissions up to 90 days after discharge, and CMS gives participating hospitals a list of all 90-day readmissions. “That information allowed us to formulate improvement strategies that decreased our readmission rates by 70 percent,” Dr. Bosco said. On the Long Island campus, Dr. Capozzi said that the metrics have helped the Department of Orthopedic Surgery significantly improve its readmission rate as well as its total joint length of stay and complication and mortality rates.
Shared Commitment to Improving Patient Experience

Amid the successes, NYU Langone Orthopedics has had to overcome several obstacles in improving the experience of a highly diverse patient population. At the Brooklyn campus, Dr. Lyon said, providers have been challenged by an older facility and a larger proportion of patients admitted non-electively through the emergency department. “Studies have shown that these admissions are generally associated with lower patient satisfaction scores,” he said. “Nevertheless, significant investments and improvements in nursing care have moved the needle upward on patient experience, and we will continue to make it a priority moving forward.” A big influx in nursing staff, for instance, improved the nurse-to-patient ratios and helped NYU Langone Hospital—Brooklyn exceed quality standards. “We’ve seen major investments in nursing staff, facilities, and information technology,” Dr. Lyon said.

Older facilities on the Long Island campus have likewise presented some obstacles for improving patient experience, but Dr. Capozzi said the site’s top-notch patient services have provided abundant opportunities to overcome the hurdles. “We have a phenomenal total joint program and a 98 percent first case on-time start rate in our operating rooms,” he said. To reduce the wait time for orthopedic appointments, the department also started a walk-in, after-hours clinic every night from 4 to 8 p.m.

One overarching lesson, Dr. Bosco said, is that successful mergers require complementary cultures. “The saying is that culture eats strategy for lunch,” he said. “We’ve all derived benefits because we started from the point of a common culture and a vision of collaboration.” The Department of Orthopedic Surgery at NYU Langone Hospital—Long Island, he noted, runs an “outstanding fragility fracture service with unbelievable outcomes and detailed evidence-based care pathways. So we adopted those throughout our system.” In the same vein, the Department of Orthopedic Surgery at NYU Langone Hospital—Brooklyn runs an “incredibly efficient operating room, and we learned a lot from integrating some of their practices across NYU Langone as well,” Dr. Bosco said.

True integration, in other words, is a two-way street of collaborative learning and sharing that can foster mutual growth while enabling high-quality patient care.
A Commitment to Diversity Helps Define Quality Care

As the Department of Orthopedic Surgery has expanded to integrate care across locations, an intentional focus on quality and outcomes has dovetailed with a commitment to care that represents everyone. Since the very first Diversity Committee was created in 2010, the department has worked to enhance diversity in order to reduce disparities and improve health equity. That focus has been amplified by the recent appointment of Toni M. McLaurin, MD, as the inaugural director of Diversity, Equity, and Inclusion (DEI) for the department, and as chair of the newly expanded Committee on DEI.

In the past year, the committee has strengthened DEI communication, convening discussions on DEI, microaggressions, and allyship; developing a website with resources and information emphasizing DEI in orthopedics; and launching a monthly newsletter in which committee members highlight DEI issues. Among the 2021–2022 residency class, the largest in the country, more than one-third identify as female, and the department has the second-highest number of Black residents in training.

“We’ve made progress, but we still have a long way to go to bring individuals across races and genders into the profession,” notes Dr. McLaurin. “Moving forward, the committee will further our commitment to recruiting academically talented and diverse faculty members, physicians in training, medical students, and staff.”
An Infrastructure for Continued Quality Improvement

As the NYU Langone network has expanded, so too have dedicated efforts to support continued prioritization of quality standards across the network’s sites. One such initiative, underway through the Center for Quality and Patient Safety Program and Infrastructure, is developing a system-wide quality infrastructure to ensure uniform quality and safety standards with coordination and communication among all NYU Langone Orthopedics care sites.

This new system encompasses multiple sites, including NYU Langone Orthopedic Hospital, NYU Langone Hospital—Brooklyn, and NYU Langone Hospital—Long Island, with each subspecialty designating a physician lead to enhance quality initiatives at both a division and site level. Within the NYU Langone Orthopedic Center, an Ambulatory Quality Committee was established to formulate, monitor, and create improvement strategies for musculoskeletal care. The committee includes physician leaders, physician assistants, and a practice manager, all under the guidance of Joseph A. Bosco III, MD, director of quality and patient safety at NYU Langone Orthopedic Hospital, and Gail S. Chorney, MD, clinical associate professor in the Department of Orthopedic Surgery.

The committee emphasizes transparency around quality data for individual physicians, including benchmarks for comparison with peers. All division chiefs and quality designees have access to a dashboard, with data monitoring and monthly review to ensure accuracy. Physicians at each site review their own infection, readmission, venous thromboembolism events, and other outcomes data to confirm accuracy and determine if cases were preventable. Regular data outputs include a monthly Divisional Quality Scorecard, a quarterly Quality Dashboard Newsletter, a quarterly Department Quality and Safety Report, monthly Snapshot Goals, and quarterly Patient Satisfaction Data distributed to all physicians.

“Maintaining and enhancing a culture of quality demands a continued, focused effort,” notes Dr. Bosco. “With these systems in place, we have the infrastructure we need to support quality outcomes with data across our department and sites.”

Access to Statewide Data to Enable Health Disparities Research

The Department of Orthopedic Surgery was recently granted access to the New York Statewide Planning and Research Cooperative System (SPARCS) database, which features de-identified patient-level data on demographics, diagnoses, treatments, and services. It also includes information on charges for each hospital inpatient stay and outpatient (ambulatory surgery, emergency department, and outpatient services) visit, and each surgery and outpatient visit to a hospital extension clinic or diagnostic and treatment center licensed to provide ambulatory surgery services.

Access to the rich data available through SPARCS will enable a range of research projects aimed at enhancing equity and reducing disparities in health access, delivery, care, and outcomes across our growing network. Proposed initial projects include a review of patient complications by race, region, and socioeconomic status for total joint arthroplasty (TJA), spine, and trauma; access to Centers of Excellence (Level I trauma centers or Magnet status) for orthopedic fractures by race across New York State hospitals; and patient and institutional factors associated with the use of technology in TJA.
Research shows that high procedure volume is associated with better performance for both institutions and individual surgeons. NYU Langone Orthopedics is committed to leveraging our high case volumes to achieve better outcomes for our patients.
Higher Patient Volumes Yield Better Outcomes

In 2021, the department performed more than 23,000 orthopedic surgery procedures. Our annual case volume has grown steadily, with a 25 percent increase in total procedures over the last five years.
Novel Scoliosis Treatment Draws Patient Referrals

An innovative non-fusion technique to correct spinal curvature in patients treated for idiopathic adolescent scoliosis at NYU Langone preserves mobility and freedom of movement compared to traditional fusion techniques. Since joining NYU Langone in June 2020, Juan C. Rodriguez-Olaverri, MD, PhD, clinical associate professor in the Department of Orthopedic Surgery, and a world-renowned scoliosis expert, has treated more than 80 patients referred nationally and internationally for his vertebral body tethering (VBT) technique. “With VBT, the spine can continue to move and bend, there’s better visual improvement to the spine, and patients have a smaller scar—all contributing to better outcomes and quality of life for these patients.”

Patients from 20 states have traveled to NYU Langone for the VBT procedure
To raise the quality of orthopedic care for all patients, our doctors conduct patient safety and outcomes research. Here are some highlights of recent efforts designed to identify the most effective strategies for treating orthopedic diseases, while optimizing quality, safety, and outcomes.
A Safe New Anesthesia Option for High-Risk Hip Fracture Patients

Hip fracture fixation is associated with a high risk of perioperative morbidity and mortality, particularly in patients who have multiple comorbidities, are frail, and have additional injuries. Most surgeons perform the fixation under general or spinal anesthesia; however, regional anesthesia with monitored anesthesia care (MAC), which preserves spontaneous breathing and airway reflexes, has become increasingly popular in recent years. MAC is associated with rapid patient recovery and fewer side effects such as urinary retention and nausea or vomiting. But studies have reached conflicting conclusions over which methods may help decrease postoperative mortality, adverse events, and hospital length of stay, and no studies have ever assessed the use of purely local anesthetic soft-tissue infiltration with MAC.

Researchers at NYU Langone Health sought to fill the knowledge gap by examining the feasibility of using MAC and soft-tissue infiltration with local anesthesia (STILA) for patients undergoing hip fracture fixation with short cephalomedullary nails (CMN). Their retrospective study, published in the Journal of Orthopaedic Trauma, included 20 consecutive OTA 13.A1-3 IT hip fracture patients treated with a short CMN and MAC-STILA protocol between October 1, 2019 and March 31, 2020. The researchers matched the patient cohort 1:1:1 with other hip fracture patients who had received either general or spinal anesthesia during their surgeries.

Of the three patient cohorts, the researchers found that the MAC-STILA protocol was best able to maintain a normal intraoperative heart rate of 60 to 100 beats per minute. Additionally, the MAC-STILA patients reported consistently lower pain scores (Visual Analog Scale score of <1) than either the spinal or general anesthesia patients (VAS >1) in the first three hours after the surgery, after which the pain scores equalized. Through the first 48 postoperative hours, patients who underwent the MAC-STILA protocol required a somewhat lower dose of narcotics than those who received spinal anesthesia and an approximately five-fold lower dose than the cohort who received general anesthesia.

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<tr>
<th>MAC-STILA PROTOCOL COMPARED TO TRADITIONAL ANESTHESIA METHODS</th>
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<tbody>
<tr>
<td><strong>Wheels in to wheels out (minutes)</strong></td>
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<tr>
<td>-----------------------------------------</td>
</tr>
<tr>
<td>Minimum heart rate (BPM)</td>
</tr>
<tr>
<td>Maximum heart rate (BPM)</td>
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<tr>
<td>Mean length of stay (days)</td>
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<tr>
<td>VAS Pain Score 2 hours postop</td>
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<tr>
<td>VAS Pain Score 3 hours postop</td>
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<tr>
<td>VAS Pain Score 8 hours postop</td>
</tr>
<tr>
<td>Morphine equivalents 12 hours postop</td>
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<tr>
<td>Morphine equivalents 24 hours postop</td>
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<tr>
<td>Morphine equivalents 48 hours postop</td>
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</table>
The researchers found no meaningful differences in intraoperative blood loss, procedural time, length of stay, minor or major complications, inpatient or 30-day mortality, 30-day readmissions, discharge location, postoperative ambulatory distance, or inpatient cost among the patient cohorts. Given their findings, they concluded that the MAC-STILA protocol is a safe and effective alternative to spinal or general anesthesia for fixing intertrochanteric hip fractures with short CMNs. For patients who have severe medical comorbidities or contraindications to general or spinal anesthesia, MAC-STILA may be preferable.

Tranexamic Acid Is Safe in Total Joint Arthroplasty Patients with Coronary Artery Disease

Orthopedic surgeons have increasingly used tranexamic acid (TXA) as a highly effective intervention for minimizing blood loss that can occur during total joint arthroplasty (TJA).

Nonetheless, many surgeons have raised questions about whether TXA might promote a prothrombotic event and increase the risk for myocardial infarction and venous thromboembolism (VTE) among patients with a history of coronary artery disease (CAD) or coronary stents.

To find out, an NYU Langone team conducted a retrospective analysis of 26,808 patients who underwent total hip or knee arthroplasty between June 2011 and September 2019, all of whom received either topical or intravenous TXA. The researchers reviewed the patients’ charts to identify any history of CAD or stents, and any myocardial infarction or VTE (either a pulmonary embolism or deep venous thrombosis) within 90 days of the arthroplasty operation.

Notably, their analysis in the Journal of Bone & Joint Surgery found no instance of postoperative myocardial infarctions among the at-risk patients. In addition, the researchers observed no significant difference in the VTE rates of arthroplasty patients, regardless of their CAD history. The same lack of difference held true when the researchers looked only...

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<tr>
<th>PATIENT GROUP</th>
<th>NO. OF PATIENTS</th>
<th>NO. OF VTEs</th>
<th>RATE</th>
<th>P-VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients with CAD undergoing THA</td>
<td>424</td>
<td>1</td>
<td>0.235%</td>
<td>0.560</td>
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<tr>
<td>Patients without CAD undergoing THA</td>
<td>12,914</td>
<td>55</td>
<td>0.426%</td>
<td>—</td>
</tr>
<tr>
<td>Patients with CAD undergoing TKA</td>
<td>604</td>
<td>2</td>
<td>0.331%</td>
<td>0.073</td>
</tr>
<tr>
<td>Patients without CAD undergoing TKA</td>
<td>12,866</td>
<td>141</td>
<td>1.096%</td>
<td>—</td>
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<tr>
<td>Patients with CAD undergoing THA or TKA</td>
<td>1,028</td>
<td>3</td>
<td>0.291%</td>
<td>0.086</td>
</tr>
<tr>
<td>Patients with coronary stents undergoing THA or TKA</td>
<td>288</td>
<td>0</td>
<td>0.000%</td>
<td>0.137</td>
</tr>
<tr>
<td>Patients without CAD or coronary stents undergoing THA or TKA</td>
<td>25,780</td>
<td>196</td>
<td>0.760%</td>
<td>—</td>
</tr>
</tbody>
</table>
at total hip arthroplasty or total knee arthroplasty cases. Similarly, the analysis found no significant difference in VTE rates based on the patients’ coronary stent history.

Although both topical and intravenous administration of TXA during TJA provides systemic levels considered therapeutic, surgeons often prefer topical application for at-risk patients due to concerns that higher levels of intravenous TXA could theoretically increase the risk of cardiac events. Little evidence exists to support the superiority of one method over the other, however. The NYU Langone Orthopedic team repeated its analysis of VTE rates in patients with a history of CAD, in patients with a history of coronary stents, and in the subset of patients who received either total knee or total hip arthroplasty. Again, they found no significant differences based on the type of TXA administration, suggesting that the systemic effect of intravenous TXA may not be as dangerous as previously thought.

Overall, the results suggest that both topical and intravenous TXA are equally safe for all TJA patient populations, including those with a history of CAD or coronary stents, leading the researchers to recommend intravenous TXA due to its potential for easier implementation.
Day-of-Surgery Video and Phone Calls Increase Patients’ Outpatient Surgery Satisfaction

Patient-centered metrics have been increasingly emphasized in the U.S. healthcare system, with patient satisfaction now accounting for 25 percent of a hospital’s quality of care score. Telemedicine is generally associated with high patient satisfaction in the field of orthopedic surgery. In a new randomized controlled trial published in the *Journal of Bone & Joint Surgery*, researchers at NYU Langone Health assessed whether telemedicine in the form of day-of-surgery video or phone calls might likewise improve patient satisfaction after outpatient surgery.

The trial enrolled 251 patients who underwent orthopedic surgery between December 2018 and May 2019; every month, the trial randomly assigned three participating surgeons from the Department of Orthopedic Surgery’s Division of Sports Medicine to one of three communication methods. One surgeon had no contact with patients after their same-day discharge, which had been the standard of care. A second surgeon contacted patients by phone after their discharge, and a third communicated with patients via a video call.

During an in-person office visit one week after surgery, the research coordinator assessed the patients’ satisfaction via the Consumer Assessment of Healthcare Providers and Systems Surgical Care survey (S-CAHPS), which evaluates their experience before, during, and after a single episode of outpatient surgery. The mean S-CAHPS top-box response rate was greater in both the video group (0.86 ± 0.14, p < 0.001) and the phone group (0.84 ± 0.17, p < 0.001) than in the no-contact group (0.68 ± 0.26).
The patients also completed a separate nine-item questionnaire that measured their satisfaction with overall care: 85.9% of patients in the video group gave the top-box response, compared with 71.8% in the phone group and 60.7% in the no-contact group. Patients in the video group, in fact, were most likely to recommend the surgeon to family and friends, feel informed about their postoperative care plan, and have a high opinion of the surgeon. The researchers also found that patients who received a video call from their surgeon reported a strong preference for that form of communication in the future.

Together, the study results suggest that both video and phone calls from an orthopedic surgeon in the hours after a same-day discharge can enhance patient satisfaction with clinical care, while video calls are superior to phone calls for improving satisfaction with overall care.
Positive Outcomes for In-Office Needle Arthroscopy in Treating Anterior Ankle Impingement

To achieve symptomatic relief, patients with anterior ankle impingement often require surgical resection of bony spurs and soft tissue impingement, traditionally achieved via open or arthroscopic anterior ankle debridement in an operating room. The treatment’s recovery period of up to eight weeks, however, has spurred orthopedic surgeons to seek alternatives such as in-office needle arthroscopy (IONA), which may allow for a faster return to sports-related activities. Building on older IONA designs, a minimally invasive nano-arthroscopy system pioneered at NYU Langone Health (known as the NanoScope™ system) features high-quality “chip on tip” visualization on a 1.9-millimeter needle and a full suite of burrs and other tools to allow direct intervention on any identified ankle pathology. Patients do not require a general anesthetic; the procedure can be done under local anesthetic through two 2-millimeter incisions, allowing for immediate mobilization.

Through a retrospective cohort study, orthopedic surgeons from NYU Langone and Amsterdam University Medical Centers in the Netherlands evaluated the clinical outcomes and the patient experience of 31 athletic individuals who underwent the IONA procedure for an anterior ankle impingement. In their new study, published in *Arthroscopy*, the researchers reported that all patients who had worked prior to the IONA procedure returned to work, with a median time-to-return of 1.98 days. Additionally, 26 of 27 patients returned to their sports activities, with a median time-to-return of 3.9 weeks. These results are far superior to those from open or traditional arthroscopic procedures for the same condition.
At the final follow-up, the researchers reported mean post-operative Foot and Ankle Outcome Score (FAOS) measurements of 79.4 ± 11.9 for symptoms; 82.9 ± 15.3 for pain; 83.5 ± 15.4 for daily activities; 71.9 ± 18.5 for sports activities; and 64.3 ± 21.4 for quality of life. The mean Patient-Reported Outcomes Measurement Information System (PROMIS) Pain Intensity T-score significantly decreased from 50.9 preoperatively to 44.5 at the final follow-up (p < 0.001), while the mean PROMIS Pain Interference T-score decreased from 60.3 preoperatively to 55.5 at the final follow-up (p < 0.001).

Overall, the data suggested that IONA treatment of anterior ankle impingement resulted in significant pain reduction, a low complication rate, and excellent patient-reported outcomes including high rates of return to both work and sports. On a 5-point Likert scale, the study reported a mean satisfaction rating of 4.64 ± 0.6; patients similarly rated the overall experience highly, with a mean rating of 9.71 ± 0.8 (out of 10). Of the 31 patients, 29 indicated that they would be willing to undergo the same procedure again, affirming the potential of the novel IONA technique to improve satisfaction and build rapport with patients.

“\textit{I think we are heading toward a time when visiting an orthopedic surgeon will be more like visiting your dentist—you’ll go in for a small procedure under local anesthetic and expect to leave on the same day.}”

— John G. Kennedy, MD

\textit{Disclosure: John G. Kennedy, MD, has received support from the Ohnell Family Foundation and Mr. and Mrs. Michael J. Levitt; he is also a consultant for Arteriocyte Industries (Isto Biologics) and Arthrex\textsuperscript{®}, which produces the NanoScope\textsuperscript{TM}.}

\begin{table}
\centering
\begin{tabular}{|l|l|}
\hline
\textbf{QUESTION} & \textbf{MEAN ± SD} \\
\hline
How was your overall experience seeing your underlying pathology at the time of the procedure?\textsuperscript{a} & 9.71 ± 0.8 \\
Do you feel this aided in your understanding of anterior ankle impingement?\textsuperscript{a} & 9.70 ± 0.6 \\
Would you prefer having this same procedure in the office, operating room, or do you have no preference?\textsuperscript{b} & 9.29 ± 1.9 \\
Did you have any pain during the procedure?\textsuperscript{c} & 0.81 ± 1.3 \\
Likert scale (1–5) & 4.64 ± 0.6 \\
Would you undergo the same procedure again? (% yes) & 29/31 (94) \\
\hline
\end{tabular}
\caption{QUESTIONNAIRE RESPONSES FROM PATIENTS WHO UNDERWENT IONA TREATMENT (N=31)}
\end{table}

\textsuperscript{a: 0-negative, 5-neutral, 10-positive experience; b: 0-operating room, 5-neutral, 10-office; c: 0-no pain, 10-worst pain}
No Major Differences in Cultural Preferences Between Eastern and Western Countries for Toe-to-Thumb Transfer Versus Pollicization

For thumb reconstruction after a traumatic hand injury, a lack of objective data on outcomes following index pollicization versus toe-to-thumb transfer has left patients and providers with few unbiased guideposts to help them choose between the procedures. Various suggestions in the hand surgery literature have posited that Eastern and Western populations may hold significantly different views on the appearance and function of a reconstructed hand. To help provide more cultural context that may aid in decision-making, orthopedic surgeons at NYU Langone Health and their international collaborators examined the differences in preferences and outcome expectations among hand surgeons and the general public in both Eastern and Western countries.

For their study, the investigators recruited several hundred adults and local hand surgeons from six countries: China and India comprised the “Eastern” nations, while Austria, Germany, the United States, and Spain comprised the “Western” nations. Researchers used a 24-question survey to evaluate the study respondents’ preferences and opinions and then graded them on a 5-point Likert scale.

Despite previous suggestions that preferences may depend upon location, the study revealed that the majority of surgeons from all six countries favored toe-to-thumb transfer over pollicization, while the general public didn’t strongly favor one procedure over the other, regardless of location. In India and China, however, more surgeons thought patients would somewhat or strongly favor a toe-to-thumb transfer. Surgeons, however, held more optimistic expectations than the general public on both procedures. After pollicization, a greater proportion of doctors predicted good-to-excellent postoperative hand function, new thumb sensation, and appearance of the reconstructed hand; after a toe-to-thumb transfer, a higher percentage of surgeons similarly held more positive expectations for function and appearance. The significantly different expectations for outcomes between surgeons and the general public, the researchers suggest, underscore the necessity of research to evaluate and more conclusively determine which thumb reconstruction procedure optimizes patient outcomes.
Assumptions around culture should be made very carefully. Our analysis shows that patients around the world are much more similar in their preferences than previously thought.

— Jacques H. Hacquebord, MD

Surgeons also appeared to underestimate the importance of having a 5-digit versus a 4-digit hand, which the majority of the general population saw as important to very important. Discussing the pros and cons of each procedure and ensuring good alignment in outcome expectations between physicians and patients prior to surgery, the researchers concluded, can increase patient satisfaction and decrease anxiety and conflict in the postoperative period.

### Survey Responses to “Which Procedure Do You Think You Would Prefer?”

<table>
<thead>
<tr>
<th>Preference</th>
<th>General Population</th>
<th>Surgeons</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>China</td>
<td>India</td>
</tr>
<tr>
<td>Strongly Favor Pollicization</td>
<td>15.6%</td>
<td>34.7%</td>
</tr>
<tr>
<td>Somewhat Favor Pollicization</td>
<td>20.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Uncertain</td>
<td>17.8%</td>
<td>8.2%</td>
</tr>
<tr>
<td>Somewhat Favor Toe-to-Thumb Transfer</td>
<td>28.9%</td>
<td>8.2%</td>
</tr>
<tr>
<td>Strongly Favor Toe-to-Thumb Transfer</td>
<td>17.8%</td>
<td>49.0%</td>
</tr>
</tbody>
</table>

Initial survey results based on n=202 for general public and n=106 for hand surgeons

### Survey Responses to “How Important is Having a 5-Digit Versus a 4-Digit Hand?”

<table>
<thead>
<tr>
<th>Importance</th>
<th>General Population</th>
<th>Surgeons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Important</td>
<td>44.0%</td>
<td>21.2%</td>
</tr>
<tr>
<td>Important</td>
<td>37.5%</td>
<td>37.5%</td>
</tr>
<tr>
<td>No Opinion</td>
<td>12.5%</td>
<td>3.8%</td>
</tr>
<tr>
<td>Unimportant</td>
<td>3.0%</td>
<td>35.6%</td>
</tr>
<tr>
<td>Very Unimportant</td>
<td>3.0%</td>
<td>1.9%</td>
</tr>
</tbody>
</table>

Initial survey results based on n=202 for general public and n=106 for hand surgeons
Vertebral Body Tethering Yields Better Correction of Fractional Curve and L5 Tilt Than Fusion for Adolescent Idiopathic Scoliosis

As an alternative to the gold standard of posterior spinal fusion (PSF) for treating adolescent idiopathic scoliosis (AIS), vertebral body tethering (VBT) is gaining momentum among orthopedic surgeons due to its ability to spare growth and motion in pediatric patients. NYU Langone Health is one of the only institutions globally to use CT imaging for precise titanium screw placement during the VBT procedure. Clinical data have suggested that AIS patients with more than a 16-degree L5 tilt are at higher risk for faster disc degeneration if the tilt remains uncorrected. VBT may help prevent such degeneration better than PSF, though surgeons are still investigating how the techniques compare in correcting the main, secondary, and fractional spinal curves as well as the L5 tilt.

To help address these questions, NYU Langone researchers, led by Juan C. Rodriguez-Olaverri, MD, PhD, clinical associate professor of orthopedic surgery, conducted a single-center retrospective cohort analysis of 41 AIS patients: 21 of whom underwent a VBT procedure and 20 of whom received a PSF intervention. The researchers used preoperative and postoperative radiographic analyses to measure differences in the main, secondary, and fractional curve Cobb angles and in the L5 tilt. The VBT patients were younger, and their cases more frequently extended to the L4 vertebra (61.9% versus 15.0%). The patient groups, however, did not differ significantly in

Preoperative and postoperative imaging demonstrates the reduction in curvature achieved with the VBT technique.
their height, weight, BMI, or Risser scores. The VBT group had larger preoperative secondary curve Cobb angles and L5 tilt, but did not differ from the PSF group in the preoperative main or fractional curve Cobb angles. At two years postoperatively, the VBT cohort had significantly smaller fractional curve angles and L5 tilt, which translated into a greater correction of the L5 tilt (−17.2 ± 10.2 versus −6.3 ± 6.9 degrees, p<0.001).

After propensity matching, differences in the preoperative measurements were no longer significant. At two years postoperatively, the remaining 12 patients in the VBT group still demonstrated a significantly smaller fractional curve Cobb angle than their 12 matched PSF counterparts. Likewise, the VBT cohort still had a significantly smaller L5 tilt, again translating into a greater correction of the L5 tilt (−16.8 ± 7.1 versus −6.2 ± 5.3 degrees, p<0.001).

The results suggest that the VBT technique, which is better at preserving AIS patients’ range of motion, flexibility, and growth, offers an effective non-fusion alternative for correcting the spinal deformity. In addition, VBT may lead to fewer complications later in life by preventing degenerative changes. A larger study with a longer follow-up period, the researchers suggest, may help to substantiate these potential benefits.

### COMPARISON OF PREOPERATIVE AND POSTOPERATIVE FRACTIONAL CURVES AND L5 TILT SCORES

#### BEFORE PROPENSITY SCORE MATCHING

<table>
<thead>
<tr>
<th></th>
<th>PREOP</th>
<th>TWO-YEAR POSTOP</th>
<th>CHANGE (Δ)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VBT (n = 21)</td>
<td>PSF (n = 20)</td>
<td>VBT (n = 21)</td>
</tr>
<tr>
<td>L5 Tilt</td>
<td>18.3 ± 6.7</td>
<td>12.9 ± 8.1</td>
<td>5.8 ± 4.1</td>
</tr>
<tr>
<td>Fractional Curve</td>
<td>24.8 ± 24.3</td>
<td>29.6 ± 11.1</td>
<td>3.6 ± 4.2</td>
</tr>
</tbody>
</table>

#### AFTER PROPENSITY SCORE MATCHING

<table>
<thead>
<tr>
<th></th>
<th>PREOP</th>
<th>TWO-YEAR POSTOP</th>
<th>CHANGE (Δ)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VBT (n = 12)</td>
<td>PSF (n = 12)</td>
<td>VBT (n = 12)</td>
</tr>
<tr>
<td>L5 Tilt</td>
<td>17.9 ± 6.5</td>
<td>15.9 ± 8.3</td>
<td>4.7 ± 2.8</td>
</tr>
<tr>
<td>Fractional Curve</td>
<td>25.7 ± 28.5</td>
<td>26.6 ± 12.2</td>
<td>4.9 ± 5.1</td>
</tr>
</tbody>
</table>
Integrated Quality and Safety Initiatives

NYU Langone Orthopedics is committed to developing unique partnerships throughout the institution to support our quality and safety initiatives.
Standardizing Total Joint Replacement Care

To ensure that evidence-based care practices in total joint replacement are standardized across the Department of Orthopedic Surgery’s three sites, an interdisciplinary, cross-campus team—including surgeons, nurses, nurse practitioners, anesthesiologists, care managers, and physical therapists—was created to develop a robust clinical pathway to meet patients’ needs.

The clinical pathway workgroup performed a current state analysis at each campus to evaluate existing workflows and order sets. With the assistance of a physician clinical informatics specialist, an electronic platform was developed to organize peer-reviewed evidence, process maps, and order revisions. Based on this data, the team implemented proposals to optimize workflow processes and order sets from pre-admission to post-discharge. As a result, pre-admission processes were enhanced, and preoperative and postoperative order sets adjusted to improve pain management, mobilization techniques, and transition practices to home.

Following the clinical pathway’s implementation, average length of stay has decreased for patients undergoing total hip arthroplasty (2.21 days to 1.89 days) and total knee arthroplasty (2.76 days to 1.83 days); patient surveys indicate high rates of satisfaction. As care for total joint arthroplasty changes, the team will continue to review the elements of pathway success, including preoperative education, standardized orders derived from evidence-based practice, and pathway compliance by nurse practitioners and surgeons.

Artificial Intelligence Could Yield Real Benefits in Stratifying Surgical Risk

The ability to accurately predict patient-specific perioperative risk is critical to ensuring optimal surgical outcomes—but existing risk stratification methods are notoriously complex and cumbersome. In response to the shift toward value-based care for complex procedures such as total joint arthroplasty, a team from NYU Langone’s Center for Orthopedic Innovation has undertaken the development of novel methods of risk stratification that can be managed efficiently at the point of care.

One such method, Constance, is a comprehensive risk assessment platform that provides a range of patient-specific surgical risk calculations conceived and co-developed by members of the orthopedic surgery team. The platform provides a stratification tool to capture perioperative risk profiles based on patient risk factors and delivers real-time calculations for patient-specific clinical decision support, with the goal of optimizing recovery times.

The machine-learning framework leverages patient data available within the electronic medical record to provide actionable information, utilizing artificial intelligence-based predictive modeling approaches for early identification and mitigation of patient-specific risk in order to improve quality metrics. The model relies on metrics, including 30- and 90-day readmissions, perioperative fractures, infections, and discharge disposition, while taking into account alternative payment model constraints.

“Constance has taken advantage of AI models that greatly enhance the ability to risk stratify our patients before surgery by identifying clinical risks that may not be readily apparent to an otherwise overwhelmed clinical care team,” notes Morteza Meftah, MD, clinical associate professor in the Department of Orthopedic Surgery and chair of the Center for Orthopedic Innovation. “The ultimate goal of utilizing these trained models is to empower providers to reduce complications after total joint replacements, and improve the quality of care both before and after surgery, without augmenting or changing current workflows.”
Capstone Project: Refining Emergent Diagnosis

As part of the NYU Wagner Graduate School of Public Service degree program, students must complete a Capstone Project—a real-world initiative designed to enhance outcomes in a critical area of public service. Through NYU Wagner’s partnership with the Department of Orthopedic Surgery at NYU Langone Health, a team of students focused its 2021 project on developing a clinical feedback system to improve the accuracy of orthopedic diagnosis in the emergency department (ED).

The ED, where clinicians may not have access to an available on-call orthopedic consultant, is a common entry point for patients—and imprecision of ED diagnosis may have potential implications such as loss of orthopedic clinic follow-up. To further define that issue, the team conducted a literature review and interviewed stakeholders across the emergency, patient quality, and orthopedic surgery departments at NYU Langone Orthopedic Hospital and NYU Langone Hospital—Brooklyn, to identify trends, research solutions implemented by other institutions, and reveal opportunities for improvement.

With the combined findings, the team determined that all patients were diagnosed appropriately and only 0.18% of the 22,364 coded entries, or 41 encounters, had refinements to their diagnosis (e.g., “chronic right knee pain” refined to “right knee osteoarthritis”) after discharge. Those insights supported a list of recommendations to enhance diagnostic precision, including interdepartmental Epic In Basket messaging; Epic e-triggering as a pop-up feature for physicians; standardized protocols for orthopedic consultation in the ED; and programs for physicians’ ongoing education.
Engineering Better Bone and Cartilage Health

Five projects initiated by the Department of Orthopedic Surgery and collaborators at the NYU Tandon School of Engineering are aimed at developing technologies to enhance musculoskeletal health and healing.

One collaboration, with Weiqiang Chen, PhD, associate professor of biomedical engineering and mechanical and aerospace engineering, is developing a bone-on-a-chip to study interactions between cell types in the bone marrow niche responsible for age-associated degeneration. The approach will enable researchers to dissect complex interactions—including those between aging hematopoietic cells and skeletal stem cells—and screen potential drug candidates in an in vitro model rather than in vivo testing.

In a second, NIH-funded collaboration, a team led by Alesha Castillo, PhD, assistant professor of biomedical engineering and orthopedic surgery, is using a mouse tibial defect model to understand how mechanical loading affects fracture healing, and studying biomimetic drugs that can be delivered intravenously to promote fracture healing and potentially alleviate osteoporotic bone loss.

A Department of Defense-funded collaboration with Paulo Coelho, DDS, PhD, professor of mechanical engineering, is applying 3D-printed scaffolds to treat large bone defects, such as those following trauma or tumor resection. In a study submitted to the NIH, the team designed a custom 3D-printed scaffold that resulted in complete osseointegration and stable healing in a sheep tibial osteotomy model.

The fourth collaboration, with Mary Cowman, PhD, professor of biomedical engineering and orthopedic surgery, and Thorsten Kirsch, PhD, professor of orthopedic surgery, cell biology, and biomedical engineering, is investigating how a 15-mer peptide that binds to hyaluronan affects cartilage repair. The team has demonstrated that the peptide, which has anti-inflammatory properties, markedly improved cartilage repair after microfracture surgery. Their research has resulted in NIH and other extramural funding, a filed patent, and ongoing discussions with companies regarding license agreements.

Finally, a collaboration with Jose Maria M. Raya Garcia Del Olmo, PhD, associate professor of radiology, and Maria Amparo Ruiz Garzon, PhD, assistant professor of radiology, is focused on developing novel imaging modalities using the 15-mer hyaluronan-binding peptide. The team is investigating use of the diagnostic imaging agent to identify early stages of osteoarthritis or osteoarthritis progression.
Selected Podium and Poster Presentations


American Academy of Orthopedic Surgeons Annual Meeting (San Diego, CA, August 31–September 3, 2021)
- Effect of Departmental Opioid-Sparing Protocol on Opioid Prescribing Patterns in Total Hip Arthroplasty Patterns. Poster.
- Accuracy of Patient Classification Following the Removal of Total Hip Arthroplasty from the Centers for Medicare & Medicaid Services Inpatient-Only List. Poster.
- Discontinued Use of Outpatient Intermittent Pneumatic Compression Devices Does Not Increase Risk of Venous Thromboembolism in Patients Undergoing Primary Total Hip Arthroplasty Using Low Dose Aspirin: A Retrospective Cohort Study. Poster.
- Temporal, Seasonal, and Monthly Effects on Total Knee Arthroplasty Surgical Site Infection Rates. Poster.
- The Effect of a Total Hip Arthroplasty Bundled Payment Program on Perioperative Smoking and Obesity. Podium Presentation.
- The Effect of Medicare’s Bundled Payments for Care Initiative on Patient Risk Factors Prior to Total Knee Arthroplasty. Podium Presentation.
- Patient Satisfaction with Overall Care Is Equivalent Using Telemedicine Versus Traditional Office-Based Follow-Up After Shoulder Arthroscopy: A Prospective Randomized Controlled Trial. Poster.
- Socioeconomic Factors on Outcomes Following Anterior Cruciate Ligament Reconstruction. Poster.
- Patient Satisfaction with Overall Care Is Equivalent Using Telemedicine Versus Traditional Office-Based Follow-Up After Arthroscopic Meniscus Surgery: A Prospective Randomized Controlled Trial. Podium Presentation.
- Reduced Opioid Prescribing Following Arthroscopic Meniscectomy Does Not Negatively Impact Patient Satisfaction. Podium Presentation.

Hand Society 76th Annual Meeting (San Francisco, CA, September 30, 2021)

2021 Movement Is Life Caucus (Washington, DC, November 4–5, 2021)
- Telemedicine Utilization by Orthopedics Patients During COVID-19 Pandemic: Demographic and Socioeconomic Analysis. Poster.
- Racial Disparities in Hospital Length of Stay and Cost for Patients Undergoing Elective Primary Total Hip and Total Knee Arthroplasty: Results from the New York SPARCS Database. Poster.

- Tranexamic Acid Has No Effect on Postoperative Pain Control Following ACL Reconstruction Using Bone Patella Tendon Bone Autograft: A Double-Blind Randomized Controlled Trial. Podium Presentation.

2021 American Association of Hip and Knee Surgeons Annual Meeting (Dallas, TX, November 11–14, 2021)
- Does Antibiotic Bone Cement Reduce Infection Rates in Revision Total Knee Arthroplasty? Poster.
- Does Surgeon Volume Affect PROMs Following Primary Total Hip Arthroplasty?—An American Joint Replacement Registry Study. Poster.
- The Effect of Hospital Volume on PROMs—An American Joint Replacement Registry Study. Poster.
- Tourniquet Use Is Associated with Improved Outcomes in Aseptic Revision Total Knee Arthroplasty. Podium Presentation.
- Impact of Pre-Operative Anemia Severity on Primary Total Knee Arthroplasty Outcomes. Poster.
- Role of Operating Room Size on Air Quality in Primary Total Hip Arthroplasty. Poster.
- Does It Matter Which PRO You Collect to Measure Health-Related Quality of Life (HRQoL) in Total Hip Arthroplasty? Poster.

- Osteotomies About the Knee Can Safely Be Performed in an Ambulatory Setting. Poster.
- Tranexamic Acid Has No Effect on Post-Operative Hemarthrosis or Pain Control Following Tibial Tubercle Osteotomy: A Double-Blinded Randomized Control Trial. Podium Presentation.
Selected Peer-Reviewed Publications


About Us

NYU Langone Orthopedics

NYU Langone Orthopedics is one of the largest and most accomplished orthopedic programs in the country. Under the leadership of Joseph D. Zuckerman, MD, the Walter A.L. Thompson Professor of Orthopedic Surgery, our expanding footprint now includes NYU Langone Hospital—Brooklyn and NYU Langone Hospital—Long Island, plus offices throughout New York City’s five boroughs, Westchester County, and New Jersey. Our faculty at NYU Grossman School of Medicine and NYU Long Island School of Medicine has grown to more than 200 physician experts dedicated to excellence in orthopedic surgery. Our physicians provide world-class care in all orthopedic subspecialties, including adult reconstructive surgery, orthopedic trauma, spine surgery, sports medicine, hand surgery, musculoskeletal oncology, shoulder and elbow surgery, pediatric orthopedics, primary care sports medicine, and foot and ankle surgery.

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Chair, Walter A.L. Thompson  
Professor of Orthopedic Surgery

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Vice Chair, Clinical Affairs and Quality

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Chair, NYU Langone Hospital—Long Island

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Vice Chair

Philipp Leucht, MD, PhD  
Director, Orthopedic Research

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Vice Chair, NYU Langone Hospital—Brooklyn

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Department Administrator

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Associate Program Director  
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Lorraine.Hutzler@nyulangone.org

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Spine  
Themistocles Protopsaltis, MD

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Veterans Affairs New York Harbor Healthcare System  
Ramesh H. Gidumal, MD

For more information about our physicians and locations, visit nyulangone.org/orthopedics
The Best Outcomes

This report serves as just one example of outstanding quality and safety standards that are the hallmarks of our institution. NYU Langone’s emphasis on continuous improvement inspires teams to continually raise the bar on quality and safety across our growing network in Manhattan, Brooklyn, Queens, Long Island, Staten Island, and Florida.

NYU Langone’s Tisch Hospital, Kimmel Pavilion, NYU Langone Hospital—Brooklyn, and NYU Langone Hospital—Long Island were each awarded an “A” in the fall 2021 Leapfrog Hospital Safety Grade. We are the only health system in the New York Metropolitan area with all “A”-rated hospitals. NYU Langone also achieved Five Star ratings on CMS Hospital Compare, along with top rankings by Vizient.

Ranked eighth by U.S. News & World Report for Best Hospitals, and ranked second for Best Grad Schools for Medical Research in the nation.

Transforming Medical Education

As COVID-19 has added new urgency to nationwide physician shortages, debt burden, and lack of diversity, we remain committed to our accelerated pathways to the MD degree and full-tuition scholarships regardless of need or merit at both NYU Grossman School of Medicine and NYU Long Island School of Medicine.
Learn more about how we are advancing orthopedics on our new website, Physician Focus.

Point your smartphone camera to the QR code.