

Vanderbilt Orthopaedia

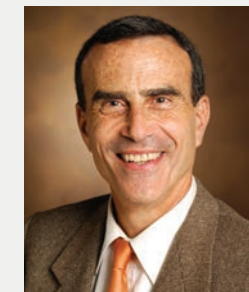
PATIENT SAFETY, QUALITY & OUTCOMES

JANUARY 2017

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NO CHANGES IN OUR MISSION

The past few months took us on a wild ride of emotions and surprise in which there were many changes. The election, the Cubs, warm weather and wildfires top the list. President-elect Donald Trump announced that he will nominate Rep. Tom Price, M.D. (R., Ga.), our orthopaedic colleague from the northern suburbs of Atlanta, for Secretary of the U.S. Department of Health and Human Services. Rep. Price visited our program and spent a day with us a year or two after he introduced his own plan to replace the Affordable Healthcare Act (AHA, or Obamacare) in 2013. Rep. Price also introduced his plan, "Empowering Patients First Act" as actual legislation. The Price plan is notable for reforms that doctors care about.



- Patient choice is promoted over mandates.
- Tort reform through the creation of Best Practice guidelines developed in collaboration with physician specialty societies.
- Creation of state health care tribunals to arbitrate malpractice claims.
- Replace AHA subsidies with health insurance tax credits (age-based) or health savings accounts for consumers who do not have coverage from their employer, Medicare, Medicaid or the VA.

Will a Price-type plan be competitive with the AHA on covering the uninsured? Costs will require analysis and review. The possibility for debate is refreshing. "Every time we start a new project, we always ask ourselves the same question: What can we do better and different?" [Ricardo Guadalupe].

In the Department of Orthopaedic Surgery and Rehabilitation at Vanderbilt University Medical Center, one thing has not and will not change. Our commitment to patient service, safety and the delivery of top-shelf quality medical care remains immutable. Enclosed please find our fourth annual patient safety, quality and outcomes *Orthopaedia* publication. Divisional studies are reported that detail a variety of observations we have investigated that we hope will improve the value of care we deliver and the education we promote.

Finally, in addition to news, highlights and recent academic productivity from the Department, our opening section details with great sadness the passing of two icons dear to us all. Drs. Art Brooks (1924-2016) and Neil Green (1940-2016) both died in July. Every one of us has strong personal memories for these storied stalwarts of our Department for whom we are thankful to have known or learned about. Art and Neil founded the edifice upon which we exist and grow along with Drs. Bill Hillman (1921-1970) and Dan Spengler. Our sympathies are extended to their families and we are grateful to the many alumni and friends who attended their funerals and honored their memories with contributions.

Sincerely,
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Remembering Two Vanderbilt Orthopaedic Icons

2016 saw the passing of two Vanderbilt Orthopaedic doctors who made tremendous contributions to the department and university, the field of orthopedics and generations of surgeons. Arthur L. Brooks, M.D., an innovator of surgical techniques and mentor to younger surgeons, died July 28 at the age of 91. Neil E. Green, M.D., a pioneer in pediatric orthopaedics and passionate educator, died July 9 at the age of 75.

A Legacy of Service, Innovation and Mentorship



Arthur L. Brooks, M.D.

Brooks' remarkable history with Vanderbilt began in 1952, when he received his medical degree here. He completed residencies in general and orthopaedic surgery at Vanderbilt before serving at Charity Hospital in New Orleans from 1959 to 1962. Following his return to Vanderbilt in 1963, he

became known as an expert surgeon, dedicated mentor and patient advocate. He twice served as acting chairman of Orthopaedics (1970-79, 1981-83) and also as chief of the Department of Orthopedics at the VA hospital in Nashville from 1974 until his retirement in 1984. Before the advent of the Monroe Carrell Jr. Children's Hospital at Vanderbilt, Brooks was an integral part of what was then called the Crippled Children's Clinic, where he cared for thousands of young patients over the years.

In 1985, Vanderbilt Medical Center dedicated the Arthur L. Brooks Center for Education and Research in Orthopedics in his honor. The Vanderbilt Orthopaedic Society, a group composed of his former residents and colleagues, also established the Arthur L. Brooks Endowment for Resident Education, which supports equipment and programs to enhance resident education.

Brooks' combination of compassion and clinical expertise positively impacted the lives of individuals as well

as the Vanderbilt Department of Orthopaedics.

"He left such a great mark on our program that basically anybody who came through the program from 1963 forward knew what he stood for and realized how important he was in the development of our Department of Orthopaedics," said friend and colleague Douglas Weikert, M.D., associate professor of Orthopaedics and Rehabilitation.

Weikert recalls that, while at Charity Hospital, Brooks treated a disabled child who had been abandoned on a doorstep. The child spoke no English and was crippled by a spinal deformity from Pott's disease. Other surgeons said nothing could be done, but Brooks researched and performed a new surgical procedure for the condition. With a second chance at life, the young boy recovered, learned English, and went on to become an accountant.

A specialist in hand surgery, Brooks' innovations include procedures for the correction of rheumatoid hand deformities and the control of mechanical instability in the cervical spine. Surgeons who trained with him benefitted from his heartfelt personal mentorship, including Saturday breakfasts at the Pancake Pantry and sharing tomatoes he grew on his farm.

Gregory Mencio, M.D., director of Pediatric Orthopaedics at Monroe Carell Jr. Children's Hospital at Vanderbilt and Neil E. Green professor and vice chairman of the Department of Orthopaedics, got to know Brooks through his continued presence at grand rounds, conferences and chief resident graduation events, even after he retired.

"As with all great teachers, Brooks understood the importance of lifelong learning," Mencio said. "His legacy as a leader, mentor, colleague and patient advocate is an important example for all of us in orthopaedics and academic medicine. His lessons and folksy wisdom continue to impact the professional lives of those he trained directly as well as several next generations of Vanderbilt Orthopaedic residents and surgeons." [Read more here.](#)

A Prolific Pioneer and Passionate Educator



Neil E. Green, M.D.

Green always knew that he wanted to be an orthopaedic surgeon, like his father, and went on to become an international leader in the field. After serving as a surgeon in the U.S. Air Force, he joined Vanderbilt Department of Orthopaedics and Rehabilitation as an assistant professor in 1976.

Over the course of 38 years, Green served as vice chairman of the department, director of Pediatric Orthopaedics, director of the residency program and chairman of the Vanderbilt Hospital Medical Board. The Neil E. Green Lectureship at Vanderbilt recognizes Green's many contributions in advancing the missions of education, research and advocacy of the orthopaedic profession, as well as his impact on the next generation of orthopaedic surgeons.

Green left an indelible mark on orthopaedics and treatments for children. He helped change the way surgeons care for pediatric patients with femur and forearm fractures, and his research on bracing for children with scoliosis helped introduce part-time bracing as an effective treatment. He was the editor of *Skeletal Trauma in Children*, later renamed *Green's Skeletal Trauma in Children*; authored more than 100 articles and book chapters; and gave more than 200 presentations and guest lectures in the United States and across the world. Acknowledging his great contributions, the American Orthopaedic Association honored him as the Alfred Shands Guest lecturer.

"Neil's surgical acumen impacted tens of thousands of young lives. He used his immense skills and warm, outgoing demeanor to help many children and their parents through often difficult circumstances related to injury or illness. I know many of them developed a deep affection for him, as did his colleagues," said C. Wright Pinson, MBA, M.D., Deputy Chief Executive Officer and Chief Health System Officer for Vanderbilt University Medical Center.

Green's clinical expertise was matched by his commitment to resident education, said Herbert S. Schwartz, M.D., chairman of the Vanderbilt Department of Orthopaedics.

"Amongst so many accolades, it is resident education that stands out in my memories. Neil transformed the culture of our orthopaedic residency and surgical education through his example and vision," Schwartz said.

After stepping down as director of Pediatric Orthopaedics in 2006, Green continued to serve as professor of Orthopaedic and Rehabilitation and associate professor of Pediatrics. Upon his retirement, he was honored by friends and colleagues at a reception in January 2015. At that time, he reflected on his years at Vanderbilt, saying "I have seen a marked transformation in Children's Hospital since I began my career at Vanderbilt. In the beginning there was a Children's Hospital in name, which was part of the main hospital. With the help of Drs. Ian Burr and Jim O'Neill we were able to create what is one of the best children's hospitals in the country."

Mencio remembers Greens as the "consummate academic medical surgeon."

"He was a skilled clinician and surgeon, but his true passion was resident education. He has rightfully earned the gratitude of so many patients, and his contributions to pediatric orthopaedics will continue to improve the care of children for many years," Mencio said. "He has had a profound impact at Vanderbilt that extends beyond the Department of Orthopaedics. His legacy lives on through the many residents and fellows he has trained who share his professional and philosophical values and the respect of his peers and associates."

Green also served as president of the Pediatric Orthopaedic Society of North America, the American Board of Orthopaedic Surgery, the Southern Orthopaedic Association, the Tennessee Orthopaedics Society and the Nashville Orthopaedic Society, among others. [Read more here.](#)

Vanderbilt University Medical Center is the Safest Trauma Center in the Country!

Hospitals were rated on: mortality, complications, inpatient quality, core process, patient safety and patient satisfaction. Only 10% of hospitals received the highest rating. Vanderbilt Medical Center was in the highest rating in all categories and was the overall #1 ranked. Another Nashville-based trauma center was ranked 364 of 370. [Read more here.](#)

RANK	HOSPITAL NAME	CITY	STATE
1	Vanderbilt University Hospital	Nashville	TN
2	Rhode Island Hospital	Providence	RI
3	North Shore University Hospital	Manhasset	NY
4	Lehigh Valley Hospital	Allentown	PA
5	St Vincent Hospital & Health Services	Indianapolis	IN
6	Providence Sacred Heart Medical Center	Spokane	WA
7	Delray Medical Center	Delray Beach	FL
8	University of Alabama Hospital	Birmingham	AL
9	Hartford Hospital	Hartford	CT
10	Mercy Hospital Springfield	Springfield	MO
11	Orlando Health	Orlando	FL
12	Indiana University Health	Indianapolis	IN
13	Abington Memorial Hospital	Abington	PA
14	Banner-University Medical Tucson	Tucson	AZ
15	Florida Hospital	Orlando	FL
16	Regional Medical Center Bayonet Point	Hudson	FL
17	Harborview Medical Center	Seattle	WA
18	Texas Health Harris Methodist Fort Worth	Fort Worth	TX
19	Community Regional Medical Center	Fresno	CA
20	Huntsville Hospital	Huntsville	AL
21	Ohio State University Hospitals	Columbus	OH
22	Brigham and Women's Hospital	Boston	MA
23	Saint Francis Hospital, Inc	Tulsa	OK
24	University of WI Hospitals & Clinics	Madison	WI
25	Wakemed, Raleigh Campus	Raleigh	NC

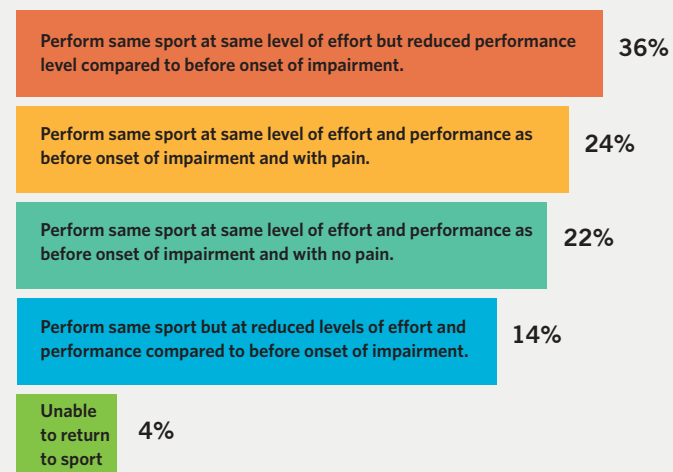
370 trauma centers were ranked on mortality and quality outcomes. Vanderbilt University Medical Center was ranked the #1 safest hospital for Trauma in the country by CareChex Quality Rating System

Impact of Preoperative Expectations and Fear of Movement on Return to Sport and KOOS Scores at 6 Months following ACL Reconstruction

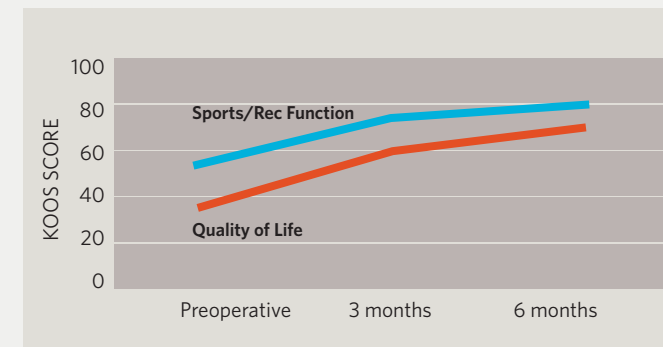
The purpose of this study was to examine the association between preoperative psychosocial characteristics and return to sport and sports function at 6 months after ACLR. A secondary objective was to examine the importance of psychosocial characteristics to knee-specific quality of life (QOL). 54 patients between the ages of 18 and 33 undergoing a primary, unilateral ACLR were enrolled. Patients completed questionnaires before surgery and 6 months after surgery.

- Patient expectations for having a successful surgery were assessed with a 10-item numeric rating scale.
- Preoperative fear of movement was assessed with the Tampa Scale for Kinesiophobia (TSK-13).
- Preoperative self-efficacy was assessed with the General Self-Efficacy Scale (GSES) and Knee Self-Efficacy Scale (KSES).
- Outcomes included Subjective Patient Outcome for Return to Sports (SPORTS) score and Knee Injury and Osteoarthritis Outcome Score (KOOS) sports/recreation and QOL subscales.

6 MONTH FOLLOW-UP RATE



The 6 month follow-up rate was 93%. 96% of patients reported returning to sport 6 months after ACLR, with 46% returning to same pre-injury level of effort and performance.



KOOS scores improve over time (p < 0.05).

MULTIVARIABLE MODELS

	SPORTS	KOOS Sports/Recreation	KOOS QOL
Activity Avoidance	0.75 (0.59, 0.95)*		-1.4 (-2.9, 0.01)
Expectations	0.74 (0.33, 1.7)	-5.0 (-9.7, -0.43)	

MULTIVARIABLE MODELS CONTROLLED FOR AGE AND PREOPERATIVE MARX ACTIVITY RATING SCALE OR KOOS SCORE, * P < 0.05

Higher preoperative activity avoidance scores were significantly associated with not returning to sport at the same level of effort and performance as before onset of impairment (OR = .75, p = .02), and worse scores on the KOOS QOL subscale (β = -1.4, p = .05) at 6-month follow-up. Higher preoperative expectations were a significant risk factor for worse outcomes on the KOOS subscales, with a 1-point increase in expectations associated with a 5.0-point decrease in KOOS sports/rec (p = 0.03) and 4.7-point decrease in KOOS QOL (p = 0.05) scores.

Screening patients for fear of movement and unrealistic expectations prior to ACL reconstruction may help identify patients at risk for poorer outcomes. Targeted psychosocial rehabilitation strategies that address activity avoidance related to fear and expectations have the potential to improve return to sport at the same level of effort and performance and knee-specific health outcomes during the early recovery period.

Surgeon-Level Variability in Cost and Outcomes for Elective Lumbar Decompression-Fusion

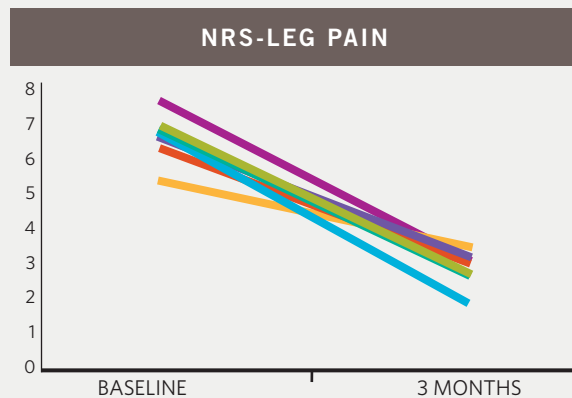
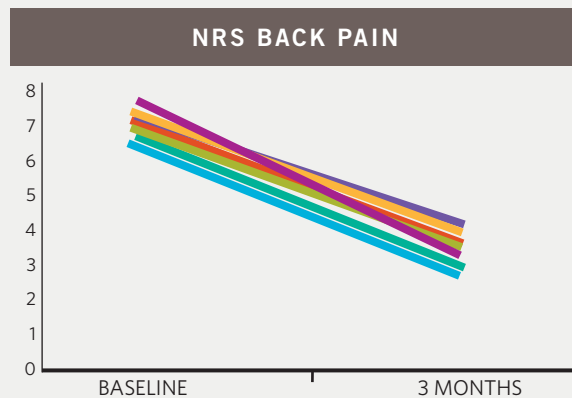
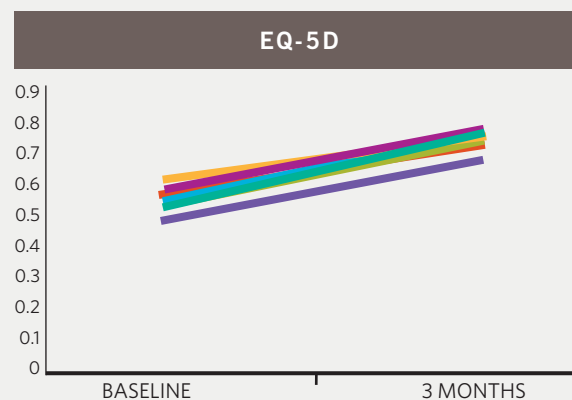
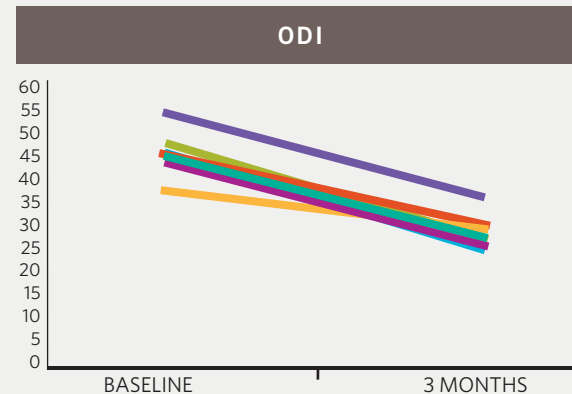
The aim of this study was to examine the surgeon-level variations in outcomes and cost for laminectomy and fusion for degenerative lumbar disease.

VARIABILITY IN PATIENT OUTCOMES

Patient-reported outcomes were also recorded at baseline and 3-months after surgery:

- 1) back-related disability: Oswestry Disability Index (ODI);
- 2) Numeric rating scale (NRS) for back pain and leg pain;
- 3) Quality of life - EuroQol-5D (EQ-5D).

There was no statistically significant difference in the change score (from baseline to 3-month after surgery) among the surgeons. ODI (P=0.18), EQ-5D (P=0.45), NRS-Back pain (P=0.71), NRS-Leg Pain (P=0.15).

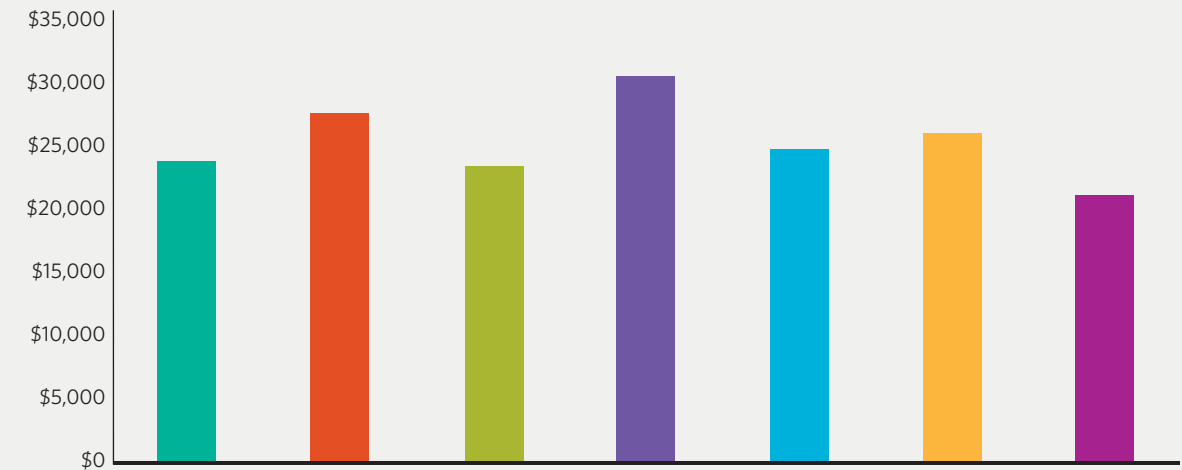


Improvement in ODI (lower the better), EQ-5D (higher the better), NRS-back pain (lower the better) and leg pain (lower the better) from baseline to 3-months after surgery among the surgeons.

This study provides valuable insight into variations in outcomes, and 90-day costs among the surgeons performing lumbar laminectomy/fusions at a single institution. Specific surgeons were found to have greater odds of performing high-cost surgeries. Adjusting for preoperative comorbidities, however, led to costs that were higher than the actual costs for certain surgeons and lower than the actual costs for others. Therefore, it is imperative to involve surgeons in the decision-making and to consider variability in cost at the individual surgeon level after adjusting for complexity of the patient population managed by each surgeon. This study can form the basis to stimulate action to improve uniformity and cost-containment for lumbar fusion surgery.

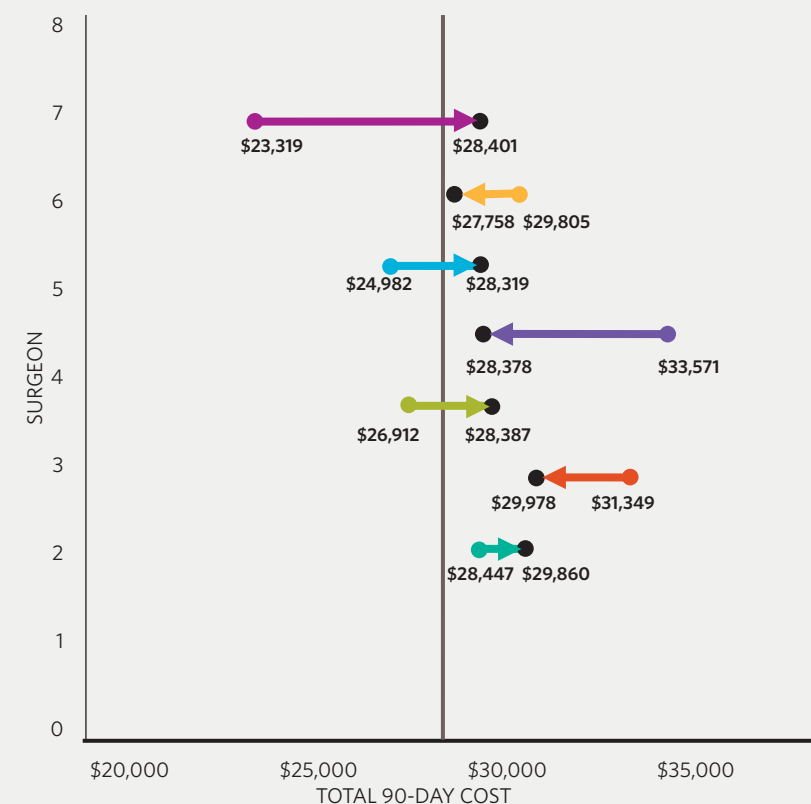
Variation in Cost

TOTAL 90-DAY COST ASSOCIATED WITH LAMINECTOMY AND FUSION



The costs are derived as the sum of inpatient hospitalization cost + surgeons' professional cost + post-discharge health care resource utilization. All the costs are estimated based on the Medicare allowable national payment amounts. These costs can vary significantly based on the payer status. Utilizing the actual payer status for each patient would make the direct costs higher than reported. The mean total 90-day direct cost for laminectomy and fusion surgery was \$28,947 ± \$9,484 (median: \$27,565, IQR: \$22,952, \$32,837). The median 90-day cost among surgeons ranged from \$23,103 to \$33,109 (P<0.0001). The DRG-based hospital cost for these patients was \$24,399 ± \$8,190 (median: \$23,419, IQR: \$19,276, \$27,807)

90-DAY ADJUSTED COST VS. ACTUAL 90-DAY COST FOR EACH PARTICIPATING SURGEON



The vertical axis represents actual median 90-day cost (\$27,565). The black dots represent mean comorbidity-adjusted 90-day cost for each surgeon and the colored dot represents the mean actual 90-day costs. The line joining the colored and black dots represents the difference between the actual and the adjusted cost. The adjusted cost was higher than the actual cost for surgeons # 1 (p=0.08), #3 (p=0.002), #5 (p<0.0001), and #7 (p<0.0001), suggesting these surgeons were less costly than predicted. In contrast, the adjusted cost was lower for surgeons # 2 (p=0.128), #4 (p<0.0001), and #6 (p=0.44), which suggests that these surgeons were more costly than predicted after adjusting for comorbidities.

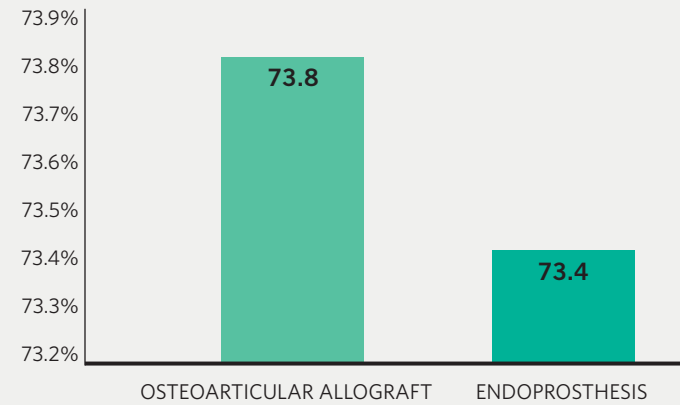
COLOR KEY FOR SURGEONS IN ALL CHARTS ON PAGES 5 AND 6

- Surgeon 1 (Teal)
- Surgeon 2 (Orange)
- Surgeon 3 (Light Green)
- Surgeon 4 (Purple)
- Surgeon 5 (Cyan)
- Surgeon 6 (Yellow)
- Surgeon 7 (Magenta)

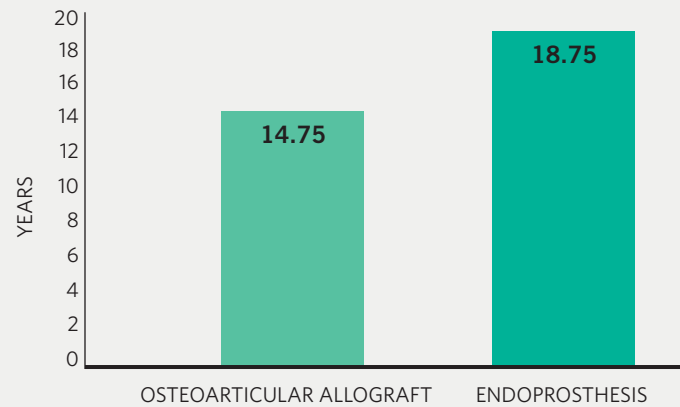
Cost-Utility of Osteoarticular Allograft vs. Endoprosthetic Reconstruction for Primary Bone Sarcoma of the Knee: A Markov Analysis

Primary bone sarcoma is a rare and potentially devastating diagnosis, with only ~2/3 of osteosarcoma and Ewing's sarcoma patients surviving 5 years. Limb salvage surgery options are equivalent to local tumor control, and perhaps functionally superior to an amputation. The objective of this study was to determine the most cost-effective surgical strategy for primary bone sarcoma about the knee considering neither option is proven to be clinically superior. Transitional probabilities were derived from a review of current literature reconstruction option for proximal tibia and distal femur.

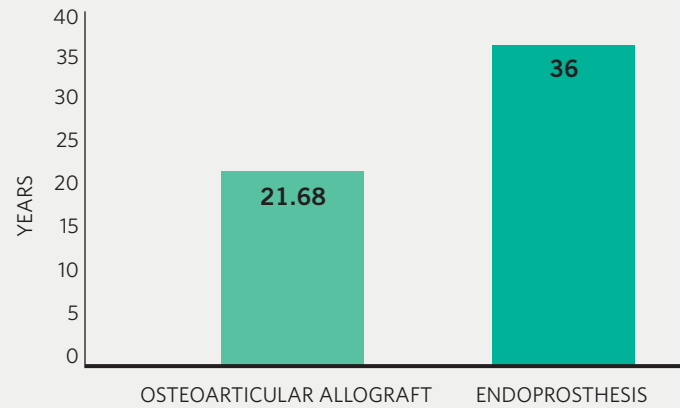
WEIGHTED AVERAGE 5-YEAR SURVIVAL



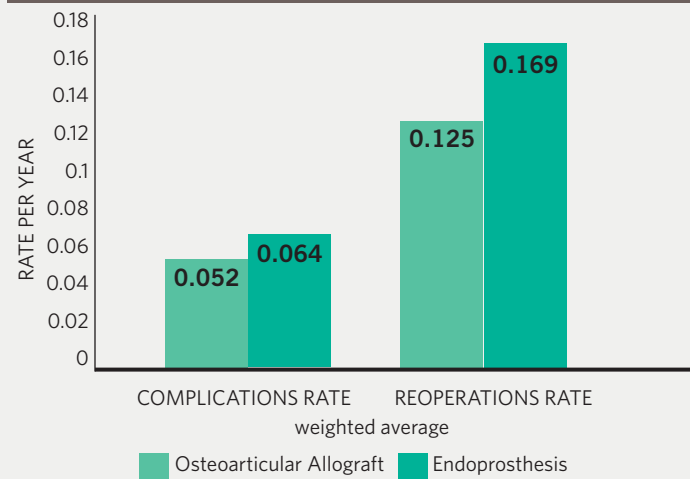
WEIGHTED AVERAGE RESECTION LENGTH



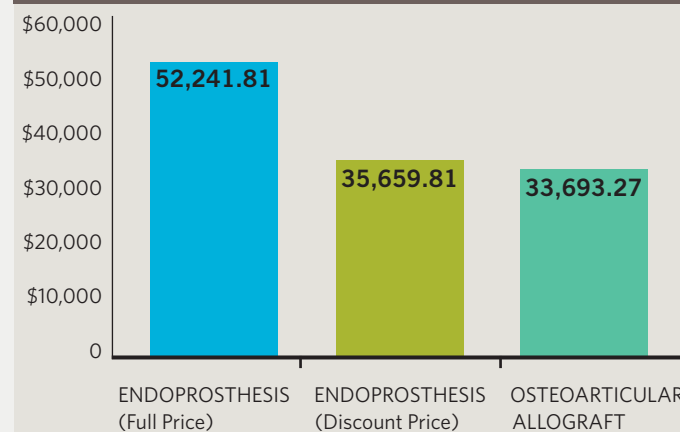
WEIGHTED AVERAGE PATIENT AGE



COMPLICATION AND REOPERATION RATES



IMPLANT COSTS 2015



Costs include: surgical excision, reconstruction costs, implant or allograft material costs, and Medicare Diagnosis Related Group (DRG) base reimbursement for procedure. Among the literature reviewed, the average rate of allograft bone grafting was 18% and cost \$11,707.24, and the average rate of endoprosthesis bushing exchanges was 3% and the average cost was \$12,711.15.

Osteoarticular allograft reconstruction is more cost-effective than a full price endoprosthetic reconstruction for primary bone sarcoma of the distal femur or proximal tibia. However, discounted endoprostheses are cost-effective and seem to be the favored strategy over allografts on sensitivity analysis.

INCREMENTAL COST EFFECTIVENESS RATIO RESULTS

Intervention	Cost Per Model Cycle	Cost Difference	Effectiveness in QALYs	Increased Effectiveness in QALYs	Incremental Cost Effectiveness Ratio (ICER)	Dominant (Strategy Rejected)
Allograft (to Full-Price Endoprosthesis)	\$64,534.72		9.095	2.29	\$414.07/QALY gained	N/A
Allograft (to Discount Endoprosthesis)	\$59,734.62	\$13,502.28	8.994	2.196		Undominated
Full-Price Endoprosthesis	\$65,485.80	\$951.08	6.798			X
Discounted Endoprosthesis	\$46,232.23		6.798		\$6,149.10/QALY gained	Undominated

This cost-effectiveness analysis used health-state utilities and quality-adjusted life years for full price allografts and full price/discounted endoprosthesis price. The full price endoprosthesis strategy was rejected in favor of allograft usage.

SENSITIVITY ANALYSIS: FULL-PRICE ENDOPROSTHESIS

Parameter	Intervention	Model Value	Range	Allograft Dominated (Rejected)
Cost	Allograft	\$33,693.27	0-\$70,000	>\$34,300
	Endoprosthesis	\$52,241.81	0-\$70,000	<\$51,450
Complication Rate	Allograft	0.0524	0-0.3	>0.057
	Endoprosthesis	0.0641	0-0.65	<0.026
Revision Rate	Allograft	0.1261	0-0.6	>0.148
	Endoprosthesis	0.1693	0-0.6	<0.15

SENSITIVITY ANALYSIS: DISCOUNT ENDOPROSTHESIS

Parameter	Intervention	Model Value	Range	Allograft Dominated (Rejected)
Cost	Allograft	\$33,693.27	0-\$70,000	<\$22,050
	Endoprosthesis	\$35,659.81	0-\$70,000	>\$51,100
Complication Rate	Allograft	0.0524	0-0.3	<0.014
	Endoprosthesis	0.0641	0-0.65	Never
Revision Rate	Allograft	0.1261	0-0.6	Never
	Endoprosthesis	0.1693	0-0.6	>0.534

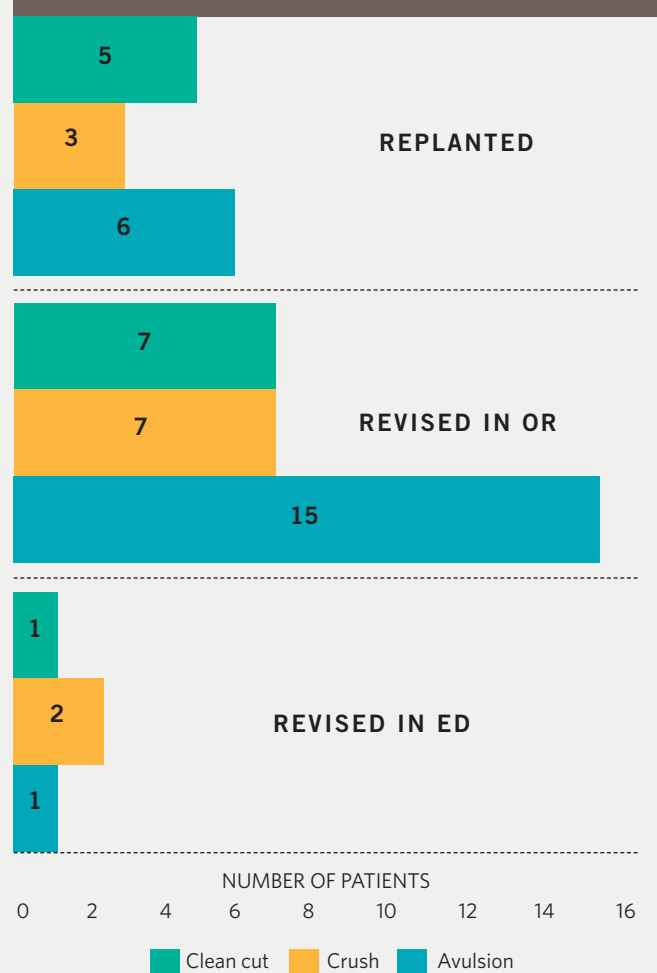
Review of Air Transportation Use for Upper Extremity Amputations at a Level-1 Trauma Center

Air transportation to tertiary care centers of patients with upper extremity amputations has been utilized in hopes of reducing the time to potential replantation; however, this mode of transportation is expensive and not all patients will undergo replantation. The purpose of this study was to review the appropriateness and cost of air transportation in upper extremity amputations. Consecutive patients transported by aircraft with upper extremity amputations to our level-1 trauma center over a 7-year period were reviewed.

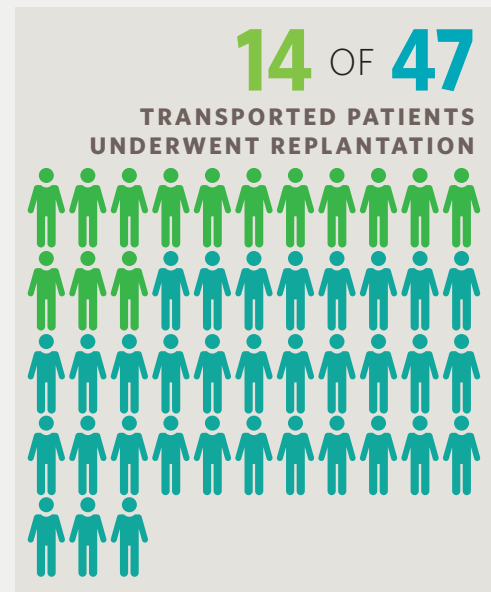
Overall, 47 patients were identified with 43 patients going to the operating room, but only 14 of those patients undergoing replantation. Air transportation cost on average was \$20,482, with only 62% being paid by the patient or insurer.

Despite the additional cost for air transportation, it is not clear that it meets its objective of expediting transfer to optimize viability of the amputated appendage for replantation.

MECHANISM OF INJURY AND TREATMENT



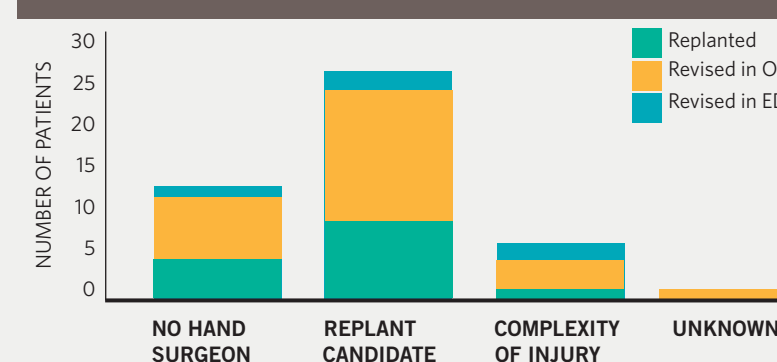
13 of the 47 patients (28%) had clean-cut amputations while 34 patients (72%) sustained avulsion or crush injuries. The main reason cited in this study for not replanting was a crush or avulsion mechanism for 70% (23/33) of patients.



\$20,482
Average Cost of Transportation by a Fixed Wing Aircraft or Helicopter

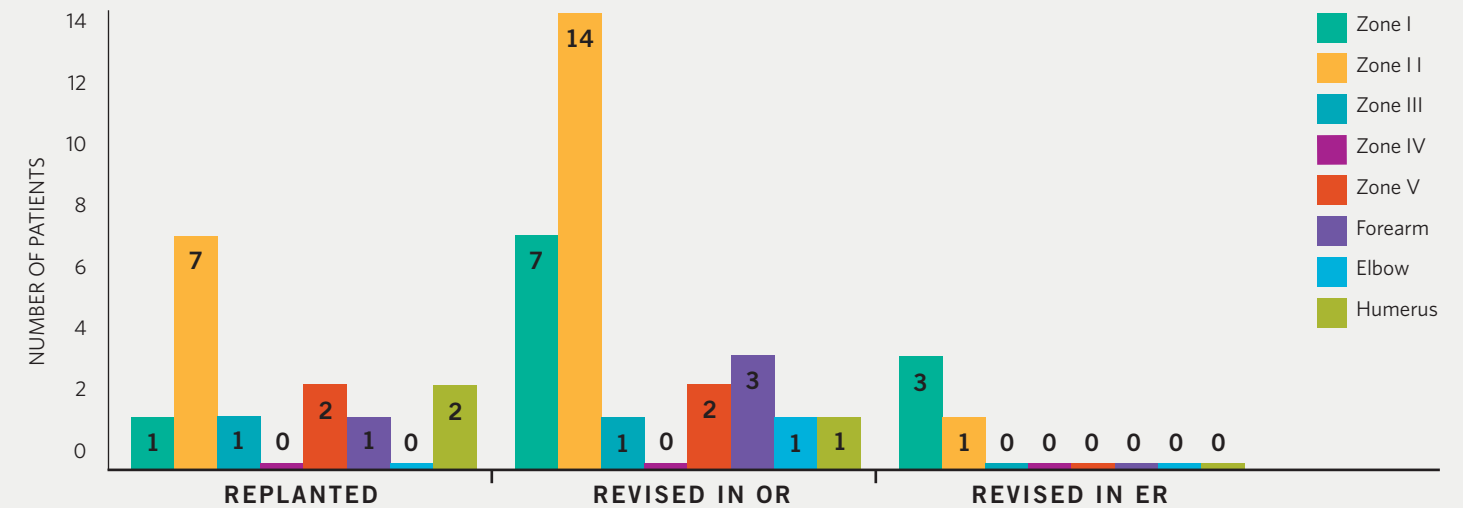
105.4 miles
Average Distance Traveled

REASON FOR REFERRAL



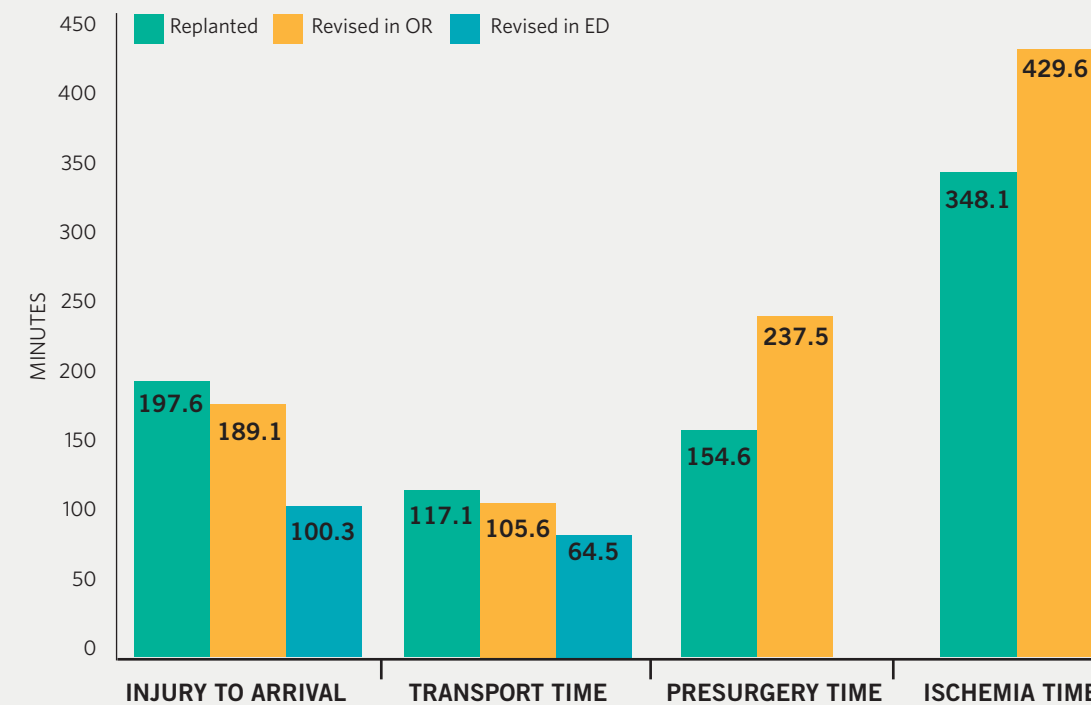
A hand surgeon was contacted before transportation on 23 (49%) occasions. 10 of these patients underwent replantation versus 4 of 15 and 0 of 9 patients, when emergency physicians or emergency medical technicians made the decision to transfer.

LEVEL OF AMPUTATION AND TREATMENT



Of the 14 patients who underwent replantation, 9 of those procedures were considered successful as the patient was discharged from the hospital with a viable appendage. None of the 3 attempted replants proximal to the wrist survived discharge. 3 patients had a good functional outcome at last follow-up, 1 had partial use of the replanted digit, and 4 had poor function of the replanted digits. Two patients eventually underwent amputation of the replanted digit due to poor function and pain. One patient was lost to follow-up.

TRANSFER CHARACTERISTICS

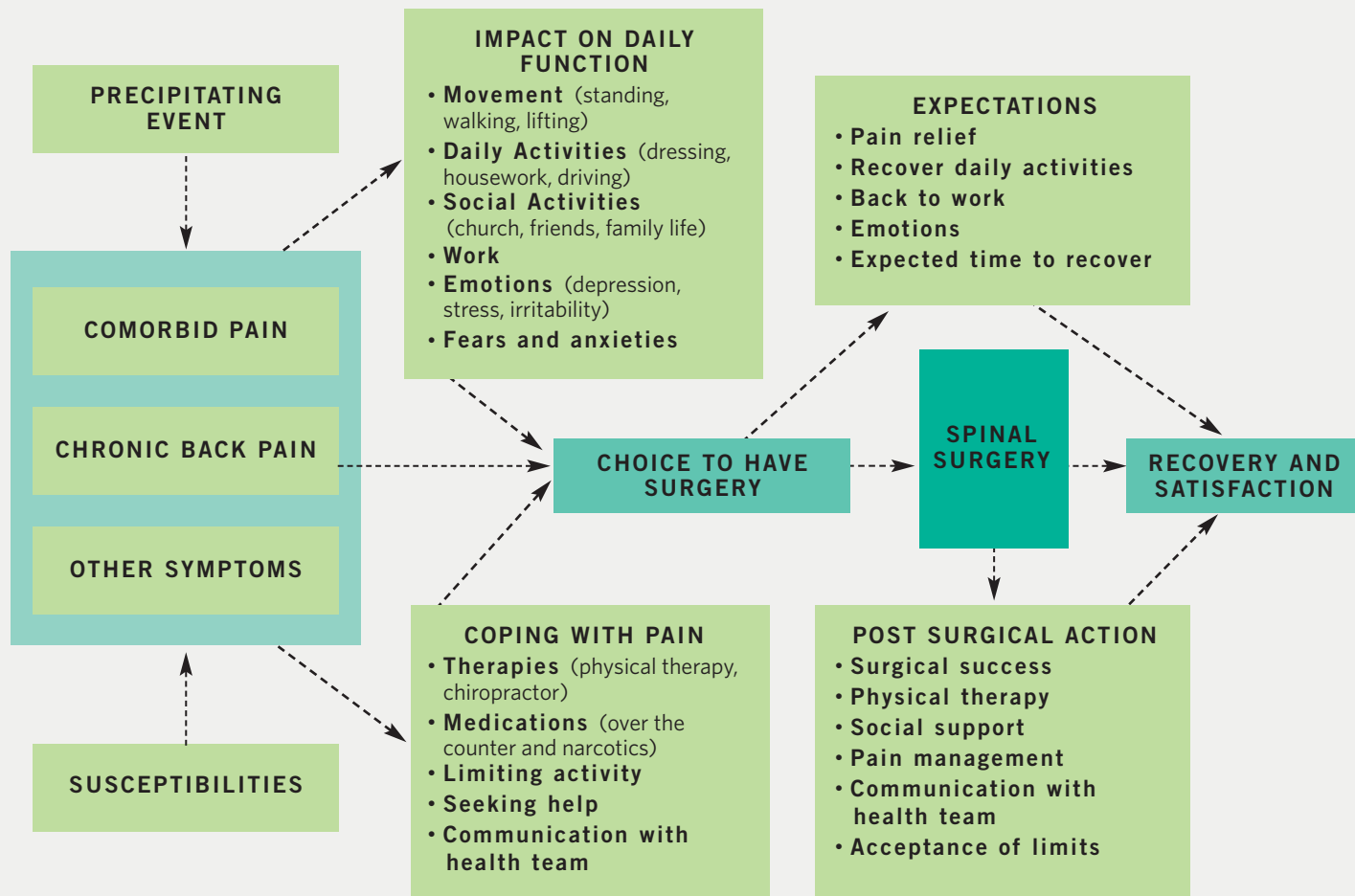


Patients were brought by aircraft to the tertiary hand surgery center with a mean time of 182.3 minutes following injury, which includes 105.2 minutes of transportation time. The pre-surgery time of those who underwent replantation was 154.6 minutes compared to 237.5 minutes for those that were revised in an operating room.

Air transportation for isolated upper extremity amputation is costly and is not usually the determining factor for replantation. The type of injury and patients' expectations often dictate the outcome and these may be better determined at the time of referral with use of telecommunication photos, discussion with a hand surgeon and patient counseling.

Patients' Experience and Expectations of Lumbar Spine Surgery for Degenerative Conditions: A Qualitative Study

The purpose of this study was to examine the factors that influence the decision to have surgery, expectations for recovery, and satisfaction in patients who undergo lumbar spine surgery. 20 patients participated in interviews and 12 patients participated in focus groups to provide information on the decision to have surgery and the recovery process.



Decision to have surgery was influenced by:

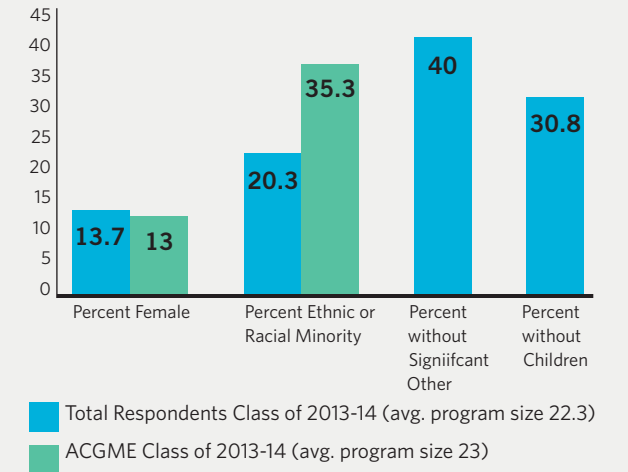
- Level of physical, social and emotional impairments resulting from chronic pain
- Poor quality of life and daily functioning
- Trusted physician recommending surgical intervention
- Failure of conservative care and minimal relief from over-the-counter and/or narcotic medication

A better understanding of patient expectations is important for optimal recovery and patient satisfaction. Recommendations for postoperative management include strategies to increase patient engagement, decrease fear and anxiety, and provide emotional and social support.

National Orthopaedic Residency Attrition: Who Is At Risk?

National U.S. orthopaedic resident attrition rates have been historically low, but no literature exists as to the characteristics of those who leave or the circumstance of the departure. For this project, all orthopaedic surgery residency program directors in the U.S. were surveyed on demographic data for their current resident class, the number of residents who left the program, as well as demographic description for each of the residents who left their program from 1998 to 2013. This is the most comprehensive study to survey orthopaedic residency directors on the characteristics of and reasons leading to resident attrition.

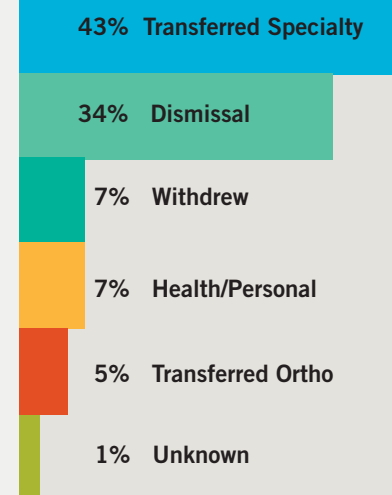
RESPONDENT DEMOGRAPHIC MAKEUP



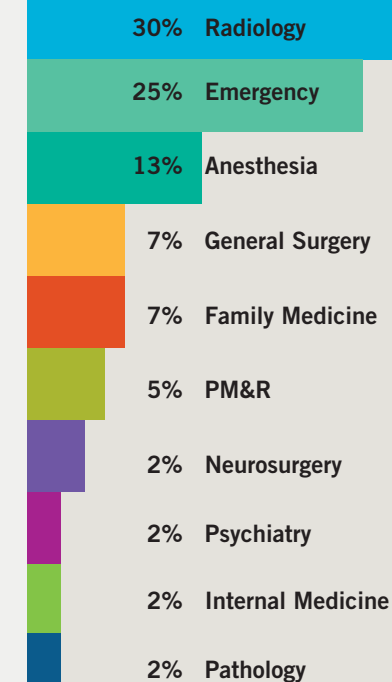
The overall response rate was 54% of residency directors, representing 51% of orthopaedic residents. The respondent demographic makeup of 13.7% female, and average program size of 22.3 residents, compared similarly to the Accreditation Council for Graduate Medical Education national average..

Orthopaedic residents who are female, single or without children are statistically more likely to undergo attrition. Considerations should be given to targeted mentoring of these resident groups.

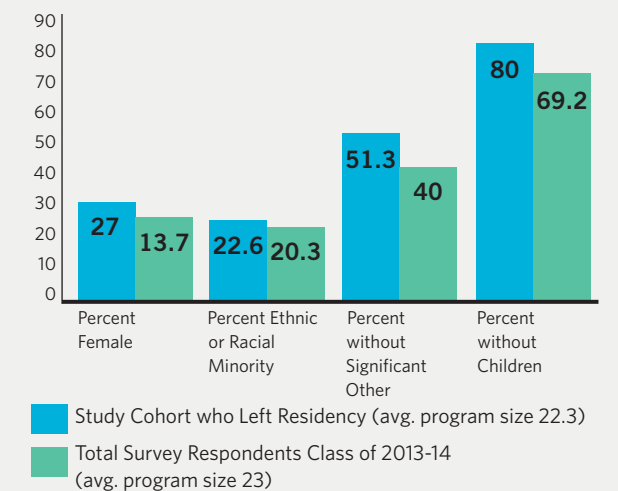
REASONS GIVEN FOR LEAVING RESIDENCY



FIELDS ENTERED BY RESIDENTS WHO TRANSFERRED



CHARACTERISTICS OF RESIDENTS WHO LEFT ORTHOPAEDIC RESIDENCY COMPARED TO OVERALL SAMPLE GROUP



The demographic characteristics of those residents who left compared to the overall sample group show a statistically significant increase for females, those without a significant other and those without children. There was no difference in rate of attrition based on ethnicity or class size that the resident came from.

A Novel Classification System Based on Dissemination of Musculoskeletal Infection is Predictive of Hospital Outcomes

Children affected by musculoskeletal infection have highly variable hospital courses, which seem to depend upon infection severity. Early stratification of infection severity would therefore help to maximize resource utilization and improve patient care. On the basis of this, the purpose of the study was to develop a severity classification system that differentiates patients based on total infection burden and the degree of dissemination of the infection. The new classification system was then applied retrospectively to a cohort of pediatric patients with musculoskeletal infection and hospital outcomes were compared between the groups.

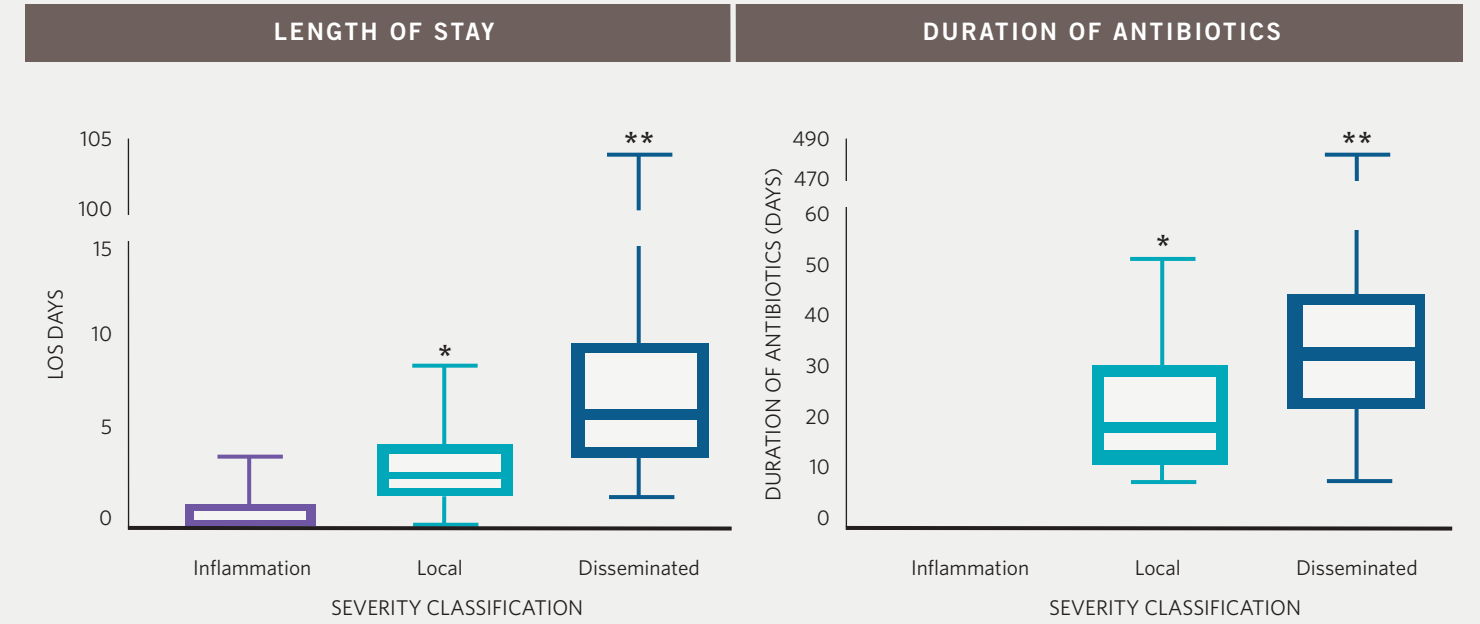
A newly developed classification system for pediatric musculoskeletal infection correlates with hospital outcomes and markers of the inflammatory response. The advantage of this novel classification system is that it can be applied to different types of musculoskeletal infection and is complimentary to the previous practice of differentiating musculoskeletal infection based on the primary diagnosis. Early identification of disease severity in children with musculoskeletal infection has the potential to enhance hospital outcomes through more efficient resource utilization and improved patient care.

OPERATIONAL DEFINITIONS OF INFECTION SEVERITY

	Definition	Example
Inflammation	All of the following (if available) must be true: <ul style="list-style-type: none"> Negative local culture Negative blood culture The criteria for local or disseminated infection are not met 	Transient synovitis
Local Infection	One of the following must be true: <ul style="list-style-type: none"> Imaging diagnostic for osteomyelitis or pyomyositis in 1 anatomic site Local culture positive AND/OR fluid/tissue consistent with infection* One positive blood culture The criteria for disseminated infection are not met 	Isolated distal femoral osteomyelitis with no subperiosteal abscess Isolated septic hip
Disseminated Infection	For 2 or more anatomic sites, at least one of the following must be true: <ul style="list-style-type: none"> Imaging diagnostic for osteomyelitis or pyomyositis Local culture positive AND/OR fluid/tissue consistent with infection* Two or more positive blood cultures Thromboembolic disease 	Distal fibular osteomyelitis with subperiosteal abscess Septic hip with surrounding muscle pyomyositis

*Grossly purulent, cell count > 50,000, positive culture includes positive PCR

3-tiered stratification system developed by the authors to separate patients into inflammation, local infection and disseminated infection based on operation definitions developed by a multi-disciplinary panel of specialists.



There were significant differences between the groups in for length of stay and duration of antibiotic treatment, with patients with disseminated infection having the longest length of stay and antibiotic treatment.

*Statistically significant differences (p<0.05) between local severity group and other two groups. **Statistically significant differences (p<0.05) between the disseminated group and the other two groups.

PEAK LABORATORY VALUES DURING HOSPITALIZATION							
	Inflammation (n=52)	Local Infection (n=46)	Disseminated Infection (n=104)	N	H/x2	df	P
Peak Laboratory Values							
CRP peak (mg/L)	5.30 (2.25-17.75)	53.80 (23.70-89.33)	110.8 (59.63-232.7)	202	100.1	2	< 0.0001*
ESR peak (mm/h)	15.00 (11.00-30.00)	36.00 (17.75-71.25)	70.00 (45.25-92.00)	201	78.25	2	< 0.0001*
WBC peak (thou/uL)	11.45 (8.65-13.65)	10.70 (9.20-14.80)	12.90 (10.55-17.13)	199	10.29	2	0.0058*
Temperature peak (°F)	98.6 (98.2-99.3)	100.4 (98.9-102.3)	102.7 (100.8-103.3)	198	68.47	2	< 0.0001*

Univariate analysis was performed using Kruskal-Wallis test for continuous variables. Values presented represent the median and the 25th to 75th percentile range. *Significant value (P≤0.05). df indicates degrees of freedom; H, Kruskal-Wallis statistic.

Peak CRP, ESR, WBC and temperature, which are key markers of inflammation, were higher in patients stratified into a more severe infection category.

PRISM Team Helps Pediatric Orthopaedic Patients

Launched in 2015, an interdisciplinary pilot program known as Pediatric Perioperative Interdisciplinary Surgery Home (PRISM) has improved the care of 50 patients undergoing hip surgeries at Monroe Carell Jr. Children's Hospital at Vanderbilt, and has generated data to demonstrate the effectiveness of the changes.

The PRISM protocol includes giving patients medications before surgery to reduce incidence and severity of pain and the need for opioids; during surgery, spinal anesthesia and intravenous anesthesia are used rather than inhaled anesthesia. Patients have experienced better recoveries, with less opioids for pain, fewer post-surgery complications and shorter hospital stays due to a transformation in the way surgeries are handled.

Shelbey Mitchell of Chapel Hill, Tennessee, saw first-hand the benefits of PRISM. She was 17 in 2014 when she had a periacetabular osteotomy at Children's



Patient Shelbey Mitchell, center, with PRISM team members from Children's Hospital

Hospital, after which she experienced significant pain, difficulty staying alert, and extreme nausea. But in 2016, when Jonathan Schoenecker, M.D., Ph.D., assistant professor of Orthopaedics and Rehabilitation and Pediatric Orthopaedics, performed the same surgery on Mitchell's other hip, the improvement in her recovery was remarkable — she had less pain, more alertness and a regular appetite. She quickly tackled the challenges of physical therapy so she could go to cheerleading camp at the end of July.

In April, the PRISM protocol was expanded to include patients undergoing pectus excavatum surgery and those with post-dural puncture headaches, and there are plans to expand to surgical areas where it's felt patients can benefit. Schoenecker is eager to add the protocol to his other orthopedic surgeries.

"Usually by the third day after one of these big surgeries the intense inflammatory response goes away, and the patient starts to look a lot better," Schoenecker said. "On our old pain protocols, that's when we would start physical therapy because the patient could not really do anything worthwhile up until that point. Now, you'll go by a patient's room the first day after surgery, and they're wide awake and can talk to you. They have discomfort, but they can start physical therapy. Typically by two or three days after surgery, they are really, really wanting to go home." [Read more here](#)

Hip Preservation Surgery Puts Teen Back On Track



Kedrick Wilbanks, far right

By the time Kedrick Wilbanks came to Vanderbilt Department of Orthopaedics, the 15-year-old could hardly walk. He was born with hip dysplasia, which didn't bother him until he was hit in the hip with a football helmet during a tackle. After that, he was constantly re-injuring the joint, sometimes from just turning the wrong way, and his condition worsened each time.

His mother, Vickie Wilbanks, said that her son went through multiple pairs of crutches while they sought treatment from the gamut of orthopaedic doctors and physical therapists in their hometown of Chattanooga. But her son wasn't getting better, and each health care provider eventually said there was nothing left to be done.



Jonathan Schoenecker, M.D., Ph.D.

When they sought yet another opinion at Vanderbilt, Kedrick was referred to Jonathan Schoenecker, M.D., Ph.D. Under his care, Kedrick underwent hip preservation surgery just a few days after his 16th birthday. He then faced nine months of physical therapy, a year of home-school (because he

couldn't walk up the stairs at school), and nearly two years without playing sports.

"The recovery was much more mental than physical because I was forced to sit down when I was used to doing multiple sports. I was used to being an athlete all day, every day," said Kedrick, who played football and basketball and ran track.

By the time he was ready to return to sports, he decided to focus solely on track. He was nervous, though, about how his hip would handle a full-on sprint. "I was afraid to reinjure myself," Kedrick said. "But once I won my first race, I was good to go."

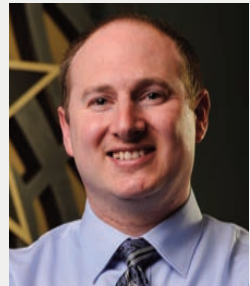
That race was the first of many that Kedrick would win. In true comeback form, Kedrick won the state title for the 100-meter dash in May, and placed third in the 200-meter dash. In June he took second place in the 100-meter at the New Balance National Outdoor youth track and field meet. He's also placed 7th nationally at the Junior Olympics, and has qualified for the New Balance National Indoor track and field competition in March.

"It was a very grueling process, but the results were fantastic, I think. The physicians were great. My hip is very good now. I like to say I'm faster."

His mom echoes the positive experience with Schoenecker and his team. "The team was phenomenal, and he had a really good support staff," she said. "They explained everything; they were really open to questions. They said 'Any time you have questions, don't hesitate to call' — and they'd mean it, and they'd get back to you. It really meant a lot."

Watching her teenage son learn to walk again was emotional, she said, but now that Kedrick is healed and strong, she jokes that instead of a car for his 16th birthday, he got his stride back.

Focus on Concussions



Alex Diamond, D.O., MPH

In July, Vanderbilt Sports Concussion Center held a seminar titled "Sports Concussion: The State of the Science," for health care professionals, athletic trainers and school officials. The seminar covered a broad range of topics, including concussion treatment, long-term effects of the brain injury, efforts by the National Football League (NFL) to prevent head trauma, and a former professional hockey player's account of dealing with post-concussion syndrome (PCS).

Alex Diamond, D.O., MPH, assistant professor of Pediatrics and Orthopaedics and Rehabilitation, served as a speaker at the seminar. He revealed that the state is working with experts from the Vanderbilt Sports Concussion Center to develop a "return to learn" guide that would help schools better manage academic activities for concussed athletes. This complements the "return to play" guidelines that were established when Tennessee implemented a sports concussion law in 2014. [Read more here.](#)



Andrew Gregory, M.D.

Andrew Gregory, M.D., associate professor of Orthopaedics and Pediatrics, was recently quoted by ABC News in a story about the soaring rate of concussion sustained in youth soccer. He suggested that the increased injury rate could be a reflection of the sport's popularity.

"I don't think people are playing rougher, I just think there are a lot more kids playing, including both genders," said Gregory. "There is more exposure, more players playing year-round, especially with multiple venues."

New Faculty



Kevin Dale, M.D.

Kevin Dale, M.D., joins Vanderbilt Department of Orthopaedics as assistant professor of Orthopaedic Surgery and Rehabilitation and will practice in pediatric orthopaedics. Dale completed a residency and fellowship in orthopaedic surgery at the University of Wisconsin, as well as an orthopaedic sports medicine fellowship at Duke University. His clinical interests include pediatric anterior cruciate ligament injuries, osteochondritis dissecans, adolescent shoulder instability and adolescent hip injuries.



Jeffrey Kutsikovich, M.D.

Jeffrey Kutsikovich, M.D., joins Vanderbilt Department of Orthopaedics as assistant professor of Clinical Orthopaedic Surgery and will practice at Vanderbilt Bone and Joint. He completed his residency at the University of Tennessee Health Science Center - Campbell Clinic and a fellowship at the Indiana Hand to Shoulder Center. His clinical interests include treatment of disorders of the hand, wrist, elbow and shoulder.



Byron Stephens, M.D.

Byron Stephens, M.D., joins Vanderbilt Department of Orthopaedics as assistant professor of Orthopaedic and Rehabilitation and will practice at Vanderbilt Orthopaedics and the Vanderbilt Spine Center. He completed his residency at the Campbell Clinic in Memphis, Tenn., and a fellowship at Emory University. He enjoys taking care of all spinal conditions but has a special clinical and research interest in scoliosis and spinal tumors.

Emeritus Faculty



Dan Spengler, M.D.

Dan Spengler, M.D., former chairman of Department of Orthopaedics and Rehabilitation, retired after 33 years of service to the institution. In honor of his accomplished career, Spengler [was recognized as emeritus faculty on July 1, 2016.](#) Spengler joined Vanderbilt in 1983 as the fourth chairman of the Department of Orthopaedics and Rehabilitation and served in that role until 2009, after which he remained on faculty as professor of Orthopaedics and Rehabilitation and professor of Neurological Surgery until his retirement in 2016.

During his 26 years as chair, the department grew in scope and size. Spengler's expertise in patient care has been recognized by Castle Connolly and Best Doctors. He also received the Volvo Award for Low Back Pain Research in 1990, the Kappa Delta Award for Outstanding Orthopaedic Research in 1991, and the Cervical Spine Research Society Award for Outstanding Basic Science Research in 1998.

Spengler has published more than 125 peer-reviewed articles and has lectured throughout the world. He also was elected to a nine-year term on the American Board of Orthopaedic Surgery, serving as president from 1993 to 1994. He served as president of the American Orthopaedic Association in 2003-04 and served on the board of trustees for the *Journal of Bone and Joint Surgery* for six years, including two years as treasurer.

Professional News

Jeffrey E. Martus, M.D., M.S., served as editor for *Orthopaedic Knowledge Update Pediatrics 5*, published September 2015. The guide was developed in partnership with the Pediatric Orthopaedic Society of North America (POSNA) and features new techniques, new



Jeffrey E. Martus, M.D., M.S.

approaches and current controversies in treatment of pediatric musculoskeletal injuries.

"It was an honor and privilege to participate in this project," Martus said. "It was a great experience. I enjoyed working with the section editors and authors to produce this new edition of OKU Pediatrics."

Andrew Gregory, M.D., associate professor of Orthopaedic Surgery and Pediatrics, served as the team physician for the men's and women's volleyball teams at the 2016 Summer Olympics in Rio. Both teams won bronze medals, which Gregory wears here.



Jeffrey S. Nyman, Ph.D., was promoted to associate professor of Orthopaedics and Rehabilitation on June 1, 2016. Nyman earned a Ph.D. in Biomedical Engineering at the University of California Davis followed by a post-doctoral fellowship at the University of Texas at San Antonio. He relocated to Vanderbilt in 2006 with Gregory Mundy, M.D. and team to establish the Vanderbilt Center of Bone Biology (VCBB). Since joining the Department of Orthopaedics and VCBB, Nyman has received VA Career Development and Merit Awards, an NIH R01, multiple R21 awards, as well as NSF and DOD funding. Nyman says, "The ultimate goal of my research is to lower the number of bone fractures associated with diabetes, aging, osteoporosis, cancer, and genetic diseases." His current research program involves the assessment of structural, architectural, compositional, and biomechanical properties of bone from genetic and pre-clinical models of disease. Congratulations to Nyman on his promotion.

5 Vanderbilt Orthopaedists were named to **2016 Nashville Best Doctors List.** [Read more here.](#)

Archer and Nyman Awarded Federal Funds

Kristin Archer, D.P.T., Ph.D. and Jeffry Nyman, Ph.D. both recently received federal funding.



Kristin Archer, D.P.T., Ph.D.

Archer, associate professor and director of the Research Division, received a Department of Defense PRORP Applied Research Award titled *MORE Resiliency in the Rehabilitation of Active Duty Service Members*. In collaboration with San Antonio Military Medical Center (SAAMC), the overall objective of this multicenter

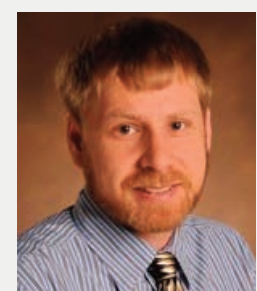
prospective study is to develop and validate a standardized measure to objectively assess resiliency following neuro-musculoskeletal injury. The measure will be specifically tailored to the injured service member.

Results from the proposed study will provide an evidence-based resiliency instrument that can be integrated into rehabilitation care in the military setting with the end goal of improving rehabilitation outcomes. This study will also provide critical data on resiliency as a predictor of rehabilitation outcomes.

Co-investigators at SAMMC are Jason Wilken, P.T., Ph.D., Director, Military Performance Laboratory, Center for the Intrepid, and Daniel Stinner, M.D., Medical Director, Center for the Intrepid. Other co-investigators are David Schlundt, Ph.D., associate professor of Psychology and Director of Qualitative Research Center, Vanderbilt University along with Stephen Wegener, Ph.D., professor and director of Rehabilitation Psychology in the Department of Physical Medicine and Rehabilitation at Johns Hopkins School of Medicine.

relevant to the future of diabetes treatment. Nyman is Principal Investigator of R21AR067871, *The Role of Tissue Matrix in the Fracture Resistance of Diabetic Bone*. Nyman and his team propose to test clinically translatable techniques that are sensitive to bone matrix properties as potentially new informative predictors of fracture resistance in type 2 diabetes. They also propose to define the underlying molecular changes in the matrix contributing to the diabetes-related increase in bone fragility. This research could provide new diagnostic techniques for fracture risk prediction as well as new targets for improving fracture resistance.

Nyman's co-investigators include Mark Does, Ph.D., professor of Biomedical Engineering at Vanderbilt University and Paul Voziyan, Ph.D., research associate professor of Medicine/Nephrology and member of Vanderbilt Center for Matrix Biology, as well as, Daniel Perrien, Ph.D., assistant professor of Medicine/Clinical Pharmacology and member of the Vanderbilt Center for Bone Biology.



Jeffry Nyman, Ph.D.

In July, Nyman, associate professor of Orthopaedics and Rehabilitation, received funds for two NIAMS R21 awards. R21AR070620 is a multi-PI award in collaboration with Katherine Thrailkill, M.D., Pediatric Endocrinologist at the University of Kentucky Barnstable Brown

Diabetes and Obesity Center. Their proposal, titled *Effects of Sodium-dependent Glucose Co-Transporter 2 Inhibition on Bone* seeks to utilize several relevant rodent models to investigate potential mechanisms contributing to the adverse effects of sodium-dependent glucose co-transporter 2 (SGLT2)-inhibitor therapy on the skeleton.

Recognizing that a lifelong increased risk for fragility fracture is now an established comorbidity of diabetes, a better understanding of the effects of SGLT2 inhibitors on bone health is both timely and highly

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Assistant Professor of Pediatrics
Pediatric Orthopaedics
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Fellowship Director, Pediatric Orthopaedics
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Musculoskeletal Oncology

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Pediatric Orthopaedics, Sports Medicine, General Orthopaedics

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Orthopaedic Trauma

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Division Director, Joint Center
Joint Replacement: Adult Reconstructive

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Sports Medicine

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Spine

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Sports Medicine; Joint Replacement

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Hand and Upper Extremity

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