Information Request from Dr. Aranow:

There is also some additional information that the COS requests the CPMA representatives to provide for the Committee. Two of the items were brought up in the last meeting but I wanted to submit them in written form.

1. The total number of a) tibial pilon fractures; b) total ankle replacements; and c) amputations of the entire foot that each podiatric resident during the past 5-10 years at the three CT podiatry residencies performed during their 3 year residency. The data should distinguish between first and differentiating between first and second assistant cases, which the surgical case logs each resident is required to maintain.
2. With respect to item 10 in the CPMA request- 44 states and the District of Columbia permit Podiatrists to perform a total ankle replacement:
   a. Please name the states (or name the other 6)
   b. Please state how many of the states allow all licensed podiatrists to perform the procedure and which states have additional training or Board Qualification/ Certification requirements.
3. With respect to item 10 in the CPMA request- 43 states and the District of Columbia permit Podiatrists to treat a tibial pilon fracture to perform a total ankle replacement:
   c. Please name the states (or name the other 7) and state how many of the states allow all licensed podiatrists to perform tibial pilon fracture surgery and which states have additional training or Board Qualification/ Certification requirements.
4. With respect to item 10 in the CPMA request- 35 states and the District of Columbia permit Podiatrists to amputate a partial or total foot:
   d. Please name the states that allow podiatrists to amputate the entire foot.
5. The percentage of podiatrists practicing in the United States that are Board Certified in Reconstructive Rearfoot/ Ankle Surgery by the American Board of Foot and Ankle Surgery and the percentage Board Qualified but not Board Certified in Reconstructive Rearfoot/Ankle Surgery by the American Board of Foot and Ankle Surgery.

Information from Dr. Winters:

Please see the requested information provided by the American Podiatric Medical Association on our national scope of practice analysis as it represents a state by state summary of our scope of practice privileges and restrictions as it relates to the three requested updates to our scope.

1. Total Ankle Replacements: An overwhelming majority of states permit treatment of the ankle and leave specific delineation of privileges up the facility. Only five states (including Connecticut), explicitly exclude podiatric physicians from performing this procedure, or do not permit treatment of the ankle at all:
      a. Alabama
      b. Massachusetts
      c. Mississippi
      d. New York

    e. South Carolina

2. Tibial Pilon Fracture: Similarly, an overwhelming majority of states permit podiatrists to treat tibial pilon fractures and leave specific delineation of privileges to perform this procedure up to hospitals and other similarly designated facilities. Only five states explicitly exclude podiatric physicians from performing this procedure, or do not permit treatment of the ankle at all:
    f. Connecticut
    g. Massachusetts
    h. Mississippi
    i. New York
    j. Tennessee
3. Total Foot Amputations: 25 states currently either expressly ban a full foot amputation, or expressly limit amputation to partial. Mississippi does not address amputation in its statute, but it defines the foot as the "tarsal bones, metatarsal bones, and phalanges," which would exclude full foot amputation.
    a. Alabama
    b. California
    c. Colorado
    d. Connecticut
    e. Florida
    f. Georgia
    g. Indiana
    h. Iowa
    i. Kansas
    j. Massachusetts
    k. Michigan
    l. Minnesota
    m. Mississippi
    n. Missouri
    o. Nebraska
    p. New Jersey
    q. North Carolina
    r. Oregon
    s. Pennsylvania
    t. South Carolina
    u. Tennessee
    v. Texas
    w. Utah
    x. Virginia
    y. Wyoming

The vast majority of states permit partial amputations to a variety of levels.

Source: 50 State Survey, American Podiatric Medical Association

Differences in Costs of Treatment for Foot Problems Between Podiatrists and Orthopedic Surgeons

Robin B. Harris, PhD; John M. Harris Jr., MD, MBA; Jon Hultman, DPM; and Scott Weingarten, MD, MPH

Abstract

We examined charge data for health insurance claims paid in 1992 for persons under age 65 covered by a large California managed care plan. Charge and utilization comparisons between podiatrists and orthopedic surgeons were made for all foot care and for two specific foot problems, acquired toe deformities and bunions. Podiatrists provided over 59% of foot care services for this commercial population of 576,000 people. Podiatrists charged 12% less per individual service than orthopedists. However, podiatrists performed substantially more procedures per episode of care and treated patients for longer time periods, resulting in 43% higher total charges per episode. Hospitalization was infrequent for all providers, although podiatrists had the lowest rates. In a managed care setting in which all providers must adhere to a preestablished fee schedule, regardless of specialty, the higher utilization by podiatrists should lead to higher overall costs. In some cases, strong utilization controls could offset this effect. We do not know if the utilization difference is due to actual treatment or billing differences. Further, we were unable to determine from the claims data if one specialty had better outcomes than the other.

(Am J Man Care 1997;3:1577-1583)

Most managed care organizations (MCOs) seek the services of the most cost-efficient health care providers. It is not known, however, if different specialties have systematically disparate charges for similar care. Available studies often emphasize charges for similar, individual services rather than charges associated with full episodes of care.

Foot surgery, offered by orthopedists and podiatrists, provides a unique opportunity to evaluate the economic effects of practices and billing patterns of different classes of providers. Both specialists perform foot and ankle surgery, although they are trained differently and belong to different specialty societies. We are aware of only one study comparing the treatment and billing patterns of orthopedists and podiatrists.[1] In this study, researchers evaluated insurance claims from the year 1982 for members of the Federal Employees Health Benefits Program (FEHBP). The authors of this study examined 60-day episodes of care and found that orthopedists performed fewer procedures per episode than podiatrists. However, the average orthopedist's procedure charge was 17% higher than the average podiatrist's comparable procedure charge, and orthopedists were more likely to perform procedures on an inpatient basis. The average charge by podiatrists for an entire foot surgery treatment episode was 30% lower than the average charge by orthopedists.

While the FEHBP study had important implications for MCOs seeking to reduce costs, there have been dramatic changes in the health care delivery landscape since 1982. MCOs now have preestablished fee schedules for all providers regardless of specialty, and they have drastically reduced hospital services. With such level reimbursements, an MCO may prefer one specialist over another based on other factors, such as utilization of procedures, ancillary care, and/or hospital care. Systematic utilization differences between specialists providing similar care can equate with significant cost differences and may also influence medical outcomes.

We sought to evaluate potential charge and utilization discrepancies associated with the surgical management of foot and ankle problems by podiatrists and orthopedists.

From the Arizona Prevention Center, University of Arizona College of Medicine,Tucson, AZ (R.H.), Medical Directions, Inc., Tucson, AZ (J.H.), Medical Business Advisors, Beverly Hills, CA (J.H.), and Department of Health Services Research and Medicine, Cedars-Sinai Medical Center, University of California at Los Angeles School of Medicine, Los Angeles, CA (S.W.)

At the time this study was conducted, Dr. Harris was an officer of Blue Cross of California, Woodland Hills, CA

Address correspondence to: Robin B. Harris, PhD, Arizona Prevention Center, 2501 Lee Street, Tucson, AZ 85716

E-mail: rharris@azcc.arizona.edu

··· METHODS ···

Insurance Claims Data

We analyzed charges from health insurance claims paid out during calendar year 1992 for members of Blue Cross of California's Prudent Buyer Plans who were less than 65 years old. The Prudent Buyer Plans network providers were paid directly by Blue Cross based on a maximum allowable fee schedule. Providers did not have risk-sharing arrangements, nor were they required to refer to in-network providers during 1992. Members were free to self-refer to any provider, but coverage was reduced when they used out-of-network providers.

During the study period, Blue Cross was attempting to enlist 75% of practicing physicians and podiatrists in California in its Prudent Buyer network. Blue Cross divided the Prudent Buyer membership population into two market segments. One segment included individual members and members from smaller employer groups, and these members usually had higher deductible and copayment levels. The other segment, which included members from large corporate or group accounts, had no or low deductibles. Estimated 1992 membership in the group market segment was 576,000 for members less than 65 years of age. We used this group as our primary data set for this analysis.

Definition of Disease and Episode of Care

We analyzed all professional claims for procedures or visits that could be related to foot and ankle problems, excluding trauma-induced fractures. Table 1 shows Interna-tional Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)[2] and Current Procedural Terminology (CPT-4)[3] codes that we used. We excluded nail diseases, since claims data did not allow us to distinguish between fingernail or toenail problems.

The claims data system recorded the charges for each procedure or service per claim and the total sum paid for the claim. The claims data included physician or podiatrist services but did not include institutional charges. We used these charges to measure services performed and reimbursement expectations. As expected, provider reimbursements did not necessarily equal these individual charges.

We calculated episodes of care from linked individual claims records for each insured person. Procedures and services linked to an individual and performed within 60 days of the first event were considered as part of one episode. We used 60 days as our criteria to allow comparison with results of the 1982 FEHBP study. Actual duration of the episode was calculated and subanalyses were performed for episodes of varying duration (<2 days, 2-30 days, 31-60 days). When more than one procedure or service was performed during an episode, we could not determine from the claims records which procedure was primary or secondary. Whenever at least one inpatient professional service was performed within the 60-day window, this was considered an inpatient care episode.

Providers

The individual claims records identified the type of practitioner providing each service according to the tax identification number. The insurance company had previously assigned specialty codes to the tax identification numbers used by its providers. We grouped provider codes as follows: podiatrists, orthopedic surgeons, general medicine specialties, other subspecialty physicians, physical therapists, and other service providers.

When more than one provider was involved in one episode, the data did not identify the primary provider of care. As a result, we characterized providers as the first or final provider of care during an episode, and we used the first provider as the primary provider. In the vast majority of cases, the first and final provider was the same provider; the percent agreement between the first and last provider of care for a 60-day episode was 95.9%.

Analyses

We removed duplicate claims and excluded claims in which the provider specialty was unknown (n = 1,670), no charge was reported (n = 22), or the primary diagnosis was unknown (n = 245). After this adjustment, our database included 94,457 individual transactions for 33,072 claims.

We estimated the incidence of foot care services for males and females by age, based on 1992 enrollment in the Prudent Buyer group insurance plan. Age- and gender-adjusted incidence rates were calculated using direct adjustment with the combined population as the standard. We then summed total charges billed by the providers for both individual service items and episodes of care. We estimated the mean charge per procedure or service for various member classifications and provider groups. The unadjusted mean charge per episode and mean number of service items per episode were also calculated. Age- and gender-adjusted mean values were estimated using least square regression methods. We used multiple *t*-tests for between-group comparisons of the mean, with

Table 1. CPT-4 and ICD-9 Codes Used to Define Foot Care Problems

ICD-9 Codes of Interest	Diagnosis
355, 35500, 3555, 35550, 3556, 35560, 3557, 35570, 3558, 35580	mononeuritis of lower limb
680.7	carbuncle or boil of foot
6811, 68110-68190	cellulitis abscess, onychia, or paronychia of toe
6827, 68270,6829	other abscess or cellulitis of foot
7071, 707, 70700	ulcer of lower limb
71117, 71127, 71137, 71147, 71157, 71167, 71177, 71187, 71197	arthropathy with infections, foot
71217, 71227, 71237, 71247, 71257, 71267, 71277, 71287, 71297	crystal arthropathy, foot
71517, 71527, 71537, 71547, 71557, 71567, 71577, 71587, 71597	osteoarthritis & allied disorders, foot
71617, 71627, 71637, 71647, 71657, 71667, 71677, 71687, 71697	other & unspecified arthropathies, foot
71817, 71827, 71837, 71847, 71857, 71867, 71877, 71887, 71897	other derangement of joints, foot
7267, 72670-72679, 72690	peripheral enthesopathies of ankle and tarsus
72706	tenosynovitis of foot and ankle
7271	bunion
72767	rupture - Achilles tendon
72768	rupture - other tendon of foot or ankle
7287	plantar fascial fibromatosis
73007, 73017, 73027, 73037, 73077, 73087, 73097	osteomyelitis, foot
7325	juvenile osteochondrosis of foot
73344	aseptic necrosis of bone - talus
734	flatfoot
735, 73500, 7351, 73510, 7352, 73520, 7353, 7350, 7354, 73540,	acquired deformities of toe
7355, 7358, 73580, 7359	"" ""
7367, 73670, 73671, 73672, 73673, 73674, 73676, 73679	other acquired deformities of ankle or foot
7545, 75450, 75453, 7546, 75460-75462, 7547, 75470, 75471	congenital deformities of feet
7556, 75502-75567	anomalies of toes & foot
CPT-4 Foot Codes of Interest	
28001-28035	Incision
28043-28175	Excision
28190-28193	Introduction/removal
28200-28360	Repair/revision/reconstruction
28705-28760	Arthrodesis
28800-28825	Amputation
28899	Miscellaneous

Scheffe's adjustment for multiple comparisons. Due to skewed distribution of the outcome variables (charges and number of procedures), we also performed analyses using log normal transformation; however, this did not change the results. Therefore, the nontransformed results are presented. Data management and statistical analyses were performed using PC-SAS systems (SAS Institute, Inc., Cary, NC).

We also sought to compare the charges submitted by podiatrists and orthopedists for the management of two specific, primary diagnoses. These diagnoses included bunions (ICD-9-CM=727.1) and acquired deformities of the toes (ICD-9-CM=735.x). We conserv-atively estimated the use of hospital services by assuming that all professional services indicating inpatient care were associated with a hospitalization.

··· RESULTS ···

Types of Claims

In this insured population, 13,934 members under 65 years of age had at least one episode of foot care during 1992. A total of $10,018,926 was billed for these services.

Table 2 shows the frequency of foot care services in this population during 1992. The age- and sex-adjusted annual incidence of foot care services (excluding nail care) was 25.9 per 1,000 members. Women were more likely to use foot care services than men for all age groups except for men less than 20 years old. The use of care (and presumably foot problems) generally increased with age, with the exception of men less than 20 years old (Table 2).

Table 3 shows the mean charge per episode, the mean number of procedures or service items billed per episode, and the mean charge per procedure or service by gender. Age-specific analyses showed little variation in charges by age for either sex. The mean values were then age-adjusted for each gender. However, care provided to women cost more per procedure/service and more per episode. Sixty-one percent of these episodes of care were provided to women, and the mean charge per episode was $647 for women, as compared with $423 for men ($P < 0.0001$).

Table 2. Use of Foot Care Services Within an Insured Population in 1992, by Age and Gender of Members

	# Members With at Least 1 Foot Care Service	Incidence Per 1,000 Members (95% Confidence Limit)
Women		
<20 years	936	13.2 (12.29-14.09)
20-29	530	13.8 (12.67-15.05)
30-39	1,440	28.9 (27.45-30.41)
40-49	2,397	39.3 (37.79-40.89)
50-59	2,033	50.1 (47.97-52.23)
60-64	950	68.6 (64.48-72.98)
All	8,286	30.2 (29.56-30.84)
Men		
<20 years	1,523	20.2 (19.22-21.25)
20-29	369	10.4 (9.37-11.51)
30-39	789	19.5 (18.17-20.89)
40-49	1,295	24.9 (23.52-26.23)
50-59	1,117	28.0 (26.26-29.61)
60-64	554	36.9 (33.98-40.08)
All	5,647	21.9 (21.30-22.43)

Table 3. Mean Professional Charges and Volume of Foot Care Services for Men and Women in an Insured Population in 1992

	Total Procedures	Total Episodes*	Mean Charge Per Procedure+	Mean Charge Per Episode†	Mean Procedures Per Episode
Men	33,698	6,968	$87 (1.09)	$423 (12.25)	4.81 (.08)
Women	60,759	10,911	$116 (1.05)	$647 (15.44)	5.57 (.08)

*Episodes consist of all services provided for a foot problem within 60 days of an initial visit.
†Mean (standard error) estimated by multivariate linear regression model, adjusted for age of members. All male-female comparisons significant at $P < 0.0001$.

Charges by Specialty

Over 59% of all services were provided by podiatrists and 57% of the episodes were attributed to podiatrists. Approximately 16% of all services claimed were from physical therapists or other nonphysician or nonpodiatrist providers.

Table 4 illustrates the relationship between foot care charges and specialist. The overall relationship between care and provider type was similar for both genders, despite the increased utilization among women. The mean values were adjusted for age and gender. Podiatrists had a 12% lower mean charge per procedure or service than did orthopedists or specialty physicians. The average procedure charge, adjusted for age and gender, was $113 for podiatrists and $129 for orthopedists ($P < 0.0001$).

However, as Table 4 illustrates, the mean charge per episode of care was significantly greater for podiatrists than orthopedists ($665 vs. $466, respectively; $P < 0.0001$). Podiatrists performed substantially more procedures per episode of care than did any physician group, and an episode of care for podiatrists was associated with a mean of 5.9 procedures compared with 3.9 procedures per episode for orthopedists ($P < 0.0001$). General practice physicians had the lowest procedure charges and episode charges. This difference in patterns of care may be due to differences in type of patients and their presenting problems.

Podiatrists tended to provide care for longer durations than orthopedists. More than 32% of episodes attributed to podiatrists were between 31 days and 60 days long, as compared with 16% of the orthopedists' episodes.

Sixty percent of all episodes were less than 2 days long, and only 18% were between 31 days and 60 days. A subanalysis of these shorter episodes revealed that, while podiatrists performed significantly more procedures per episode, total charges for the short episodes were statistically comparable between provider groups (Table 4).

Over 23% of all services claimed by podiatrists and 22% of orthopedists' services were for foot surgeries or foot x-rays. Podiatrists performed substantially more casting or strapping procedures or muscle testing procedures than orthopedists (14.9% vs. 3.97%, respectively).

Location of the Service and Provider Specialty

When we examined the location of service, we found that most services were provided in the office setting (91% for podiatrists and 89% for orthopedists). All providers seldomly used inpatient services, although podiatrists were less likely to perform individual services in the inpatient setting than orthopedists (1.25% vs. 4.46% of services were performed on an inpatient basis by podiatrists and orthopedists, respectively; $P < 0.0001$).

In this insured population, we identified 638 episodes with at least one inpatient service. Approximately 2.8% of all podiatrists' episodes were so defined as inpatient compared with 4.8% of orthopedists' episodes. The mean professional charges for episodes of care containing at least one hospital service, adjusted for age and gender of member, were similar for orthopedists and podiatrists ($3,468 and $3,195, respectively; $P < 0.05$).

We attempted to match hospital charge data with professional charge data, but less than 46% of the episodes could be matched. For matched episodes, episodes with a podiatrist identified as the primary provider were associated with lower, but not statistically significant, institutional charges than services from other provider groups. The adjusted institutional charges were $9,788 for podiatrists versus $11,994 for orthopedists ($P = 0.43$). The average adjusted lengths of stay were also similar between specialty groups (2.5 days for podiatrists and 2.7 days for orthopedists; $P = 0.80$).

Table 4. Comparison of Professional Charges and Volume of Foot Care Services by Provider Specialty

Provider Specialty*‡	Total Procedures	Mean Charge Per Procedure*	Total Episodes†	Mean Charge Per Episode*†	Mean Procedures Per Episode*†
All episodes					
Podiatry	55,364	$113 (1 13)§	9,497	$665 (15.38)§	5.91 (.08)§
Orthopedics	9,082	$129 (2.66)	2,501	$466 (29 06)	3.88 (.14)
General medicine	7,399	$69 (2 94)	2,604	$245 (28 41)	3 14 (.14)
Other specialty MD	7,844	$127 (2 88)	1,999	$528 (32.71)	4.23 (.16)
Episodes <2 days duration					
Podiatry			5,129	$253 (8.48)	2.74 (.03)§
Orthopedics			1,661	$237 (14 52)	2 05 (0.6)
General medicine			1,964	$105 (13 31)‖	1.84 (0 5)
Other specialty MD			1,443	$279 (15.70)	2.28 (0.6)

*Mean (standard error) estimated by multivariate linear regression model, adjusted for age and gender of members.
†Episodes defined as all procedures and services that occurred within 60 days of the initial service date.
‡Provider is classified as the specialty of the first physician or podiatrist performing a service during the episode. Count for total procedures attributed to provider actually performing the service. During episode, count attributed to primary provider.
§$P < 0.001$ comparing podiatrists versus other provider, adjusting for multiple comparisons.
‖$P < 0.001$ comparing general medicine versus other provider groups

Comparison of Charges for Specific Problems

We performed separate analyses for two categories of specific, common foot problems that can result in surgical treatments: acquired toe deformities and bunions. We identified 3,835 episodes of acquired toe deformities treated by podiatrists or physicians and 1,053 episodes of bunions. Table 5 shows the mean professional charges per treatment episode and the mean number of procedures performed during the episode for both types of foot problems and for each provider group.

Approximately 65% of the episodes relating to acquired toe deformity problems were single-day episodes. While the mean professional charges for the 1-day episodes were relatively similar for both provider types, the mean adjusted charges for all episodes were higher for podiatrists when compared with orthopedists. During 60-day episodes of care for acquired toe deformities, podiatrists performed 41% more procedures than orthopedists ($P < 0.01$). Fewer episodes attributed to podiatrists required hospital services (4.4% of podiatrists' episodes versus 8.5% for orthopedists, $P < 0.0001$).

Service charges for bunion care are also shown in Table 5. A substantial portion of bunion care was provided in single-day episodes; at least 63% of bunion episodes were 1-day episodes. Podiatrists had greater charges than orthopedists at all episode lengths and claimed more services per episode than did orthopedists. As with acquired toe deformities, most services were performed in the ambulatory setting, with 5.7% of bunion episodes by podiatrists requiring hospital services as compared with 12.4% by orthopedists ($P < 0.0001$).

Table 5. Comparison of Professional Charges for Episodes of Foot Care for Specific Foot Problems

Provider Specialty	Total Episodes	Mean Charge Per Episode*	Mean Procedures Per Episode*
	Acquired Toe Deformities (ICD-9-CM=735)		
All Episodes			
Podiatry	2,825	$867 (42)†	5.58 (.16)‡
Orthopedics	268	$552 (117)	3.62 (.45)
Episodes <2 days, duration			
Podiatry	1,729	$273 (24)	2.64 (.08)
Orthopedics	172	$303 (66)	2.13 (.23)
	Bunions (ICD-9-CM=727.1)		
All Episodes			
Podiatry	517	$1,021 (90)	5.86 (.31)‡
Orthopedics	132	$488 (155)†	3.12 (.53)
Episodes <2 days, duration			
Podiatry	282	$327 (60)	2.89 (.19)
Orthopedics	81	$223 (103)	2.13 (.33)

*Mean (standard error) estimated by multivariate linear regression model, adjusted for age and gender of members. Overall model also adjusted for length of episode.
†$P < 0.01$ comparing podiatrists versus orthopedists.
‡$P < 0.001$ comparing podiatrists versus orthopedists.

··· DISCUSSION ···

Provider practice patterns can profoundly influence MCO network costs. Providers who receive less money per unit of service may not be less costly to the MCO if they utilize more services. Studies designed to determine the true cost-effectiveness of MCO network management strategies often reveal conflicting results. One study demonstrated that chiropractic care has a beneficial effect on back pain cost outcomes,[4,5] whereas a more recent study demonstrated no difference in back pain outcomes between provider groups, with primary care physicians providing the least expensive care.[6]

Despite the fact that 10% of Americans and 25% of the elderly report problems with their feet, foot care has received relatively little attention in the health policy debate.[7,8] We examined the utilization of foot care by a commercially insured population and attempted to clarify differences in treatment patterns between podiatrists and orthopedists.

Podiatrists provided the majority of foot care for the population we studied, and this agrees with national surveys.[7,9] We found that podiatrists charged less per procedure or service than orthopedists. However, podiatrists charged more per episode of foot care because they saw their patients more frequently than orthopedists. This held true when we analyzed two specific surgical conditions: bunions and acquired toe deformities.

This study confirms findings from the 1982 FEHBP study, in that orthopedists charged more per procedure for foot care and podiatrists provided more units of care per 60-day treatment episode. Both studies also found that orthopedists tended to use hospital services more often, although our study showed a considerable decrease in the use of hospital resources by all providers. According to the FEHBP study, in 1982, orthopedists hospitalized 93% of their patients who were surgically treated for bunions and podiatrists hospitalized 38% of these patients. In our study, podiatrists used hospital services for 5.7% of bunion episodes and orthopedists used hospital services for 12.4% of these episodes. The fact that orthopedic services were still less expensive despite this 6.7% higher use of hospital services suggests that savings are not likely to result from further reductions in institutional use when treating these two common foot problems.

This study also confirms that women over 20 years of age use more foot care services than men. This finding was briefly noted in the FEHBP study. The increased use of foot care services among women in this population was associated with higher costs. It may be possible that women have more foot problems or more complex problems due to shoe type. Alternately, women may be more willing to undergo therapeutic procedures. It is important to consider that utilization of health care services can vary according to gender and age, and different providers may be more likely to attract different patient populations.

This claims-based study was limited in that we could not assess qualitative factors such as case-mix, clinical outcomes, and patient satisfaction. Further analysis of clinical records or patient-reported outcomes data could help us determine if higher utilization of procedures and services by podiatrists (or differences among podiatrists) is associated with different types of patients and/or outcomes. This would help characterize the service pattern that is associated with good outcomes and efficient service utilization.

While this study would seem to show that podiatrists are generally more expensive providers in the care of patients with foot problems, this effect could be attentuated with strong utilization controls that reduce podiatry referrals or by capiation arrangements that are independent of actual utilization. Overall, this study underscores the need to examine practice patterns of different specialists who perform similar procedures when making decisions about the cost-effectiveness of care.

Acknowledgments

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FOOT & ANKLE INTERNATIONAL

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Foot and Ankle Experience in Orthopedic Residency: An Update

Vinod K. Panchbhavi, MD, FRCS, FACS; Michael S. Aronow, MD; Benedict F. DiGiovanni, MD; Eric Giza, MD; Jerry S. Grimes, MD; Thomas G. Harris, MD; Matthew M. Roberts, MD; Brian Straus, MD

Galveston, TX

ABSTRACT

Background: **In 2003, a limited survey regarding the number of dedicated foot and ankle faculty and foot and ankle rotations at orthopaedic surgery residency programs was published. The purpose of this paper was to update the results of that previous survey and provide additional, more in-depth information.** *Materials and Methods:* **A survey questionnaire was emailed to the program directors and chairpersons of the 150 ACGME-accredited orthopaedic residency training programs in the United States.** *Results:* **Responses were obtained from all programs. One hundred thirty-seven (91.3%) programs had one or more orthopaedic surgeon faculty members with a predominantly foot and ankle practice (at least 50%), an increase of 5.5 percentage points from the survey performed 6 years previously. One hundred forty three (95.3%) programs had one or more orthopaedic surgeon faculty members with a practice consisting of at least 25% foot and ankle. One hundred twenty programs (80%) had one or more dedicated foot and ankle rotations, an increase of 15.1% from 6 years prior. Orthopaedic surgery residents were felt to spend a mean of 30.4% and a median of 20% of their time with board-certified/ board-eligible orthopaedic surgeons in rotations that include treatment of foot and ankle pathology but were not considered "dedicated" foot and ankle rotations.** *Conclusions:* **The number of orthopaedic surgery residency programs with rotations and faculty members dedicated to foot and ankle education has increased over the 6 years between surveys. Orthopaedic surgery residents' experience and skill development in foot and ankle surgery during their 5 years of residency training are not limited to their time spent in dedicated foot and ankle rotations.**

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Corresponding Author:
Michael S. Aronow, MD
University of Connecticut Health Center
Department of Orthopaedic Surgery
Medical Arts and Research Building
263 Farmington Ave
Farmington, CT 06034-4037
E-mail: aronow@nso.uchc.edu
For information on pricings and availability of reprints, call 410-494-4994, x232.

Key Words: Orthopaedic; Residency Training; Foot and Ankle Education

INTRODUCTION

In the fall of 2002, the Resident Education Committee of the American Orthopaedic Foot and Ankle Society sent a questionnaire to the chairpersons of all 148 orthopaedic surgery residency programs in the United States that were accredited by the Accreditation Council for Graduate Medical Education (ACGME). The goal was to assess the exposure of orthopaedic residents to the discipline of foot and ankle orthopaedics. The questions asked were the number of faculty with a dedicated foot and ankle practice (defined as having foot and ankle account for at least 50% of their clinical practice), whether the residents had a dedicated foot and ankle rotation, and if so, the postgraduate year and duration in weeks of the rotation. The survey results were published in ***Foot & Ankle International***[1] in July 2003 with the hope that by focusing attention on the subject that they would encourage residency programs to work to further improve foot and ankle training during orthopaedic surgery residency training. One purpose of this current paper was to update the results of the previous paper to determine how much change, if any, there has been in the training of orthopaedic residents in foot and ankle orthopaedics during the ensuing six years. Another purpose was to attempt to capture additional information not included in the previous survey, including the previous training of the faculty members providing orthopaedic resident education and the amount of foot and ankle education orthopaedic residents obtain outside of dedicated foot and ankle rotations and from orthopaedic surgeons who perform foot and ankle surgery that encompasses less than 50% of their practices.

MATERIALS AND METHODS

In December 2007, the Postgraduate Medical Education and Training Committee of the American Orthopaedic Foot and Ankle Society sent a survey to the chairpersons and residency training directors of the 150 orthopaedic surgery residency programs in the United States, including Puerto Rico, that were accredited by the ACGME. After contacting initial non-responders by telephone or email, we received replies from all 150 programs, with the vast majority of the responses received in 2008. The survey questionnaire asked for the names of the primary residency teaching faculty members for foot and ankle; their postgraduate degree(s); whether they were full-time, part-time, or volunteer faculty; whether they were foot and ankle fellowship trained; and whether their practice consisted or more than 90%, more than 50%, more than 25%, or less than 25% foot and ankle. It asked whether their residency program had a dedicated foot and ankle rotation, and if so, the number of weeks in each postgraduate year of residency training. The survey questionnaire also asked "of the total residency training period what percentage of a resident's time is spent with board-certified/ board-eligible orthopaedic surgeons in rotations that include treatment of foot and ankle pathology but are NOT specifically dedicated foot and ankle rotations." While some programs included clinical and research non-orthopaedic surgeon faculty in their responses, only orthopaedic surgeon faculty were included in the results of this paper.

RESULTS

The results of the 2008 survey questions in comparison with results obtained 6 years previously are shown in Table 1. The results for number per program of orthopaedic surgeon faculty involved in orthopaedic resident foot and ankle education including those whose practices encompass 50% or less foot and ankle surgery are shown in Table 2. With respect to the percentage of a resident's time spent with board-certified/board-eligible orthopaedic surgeons in rotations that include treatment of foot and ankle pathology but are not dedicated foot and ankle rotations, there was a wide range of responses, with a mean of $30.4 \pm 24.9\%$ and a median of 20%.

DISCUSSION

For an orthopaedic residency training program to maintain ACGME accreditation it must provide for its residents[2]: "Clinical problems of sufficient variety and volume to afford the residents adequate experience in the diagnosis and management of adult and pediatric orthopaedic disorders. The residents' clinical experience must include adult orthopaedics, including joint reconstruction; pediatric orthopaedics, including pediatric trauma; trauma, including multisystem trauma; surgery of the spine, including disk surgery, spinal trauma, and spinal deformities; hand surgery; foot surgery in adults and children; athletic injuries, including arthroscopy; metastatic disease; and orthopaedic rehabilitation, including amputations and post-amputation care."

In some orthopaedic surgery residency programs this education includes dedicated rotations in foot and ankle surgery. It may also include rotations in which residents rotate with faculty who subspecialize in foot and ankle surgery. However, this grossly underestimates the amount of time orthopaedic surgery residents spend being educated in the treatment of foot and ankle disorders. Some orthopaedic surgery residency faculty members are extremely knowledgeable about foot and ankle surgery, and even sub-specialize in foot and ankle surgery, yet spend less than 50% of their practice time on foot and ankle disorders because of practice demands or other clinical interests. Orthopaedic surgery residents are also educated in the non-operative and operative treatment of the foot and ankle during non-dedicated foot and ankle rotations by board-certified/board-eligible orthopaedic surgeons who are often fellowship trained in foot and ankle surgery or other orthopaedic subspecialties that commonly treat foot and ankle disorders. Illustrative examples include ankle fractures and midfoot dislocations during trauma rotations, Achilles tendinopathy and ankle instability during sports medicine rotations, clubfoot and adolescent flatfoot deformities during pediatric rotations, plantar fibromatosis and enchondromas during musculoskeletal oncology rotations, spastic equinovarus deformities and claw toes during orthopaedic rehabilitation rotations, and bunions and interdigital neuromas during general orthopaedic surgery rotations.

Orthopaedic surgery residents receive extensive training in the care of the entire musculoskeletal system, and the skills learned taking care of other areas of the body are applicable to the care of patients with foot and ankle disorders. The patient management skills learned with respect to history taking, physical examination, clinical decision-making, patient communication, and properly managing post-surgical complications can be obtained from and applied to all orthopaedic patients. Surgical dexterity, including developing speed and accuracy during surgical exposure, the proper use of orthopaedic instruments, and wound closure, is developed by operating not only in the foot and ankle region but also in other areas of the body. The arthroscopic skills developed and techniques learned performing arthroscopy of the shoulder, elbow, wrist, hip, and knee are often transferable to arthroscopy of the ankle and subtalar joints. The principles of fracture care, including soft tissue management and stabilization techniques used to treat fractures of the upper extremity, spine, pelvis, and remainder of the lower extremity, are applicable to trauma of the foot and ankle. Disorders of other areas of the body including the spine, hip, and knee can cause or influence the treatment of foot and ankle disorders and orthopaedic surgery residents are trained in the coordinated care of all of these conditions.

In the 6 years since the original 2002 survey, the percentage of orthopaedic surgery residency programs with a dedicated foot and ankle rotation increased from 64.9% to 80.0%. The percentage of orthopaedic surgery residency

Table 1: Comparison of 2002 and 2008 Survey Results

Faculty Responsible for Resident Foot and Ankle Education with Greater Than 50% Foot and Ankle Practice

Number of Faculty	Number of Programs 2002	Number of Programs 2008
0	21 (14.2%)	13 (8.7%)
1	80 (54.1%)	58 (38.7%)
2	27 (18.2%)	49 (32.7%)
3 or more	20 (13.5%)	30 (20%)

Dedicated Foot & Ankle Clinical Rotation

	2002	2008
Yes	96 (64.9%)	120 (80%)
No	52 (35.1%)	30 (20%)

Postgraduate Year of Training with Dedicated Foot & Ankle Experience

PGY year	Number of Programs 2002	Number of Programs 2008
None	52 (35.1%)	30 (20%)
1	1 (0.7%)	2 (1.3%)
2	15 (10.1%)	15 (10.0%)
3	27 (18.2%)	27 (18.0%)
4	15 (10.1%)	19 (12.7%)
5	5 (3.4%)	2 (1.3%)
Multiple	33 (22.3%)	55 (36.7%)

Total Weeks of Dedicated Foot & Ankle Experience

Weeks	Number of Programs 2002	Weeks 2008	Number of Programs 2008
0	52 (35.1%)	0	30 (20.0%)
6	9 (6.1%)	4.0–7.0	8 (5.3%)
8	17 (11.5%)	7.1–9.0	13 (8.7%)
10	7 (4.7%)	9.1–11.0	14 (9.3%)
12	32 (21.6%)	11.1–14.0	45 (30.0%)
16	13 (8.8%)	14.1–18.0	24 (16.0%)
20+	18 (12.2%)	20.0+	16 (10.7%)

programs with multiple foot and ankle rotations increased from 22.3% to 36.7% and the percentage of orthopaedic surgery residency programs with a dedicated foot and ankle rotation of 12 weeks or longer increased from 42.6% to 56.7%. The percentage of orthopaedic surgery residency programs with a faculty member whose practice encompasses more than 50% foot and ankle surgery improved from 85.8% to 91.3% while the number of programs with multiple faculty members whose practice encompasses more than 50% foot and ankle surgery increased from 31.7% to 52.7%. These data may underestimate the improvement, as there is no way to ascertain whether the responders to the 2002 survey included non-orthopaedic surgeon faculty in their responses that were not included in the results of this study. Additionally, there was at least one program without a faculty member whose practice encompasses more than 50% foot and ankle surgery that responded that it had had one who had just left and was in the process of recruiting another.

Table 2: 2008 Orthopaedic Surgeon Foot and Ankle Faculty Results

Faculty Responsible for Resident Foot and Ankle Education with Greater Than 25% Foot and Ankle Practice

Number of Faculty	Number of Programs
0	7 (4.7%)
1	57 (38.0%)
2	49 (32.7%)
3 or more	37 (24.7%)

Faculty Responsible for Resident Foot and Ankle Education Including Less Than 25% Foot and Ankle Practice

Number of Faculty	Number of Programs
0	2 (1.3%)
1	42 (28.0%)
2	46 (30.7%)
3 or more	60 (40.0%)

The principal limitation of this study is that it depends on the accuracy of survey responses as opposed to data collected by actual site visits. There may have been differences in how the survey respondents collected their data and likely some variability as to the estimates of whether some faculty members' practices encompass slightly more or less than 25% or 50% foot and ankle surgery and the extent of foot and ankle experience in non-foot and ankle rotations.

CONCLUSION

There was substantial improvement in the number of orthopaedic surgeons whose practice encompasses 50% or greater foot and ankle surgery and the number and length of dedicated foot and ankle rotations associated with orthopaedic surgery residencies between 2002 and 2008. Nevertheless, the Postgraduate Medical Education and Training Committee of the American Orthopaedic Foot and Ankle Society advocates taking a proactive approach to encourage continued enhancement of the foot and ankle training experience of orthopaedic residents. The results of this survey document that most orthopaedic surgery residents receive focused foot and ankle subspecialty training during dedicated orthopaedic foot and ankle rotations. This training is supplemented by the training all orthopaedic residents receive during exposure to foot and ankle orthopaedics during non-dedicated foot and ankle rotations along with the development of clinical skills which can be translated to the treatment of foot and ankle disorders during the 5 years of post-graduate surgical residency training. In addition, orthopaedic residency programs need to satisfy the ACGME accreditation requirement to provide their residents adequate experience in the diagnosis and management of adult and pediatric orthopaedic disorders, including foot surgery in adults and children. Therefore, we believe that orthopaedic residency training provides sufficient training to produce orthopaedic surgeons overall well-qualified to treat patients with foot and ankle disorders.

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Research Article

Lower Complication Rate Following Ankle Fracture Fixation by Orthopaedic Surgeons Versus Podiatrists

Jeremy Y. Chan, MD
Jeremy N. Truntzer, MD
Michael J. Gardner, MD
Julius A. Bishop, MD

Abstract

Introduction: Increased overlap in the scope of practice between orthopaedic surgeons and podiatrists has led to increased podiatric treatment of foot and ankle injuries. However, a paucity of studies exists in the literature comparing orthopaedic and podiatric outcomes following ankle fracture fixation.
Methods: Using an insurance claims database, 11,745 patients who underwent ankle fracture fixation between 2007 and 2015 were retrospectively evaluated. Patient data were analyzed based on the provider type. Complications were identified by the *International Classification of Diseases, Ninth Revision*, codes, and revision surgeries were identified by the Current Procedural Terminology codes. Complications analyzed included malunion/nonunion, infection, deep vein thrombosis, and rates of irrigation and débridement. Risk factors for complications were compared using the Charlson Comorbidity Index.
Results: Overall, 11,115 patients were treated by orthopaedic surgeons and 630 patients were treated by podiatrists. From 2007 to 2015, the percentage of ankle fractures surgically treated by podiatrists had increased, whereas that treated by orthopaedic surgeons had decreased. Surgical treatment by podiatrists was associated with higher malunion/nonunion rates among all types of ankle fractures. No differences in complications were observed in patients with unimalleolar fractures. In patients with bimalleolar or trimalleolar fractures, treatment by a podiatrist was associated with higher malunion/nonunion rates. Patients treated by orthopaedic surgeons versus podiatrists had similar comorbidity profiles.
Discussion: Surgical treatment of ankle fractures by orthopaedic surgeons was associated with lower rates of malunion/nonunion when compared with that by podiatrists. The reasons for these differences are likely multifactorial but warrants further investigation. Our findings have important implications in patients who must choose a surgeon to surgically manage their ankle fracture, as well as policymakers who determine the scope of practice.
Level of Evidence: Level III—retrospective cohort study

From the Department of Orthopaedic Surgery, Stanford Health Care, Stanford, CA.

Correspondence to Dr. Chan: jychan04@stanford.edu

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Surgical treatment of ankle fractures has increased as a result of the increasing incidence of these injuries, particularly in the elderly.[1,2] Among the Medicare patients, ankle fractures are the third most common extremity fracture, costing more than half a billion dollars per year.[3,4] Although most ankle fracture care continues to be provided by orthopaedic surgeons, the growing presence and expanding scope of practice of podiatrists has resulted in changes in the management of foot and ankle injuries. For example, following the introduction of podiatric staff privileges at a level-I trauma center, the overall proportion of foot and ankle consults seen by podiatrists increased sixfold from 9% to 58% within 5 years.[5] Similarly, the proportion of foot and ankle injuries surgically treated by podiatrists increased from 8% to 41% in the same time frame.[5] Despite the greater involvement of podiatrists in the surgical management of foot and ankle injuries, currently, no studies exist in the literature that directly compare orthopaedic and podiatric outcomes following ankle fracture fixation. In addition, no published studies have compared longitudinal trends in the proportion of ankle fractures treated by orthopaedic surgeons versus podiatrists.

Therefore, this study evaluated short-term complication rates following ankle fracture fixation based on the provider type. We also sought to identify changes in the proportion of ankle fractures treated by orthopaedic surgeons versus podiatrists. Our hypotheses were that (1) podiatrists would have increasing involvement in surgically treated ankle fractures and (2) surgical treatment of ankle fractures by orthopaedic surgeons would be associated with similar complication rates as compared with podiatrists.

Methods

A retrospective cohort study was conducted using data from all patients between the ages of 20 and 80 years within the Humana subset of the PearlDiver Patient Record Database (Pearl-Diver Technologies) who underwent ankle fracture fixation between 2007 and 2015. The research and compliance office at our institution deemed the study exempt from human studies review because the data extracted for this study was from a publicly available source and all information received was de-identified. Patients who were diagnosed with an ankle fracture were identified using codes from the *International Classification of Diseases, Ninth Revision* (*ICD-9*), list for unimalleolar (824.0, 824.1, 824.2, 824.3), bimalleolar (824.4, 824.5), and trimalleolar (824.6, 824.7) fractures. Inclusion criteria for this study required patients to have undergone subsequent surgical treatment within 30 days of their primary ICD-9 code to limit the analysis to the treatment of acute ankle fractures alone. Surgical treatment was identified using the Current Procedural Terminology (CPT) codes for unimalleolar (27766, 27792), bimalleolar (27814), and trimalleolar (27822, 27823) fracture fixation with or without concomitant syndesmotic fixation (27829). Patients were then separated based on their provider type using the Healthcare Provider Taxonomy Code Set for orthopaedic surgeons (207X0004X, 207XX0801X) and podiatrists (213E00000X, 213EG0000X, 213ES0103X, 213ES0131X). A sample of our search algorithm for unimalleolar fractures is illustrated (Figure 1).

Among the identified patients who underwent ankle fracture fixation, subsequent complication rates were identified using a combination of *ICD-9* and CPT codes. Within 90 days of surgical treatment, the following complications were identified: new diagnoses of infection (*ICD-9* 996.67, 996.69, 998.51, 998.59), deep vein thrombosis (DVT) (*ICD-9* 453.40, 453.41 and 453.42), and revision surgery for irrigation and débridement (CPT 20000, 20005, 10140, 10180, 11042, 11043, 11044, 27603, 27607, 27610). These revision surgery codes were chosen as indicators of postoperative wound dehiscence or infection that could potentially be attributable to the treatment provider. Within 1 year of surgical treatment, the following complications were identified: new diagnoses of malunion or nonunion (*ICD-9* 733.81, 733.82). We did not analyze complications such as cardiac or respiratory events because of the likelihood of confounding factors that were not attributable to the surgical treatment directly.

Demographic data collected included sex, age, and Charlson Comorbidity Index (CCI). Statistical analyses to compare demographic data and complication rates were performed using chi-squared test for proportions and two-sample *t*-test

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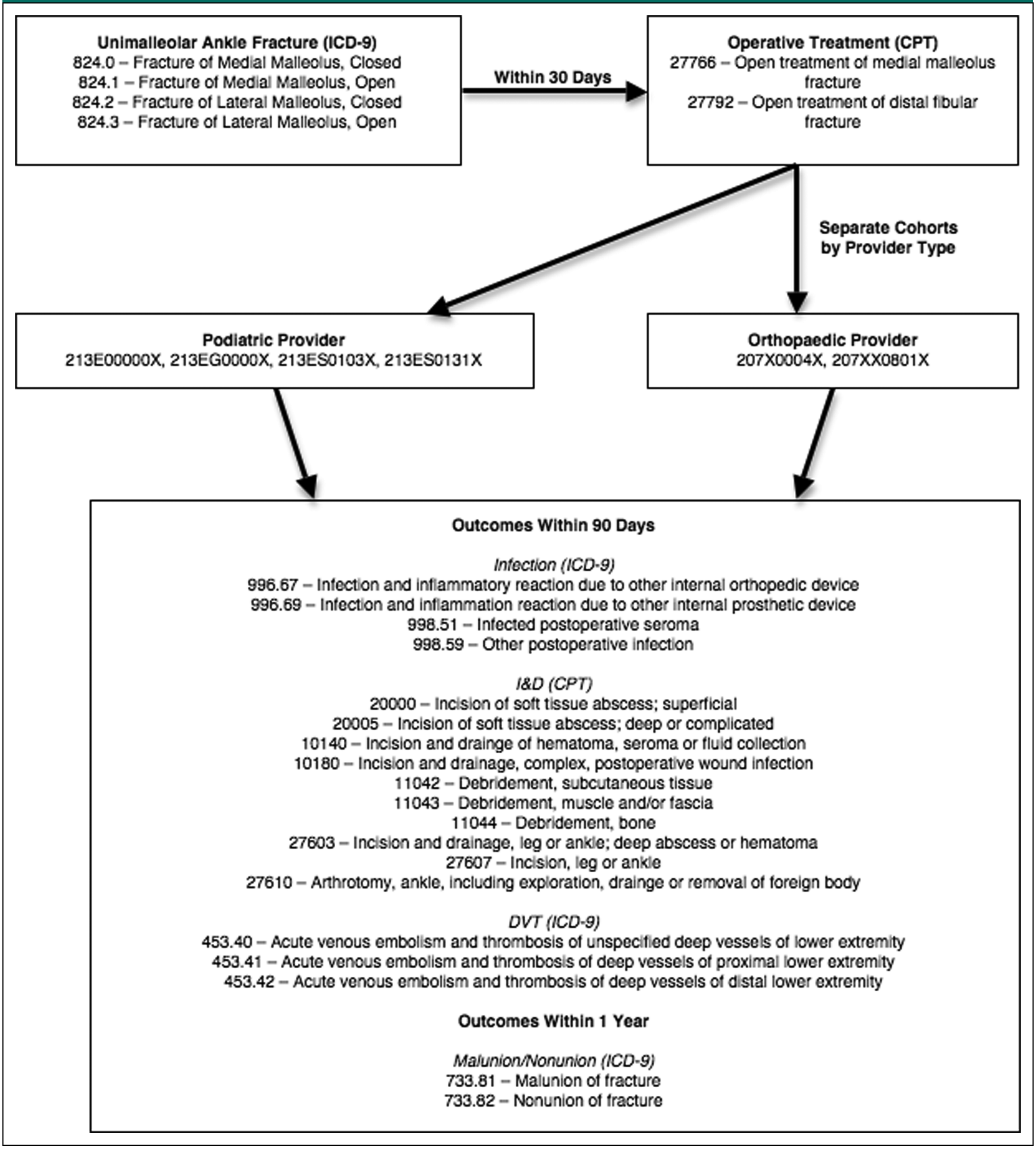
Figure 1



Flow chart showing the data search algorithm used to identify complication and revision surgery rates following unimalleolar ankle fractures from the PearlDiver claims database.

for means (Med Calc Software Version 15.1). With both of these tests, *P* values less than or equal to 0.05 were considered statistically significant.

Results

We identified a total of 11,115 ankle fracture patients who were surgically treated by orthopaedic surgeons and 630 ankle fracture patients who were treated by podiatrists. When comparing the overall demographics of the two patient cohorts, no difference

Table 1

Patient Demographics

Factor	Ortho	Podiatry	*P* Value
Patients	11115	630	
Age (%)			
<60 yr	34.5	36.1	0.41
>60 yr	65.5	63.9	
Sex (%)			
Male	32.5	35.6	0.11
Female	67.5	64.4	
CCI (mean ± SD)	2.7 ± 3.4	2.8 ± 3.3	0.47

CCI = Charlson Comorbidity Index

was found in sex or the proportion of patients who were younger than or older than 60 years (Table 1). In addition, the mean CCI score was comparable between the orthopaedic cohort (mean, 2.7 ± 3.4) and the podiatric cohort (mean, 2.8 ± 3.3).

From 2007 to 2015, the proportion of ankle fractures treated by podiatrists doubled from 3.5% to 7.0%. The proportion of ankle fractures treated by orthopaedic surgeons decreased over the period from 96.5% to 93.0%. Across all types of ankle fractures, a statistically significantly higher rate of malunion/nonunion was found in the patient cohort treated by podiatrists compared with the cohort treated by orthopaedic surgeons (7.3% versus 4.6%). The relative risk for malunion/nonunion across all ankle fractures was 1.6 (95% confidence interval, 1.2 to 2.1; $P = 0.002$) when treated by podiatrists as compared with orthopaedic surgeons. No significant differences were reported in the observed rate of infection, DVT, or irrigation and débridement (Table 2).

Among the subgroup of patients with unimalleolar ankle fractures, a trend toward a higher rate of malunion/nonunion in ankle fractures was observed in those treated by podiatrists compared with those treated by orthopaedic surgeons (6.2% versus 4.0%), although this was not statistically significant. Among the subgroup of patients with bimalleolar or trimalleolar ankle fractures, surgical treatment by podiatrists was associated with a significantly higher rate of malunion/nonunion compared with surgical treatment by orthopaedic surgeons (8.2% versus 4.9%). The calculated relative risk for malunion/nonunion in patients with a bimalleolar or trimalleolar ankle fracture was 1.7 (95% confidence interval, 1.2 to 2.4; $P = 0.006$) when surgical treatment was performed by a podiatrist.

Discussion

Although the amount of overlap in the scope of practice between podiatrists and orthopaedic surgeons varies from state to state, surgical treatment of unstable ankle fractures is a common procedure performed by both provider types. However, currently no studies exist in the literature that directly compare patient outcomes following ankle fracture treatment by orthopaedic surgeons and podiatrists. Our study evaluated short-term complication rates following ankle fracture fixation by orthopaedic surgeons and podiatrists, and revealed higher rates of malunion or nonunion following podiatric surgery among all types of ankle fractures. This difference in malunion and nonunion rate was driven primarily by higher complexity bimalleolar and trimalleolar ankle fractures. No significant differences were found in the rates of postoperative infection, DVT, or irrigation and débridement. In addition, our study demonstrated a longitudinal trend toward increasing involvement

Table 2

Complication Rates by Provider Type Following Ankle Fracture Fixation

	All Ankle Fractures					Single Malleolar Fractures					Bimalleolar or Trimalleolar Fractures				
Factor	Orthopaedic	Rate	Podiatry	Rate	*P* Value	Orthopaedic	Rate	Podiatry	Rate	*P* Value	Orthopaedic	Rate	Podiatry	Rate	*P* Value
Total patients	11,115		630			3,638		275			7,477		355		
Malunion or nonunion	512	4.6%	46	7.3%	0.002	144	4.0%	17	6.2%	0.07	368	4.9%	29	8.2%	0.006
Infection	476	4.3%	21	3.3%	0.23	149	4.1%	8	2.9%	0.33	327	4.4%	13	3.7%	0.53
Irrigation and débridement	347	3.1%	20	3.2%	0.89	110	3.0%	9	3.3%	0.78	237	3.2%	11	3.1%	0.92
Deep vein thrombosis	190	1.7%	14	2.2%	0.35	53	1.5%	7	2.5%	0.20	137	1.8%	7	2.0%	0.78

of podiatry in the surgical treatment of ankle fractures.

The disparity in malunion and nonunion rates between podiatrists and orthopaedic surgeons is important because these complications have the potential to impact patient outcome. Fibular and medial malleolar malunion resulting in tibiotalar malalignment has been shown to significantly alter tibiotalar contact pressures.[6-10] Moreover, complications such as delayed union or nonunion following ankle fracture fixation has been associated with increased rates and decreased latency time to the development of posttraumatic ankle osteoarthritis.[11]

The underlying cause for the difference in malunion and nonunion rate remains unclear but is likely multifactorial. Risk factors for postoperative complication rates following ankle fracture fixation can generally be categorized into patient-specific factors and surgeon-related variables. In regard to patient-specific factors, no observed differences was observed in the age and sex proportions between the two cohorts that would account for the difference in malunion or nonunion. Patient comorbidities, such as diabetes and peripheral vascular disease, have previously been demonstrated to be a risk factor for short-term complications following ankle fracture fixation.[12-14] However, similar CCI scores were reported in our podiatric and orthopaedic cohorts, suggesting a comparable level of comorbidities. Our study did not specifically exclude patients with multiple injuries or open fractures, which could potentially affect the observed complication rates. These surgeries are typically performed by orthopaedic surgeons on an inpatient basis though, which would be more likely to bias complications toward the orthopaedic cohort.

Surgeon-related variables, such as surgical technique, case volume, and training, may also contribute to the observed difference in malunion and nonunion rates. In our study, a large discrepancy was observed in the number of ankle fractures treated by orthopaedic surgeons versus podiatrists. Previous studies have implicated surgical case volume as a factor that can affect patient outcomes. In lumbar spine surgery, surgeons and hospitals with surgical volume in the top 25% of the National Inpatient Sample were found to have significantly lower rates of mortality and perioperative complications.[15] In total hip arthroplasty, patients treated by surgeons who performed less than 35 cases per year were found to have higher rates of dislocations as well as revision surgeries.[16] Similarly, in total ankle arthroplasty, surgeons with case volume greater than the 90th percentile were found to have decreased rates of complications and intraoperative fractures.[17] However, the association between case volume and complications has not been demonstrated in studies on ankle fractures to date.[13,14] Although the claims database that our data were extracted from precluded an analysis of the average volume of ankle fractures treated by individual surgeons, more than 90% of all surgically treated ankle fractures identified were treated by an orthopaedic surgeon. Notably, the ratio of ankle fractures treated by orthopaedic surgeons compared with those treated by podiatrists was even higher in the bimalleolar and trimalleolar subgroup than in the unimalleolar subgroup. The lower volume of bimalleolar and trimalleolar ankle fractures treated by podiatrists could certainly be a contributing factor to the increased rates of malunion and nonunion observed with these higher complexity patterns.

Finally, significant differences exist in the training that orthopaedic surgeons and podiatrists receive, which could potentially affect outcomes following ankle fracture fixation. Orthopaedic surgeons are required to complete 4 years of medical school, 5 years of residency, and often another year of subspecialized fellowship training. In contrast, podiatry training was recently standardized in 2011 to 4 years of podiatry school followed by a 3-year residency. Over the course of residency, orthopaedic surgeons are afforded a longer surgical training time and extensive exposure to fracture care in all areas of the body. This increased exposure likely improves competency and may help to optimize patient outcome.[18,19] Furthermore, a previous study revealed shortcomings in general musculoskeletal knowledge among podiatric residents compared with orthopaedic residents,[20] which may be relevant to patient outcomes following ankle fracture surgery. The only other studies that have been published, which have directly compared surgical outcomes based on surgeon specialty, are from the spine literature. These studies used patients from the National Surgical Quality Improvement Program database and found no difference in postoperative complication rates following certain procedures between neurosurgeons and orthopaedic surgeons.[21-23] However, the intensity and length of training between neurosurgery and orthopaedic surgery are more comparable, which may minimize any observed differences in outcomes.

Limitations of the present study include those associated with the use of an administrative claims data set such as PearlDiver. Patients who relocated or changed insurance providers postoperatively would not be captured by this study. Similarly, the rate of complications such as infection, malunion, and nonunion is reliant on accurate coding and diagnosis by the treatment providers. We did not have objective radiographic measures to corroborate the diagnoses of malunion or nonunion. In addition, we did not have access to patient-reported outcomes to assess the clinical importance of the observed complication rates. Furthermore, we intentionally limited our analysis to short-term complications in an attempt to only capture complications that could be directly related to the treatment provider. As such, we were unable to assess long-term complications such as the development of posttraumatic ankle arthritis or subsequent conversion to ankle arthrodesis or arthroplasty. Finally, our study was designed only to identify the rates of complication and revision surgery based on provider type rather than the underlying cause for these differences. Further studies will need to be performed to address the reasons behind the observed difference in complication rates.

In conclusion, our study found that surgical treatment of ankle fractures by podiatrists was associated with higher rates of malunion and nonunion compared with treatment provided by orthopaedic surgeons. This observation is particularly relevant given that our study also identified an increasing involvement of podiatrists in the surgical management of ankle fractures. Although the specific reasons for the difference in malunion and nonunion rate is likely multifactorial, our findings have important implications in patients who must choose a surgeon to surgically manage their ankle fracture, as well as policymakers who determine the scope of practice.

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Cost Determinants in the 90-Day Management of Isolated Ankle Fractures at a Large Urban Academic Hospital

Matthew A. Varacallo, MD, Patrick Mattern, BS, Jonathan Acosta, BS, Nader Toossi, MD, Kevin M. Denehy, MD, and Susan P. Harding, MD

Objectives: To determine the independent risk factors associated with increasing costs and unplanned hospital readmissions in the 90-day episode of care (EOC) for isolated operative ankle fractures at our institution.

Design: Retrospective cohort study.

Setting: Level I Trauma Center.

Patients: Two hundred ninety-nine patients undergoing open reduction internal fixation for the treatment of an acute, isolated ankle fracture between 2010 and 2015.

Intervention: None.

Main Outcome Measures: Independent risk factors for increasing 90-day EOC costs and unplanned hospital readmission rates.

Results: Orthopaedic (64.9%) and podiatry (35.1%) patients were included. The mean index admission cost was \$14,048.65 ± \$5,797.48. Outpatient cases were significantly cheaper compared to inpatient cases (\$10,164.22 ± \$3,899.61 vs. \$15,942.55 ± \$5,630.85, respectively, $P < 0.001$). Unplanned readmission rates were 5.4% (16/299) and 6.7% (20/299) at 30 and 90 days, respectively, and were often (13/20, 65.0%) due to surgical site infections. Independent risk factors for unplanned hospital readmissions included treatment by the podiatry service ($P = 0.024$) and an American Society of Anesthesiologists score of ≥3 ($P = 0.017$). Risk factors for increasing total postdischarge costs included treatment by the podiatry service ($P = 0.011$) and male gender ($P = 0.046$).

Conclusions: Isolated operative ankle fractures are a prime target for EOC cost containment strategy protocols. Our institutional cost analysis study suggests that independent financial clinical risk factors in this treatment cohort includes podiatry as the treating surgical service and patients with an American Society of Anesthesiologists score ≥3, with the former also independently increasing total postdischarge costs in the 90-day EOC. Outpatient procedures were associated with about a one-third reduction in total costs compared to the inpatient subgroup.

Key Words: bundled payments, isolated extremity trauma, lower extremity trauma, ankle fractures

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From the Department of Orthopaedics, Drexel University College of Medicine, Philadelphia, PA.
The authors report no conflict of interest.
Reprints: Matthew Varacallo, MD, Department of Orthopaedics, Drexel University College of Medicine, University Orthopaedic Institute, 245 N. 15th St, MS 420, Philadelphia, PA 19102 (e-mail: orthopedicpapers@gmail.com).

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INTRODUCTION

Ankle fractures currently account for 10% of all fractures.[1] The overall incidence of these injuries has steadily been increasing since the 1970s, demonstrating a bimodal distribution with peaks in populations of younger males and older females.[2] By 2030, the overall ankle fracture incidence in all age groups is expected to triple.[3]

Cost analysis studies in orthopaedics are at the forefront of contemporary literature as we continue the transition into the alternative payment and bundled payment era.[4,5] Although current estimates report an \$11 billion economic burden of foot and ankle surgery, little attention has been given to the perioperative cost containment strategies for isolated ankle fractures.[6,7] The limited reports available are either not exclusive to closed, isolated operative injuries[8] or they lack inclusion of postoperative complications and unplanned hospital readmissions.[9] In addition, the most recent studies reporting adverse events and readmission rates after the surgical management of ankle fractures do not include the entire 90-day follow-up period,[6,10] thus underestimating the projected financial impact of these factors in a theoretical bundled payment model.[11] For example, in elective total joint arthroplasty (TJA), postdischarge costs have been tagged with a projected financial accountability range of 36%–55% of the total costs in a given 90-day episode of care (EOC) bundled payment program.[12]

Although the acute surgical management of isolated ankle fractures is an extremely common procedure in orthopaedics, the various risk factors that could significantly impact a simulated bundled payment period are far from delineated. The purpose of this study was 2-fold: first, we sought to determine the clinical variables associated with increasing total costs in a 90-day EOC for the management of isolated ankle fractures requiring surgery at our institution. Second, we calculated the unplanned hospital readmission rates and the associated independent risk factors at 30 and 90 days after discharge from our large urban academic hospital.

PATIENTS AND METHODS

Patient Cohort and Selection Criteria

Before conducting this study, we obtained approval from our Institutional Review Board. Patients undergoing open reduction internal fixation for the treatment of an acute, isolated ankle fracture between 2010 and 2015 were identified using our hospital's administrative database and diagnostic procedure codes. All patients included were treated by either the orthopaedic surgery service or the podiatry service. The referred surgical treatment team was determined by a combination of (1) adherence to an on-call referral schedule and (2) emergency department (ED) attending individual referral preference. Subsequent surgical intervention either occurred upon immediate admission to the hospital or from ED referral to the orthopaedic or podiatry clinics with ensuing surgical scheduling through the office.

Exclusion criteria included any concomitant surgical procedures, malunion and nonunion cases, other traumatic injuries to the ipsilateral or contralateral limbs (ie, polytrauma patients), patients with previous surgeries to the affected ankle, open fractures, and all nonoperatively treated cases.

Data Collection

Individual chart reviews were used to collect all relevant patient demographic and clinical variables. Body mass index (continuous variable), insurance type (government-based vs. private), hospital length of stay (continuous variable), American Society of Anesthesiologists physical status scores [ASA scores: "high" (3 or 4) vs. "low" (1 or 2)], tobacco use status, and diabetes mellitus as a comorbidity were all factored into the study. Individual charts were then reviewed for subsequent return(s) to the ED and/or unplanned hospital readmissions within 90 days after discharge. Reasons for readmission were determined by cross-checking the International Classification of Diseases, Ninth Revision diagnosis codes with individual chart reviews.

Chart reviews encompassed the 90-day postdischarge period including standard clinical follow-up visits in the office. Unimalleolar fractures (medial, lateral, or posterior malleolus), isolated syndesmotic injuries requiring surgery, and bimalleolar, bimalleolar equivalent, trimalleolar, and trimalleolar equivalent injuries were included. Injury patterns were identified from the attending surgeon's operative report dictations. To simplify comparison, injuries were divided into 3 separate groups as delineated in Table 1.

Cost Data

Cost data were obtained via our institution's financial department and represent actual payments from insurers to the hospital as calculated from cost-to-charge ratios. Hospital charges and the cost-to-charge ratios at our institution are not influenced by the treating surgical service (orthopaedics vs. podiatry). The EOC aggregate cost analysis included the direct total hospital costs (ie, actual hospital payments) associated with each individual encounter and any subsequent postdischarge costs (ie, actual hospital payments) associated with any returns to the ED and/or any unplanned hospital readmissions within 90 days of the index clinical encounter.

TABLE 1. Ankle Fracture Groups

Group Number	Fracture/Injury Patterns Included
1	Unimalleolar fracture (medial, lateral, or posterior) and isolated syndesmotic injuries
2	Bimalleolar and bimalleolar equivalent
3	Trimalleolar and trimalleolar equivalent

Statistical Analysis

Distribution parameters (mean values, SDs, frequencies, and proportions) were used to describe the study patient samples and cost data. Patient demographics by primary treatment service are compared in Table 2. Cohort characteristics, clinical outcome measures, and cost breakdown comparisons by treatment group are delineated in Tables 3 and 4, respectively.

Univariate analyses were conducted between all clinical variables and the outcomes of hospital readmission at 30 and 90 days and total postdischarge costs. For the final multivariate model, risk factors that demonstrated at least 10 total occurrences in the total sample population and statistically significant different distributions noted by univariate analyses between the readmission and nonreadmission populations at the $P < 0.20$ significance level were included (Table 5). The final multivariate logistic and log-linear regression models were used to evaluate independent risk factors associated with early hospital readmissions and total postdischarge costs, respectively. The adjusted estimates of the likelihood of readmission for each risk factor are demonstrated as odds ratio (OR) and 95% confidence interval (CI) calculations (Table 5). In the final model, we used a $P < 0.05$ as our significance level. Finally, Hosmer–Lemeshow and C-statistics were computed to assess the goodness-of-fit and predictive ability of the model. Data were analyzed using SPSS Statistical Software (IBM Corporation 2012, Somers, NY).

RESULTS

General Cohort Characteristics

In total, 299 cases met inclusion criteria. Ankle injury patterns were divided into 3 groups to facilitate the analysis (Table 1). The average patient age was 43 ± 14 years, and 57.9% (173/299) of patients were female. The majority of patients had government-based insurance at the time of injury (261/299, 87.3%). Patient demographics are listed in Table 2. Ankle injury groups were mostly unimalleolar fractures ("group 1"; 115/229; 39.5%) or bimalleolar-type fracture patterns ("group 2"; 111/229; 37.1%). Over two-thirds (201/229; 67.2%) of cases were performed in the inpatient setting, and the average length of stay was 2.7 ± 2.3 days (Table 3).

The podiatry cohort consisted of 4 surgeons in total, with 2 of the surgeons performing 81.0% (85/105) of the podiatric surgeries. There were 9 total treating orthopaedic surgeons, and the senior author (S.P.H.) treated 71.0% (137/194) of the cases. Collectively, of the 13 total treating surgeons, 8 of the surgeons performed less than 10 total cases each.

In total, follow-up clinical documentation was available for 295 patients (295/299 or 98.7%). These individual charts

TABLE 2. Cohort Characteristics and Demographics by Primary Treatment Service

	Total Cohort	Orthopaedics	Podiatry	P*
Case volume	299	194	105	
Age (y, continuous)	43.0 ± 14.6	42.6 ± 15.5	43.5 ± 12.9	0.053
Gender (n, %)				0.297
Male	126 (42.1)	86 (44.3)	40 (38.1)	
Female	173 (57.9)	108 (55.7)	65 (61.9)	
Race (n, %)				0.375
White	113 (37.8)	76 (39.2)	37 (35.2)	
Black	147 (49.2)	90 (46.4)	57 (54.3)	
Other	39 (13.0)	28 (14.4)	11 (10.5)	
Insurance type (n, %)				0.114
Government-based	261 (87.3)	165 (85.1)	96 (91.4)	
Private	38 (12.7)	29 (14.9)	9 (8.6)	
Diabetes (n, %)				
Yes	33 (11.0)	20 (10.3)	13 (12.4)	
No	266 (89.0)	174 (89.7)	92 (87.6)	
Tobacco use (n, %)				0.121
Yes	130 (43.5)	78 (40.2)	52 (49.5)	
No	169 (56.5)	116 (59.8)	53 (50.5)	
ASA category (n, %)				0.070
High (3 or 4)	65 (21.7)	36 (18.6)	29 (27.6)	
Low (1 or 2)	234 (78.3)	158 (81.4)	76 (72.4)	
BMI (kg/m^2)	30.6 ± 7.4	30.2 ± 7.2	31.3 ± 7.8	0.213

Values are represented as mean and SD for continuous variables (*) and counts (n) and percentages (%) for categorical variables.
**P*-values for associated variable comparison between orthopaedic and podiatry treatment services; statistical significance was set at the $P < 0.05$ significance level.
BMI, body mass index.

were also reviewed for documentation alluding to potential ED visits and/or hospital readmissions at other outside institutions. No reports suggested any additional occurrences that could definitively influence the outcomes data. The remaining 4 patients lacking postoperative office visit documentation consisted of 2 patients from each treatment cohort, and these patients also did not present to our hospital's ED. All 4 patients had unimalleolar ankle fractures. Furthermore, no in-hospital mortalities occurred during this period.

Cost Analysis

The mean index hospital admission cost total (inpatient and outpatient) was on average, $14,048.65 ± $5797.48

TABLE 3. Clinical Variables and Outcomes by Treatment Service

	Total Cohort	Orthopaedics	Podiatry	P†
Case volume	299	194	105	
Ankle injury groups (n, %)				**<0.001**
1	115 (39.5)	46 (23.7)	69 (65.7)	
2	111 (37.1)	93 (47.9)	26 (24.8)	
3	70 (23.4)	55 (28.4)	10 (9.5)	
Patient class (n, %)				**<0.001**
Inpatient	201 (67.2)	147 (75.8)	54 (51.4)	
Outpatient	98 (32.8)	47 (24.2)	51 (48.6)	
Length of stay (d)*	2.7 (2.3)	2.7 ± 2.3	2.6 ± 2.5	0.087
Returns to ED (n, %)	36 (12.0)	17 (8.8)	19 (18.1)	**<0.001**
Unplanned readmissions (n, %)				
30 d	16 (5.4)	2 (1.0)	14 (13.3)	**<0.001**
90 d	20 (6.7)	5 (2.6)	15 (14.3)	**<0.001**
Return to operating room (n, %)	9 (3.0)	2 (1.0)	7 (6.7)	**0.019**

*Values are represented as mean and SD for continuous variables (*) and counts (n) and percentages (%) for categorical variables.
†*P*-values for associated variable comparison between orthopaedic and podiatry treatment services; bold values indicate statistical significance at the $P < 0.05$ significance level.

TABLE 4. Ninety-Day Episode of Care Cost Breakdown by Treatment Service

Average Total Costs*	Total Cohort	Orthopaedics	Podiatry	P†
Index admissions	\$14,048.65 ± \$5,797.48	\$15,381.25 ± \$5,676.18	\$11,586.51 ± \$5,204.21	**<0.001**
Inpatient subgroup‡	\$15,942.55 ± \$5,630.85			**<0.001**‡
Outpatient subgroup‡	\$10,164.22 ± \$3,899.61			
Returns to the ED	\$6,373.59 ± \$5,170.55	\$4,933.76 ± \$4,729.62	\$7,813.41 ± \$5,318.12	**0.015**
Hospital readmissions	\$21,600.55 ± \$2,124.61	\$11,559.17 ± \$9,256.18	\$24,947.68 ± \$2,324.04	0.214
90-day postdischarge	\$9,478.25 ± \$1,716.86	\$3,175.08 ± \$638.96	\$14,380.72 ± \$2,108.03	**0.002**

*Values are represented as mean and SD for continuous variables.
†*P*-values for associated variable comparison between orthopaedic and podiatry treatment services; bold values indicate statistical significance at the $P < 0.05$ significance level.
‡Separate subgroup analysis and associated *P*-value represents statistical significance at the $P < 0.05$ significance level for cost comparison between inpatient and outpatient encounters.

(Table 4). Outpatient cases were significantly cheaper compared to inpatient cases (\$10,164.22 ± \$3899.61 vs. \$15,942.55 ± \$5630.85, respectively, $P < 0.001$).

When factoring in all postdischarge utilization encounters, the 90-day postdischarge costs averaged \$9478.25 ± \$17,168.56 and was significantly higher in patients treated by the podiatry service as opposed to those treated by the orthopaedic service (\$14,380.72 ± \$21,080.34 vs. \$3175.08 ± \$6389.64, respectively, $P = 0.002$) (Table 4). Furthermore, male gender was an independent risk factor for increasing total postdischarge costs in the final multivariate model (Table 5).

Hospital Readmissions

The unplanned readmission rates (URRs) were 5.4% (16/299) and 6.7% (20/299) at 30 and 90 days, respectively (Table 3). Independent risk factors for 30- and 90-day hospital readmission included treatment by the podiatry service (30-day: OR = 2.37, 95% CI = 0.72–4.01, $P = 0.005$; 90-day: OR = 1.70, 95% CI = 0.50–2.88, $P = 0.005$) and an ASA score ≥3 (30-day: OR = 1.38, 95% CI = 0.19–2.58, $P = 0.024$; 90-day: OR = 1.34, 95% CI = 0.242–2.44, $P = 0.017$) (Table 5). In addition, reasons for readmission were infection and/or wound-related complications in 65.0% (13/20) of the encounters. Other reasons for hospital readmission included exacerbation of preexisting medical conditions (5/20, 25.0%) and trauma admissions unrelated to the primary procedure (2/20, 10.0%).

Comparisons by Treatment Service

Overall, the orthopaedic surgery service managed 194 of the 299 cases (64.9%), including a larger relative proportion of bimalleolar- and trimalleolar-type injuries, whereas nearly two-thirds of patients treated by podiatry were unimalleolar injuries (Table 3, $P < 0.001$). Treatment by the podiatry service resulted in significantly more returns to the ED (Table 3, $P < 0.001$), higher readmission rates at 30 and 90 days (Table 5; $P = 0.005$), and more returns to the

TABLE 5. Adjusted Associations of Clinical Variables on Hospital Readmission and Total Postdischarge Cost Outcomes

	Readmission Within 30 Days		Readmission Within 90 Days		Total Postdischarge Costs	
	Adjusted OR (95% CI)	P*	90-Day Adjusted OR (95% CI)	P*	Adjusted Coefficient† (95% CI)	P*
Treatment service (podiatry)	2.37 (0.72–4.01)	**0.005**	1.70 (0.50–2.88)	**0.005**	1.72 (0.42–3.01)	**0.011**
Gender (male)	—	—	—	—	1.35 (0.03–2.68)	**0.046**
ASA category (high)	1.38 (0.19–2.58)	**0.024**	1.34 (0.242–2.44)	**0.017**	0.85 (−0.33 to 2.03)	0.152
BMI (kg/m²)‡	0.01 (−0.06–0.08)	0.853	—	—	—	—
Length of stay (d)‡	0.17 (−0.03 to 0.37)	0.094	0.12 (−0.03 to 0.26)	0.116	—	—
Injury code (ref: group 1)						
2	−0.54 (−2.03 to 0.95)	0.479	−0.67 (−1.95 to 0.62)	0.309	0.10 (−1.38 to 1.58)	0.894
3	−0.10 (−1.86 to 1.65)	0.914	0.15 (−1.23 to 1.53)	0.831	0.18 (−1.67 to 2.02)	0.846
Diabetes	—	—	−0.262 (−1.64 to 1.13)	0.709	—	—
Race (ref: white)						0.114
Black	—	—	—	—	−0.65 (−2.04 to 0.75)	0.356
Other	—	—	—	—	−1.45 (−3.44 to 0.54)	0.148

Inclusion of clinical variables was based on provisional statistical significance with a *P*-value set at <0.20. Variables excluded from the table and blank regions in the multivariate analyses represent unmet criteria.
**P*-values for the adjusted calculations in the multivariate models are presented with bold values indicating statistical significance at the $P < 0.05$ level.
†Adjusted log-linear regression coefficients for the total postdischarge costs (continuous variable), reflecting each variable's relative effect on a single unit change.
‡Odds ratios for continuous variables represent increases in likelihood per unit change with a C-statistic of 0.804.
BMI, body mass index.

operating room to manage complications related to the primary procedure (Table 3, $P = 0.019$).

DISCUSSION

There is a paucity of literature with respect to cost analysis in the 90-day management of isolated ankle fractures.[12] To our knowledge, this is the first cost analysis study including the 90-day perioperative management period for isolated ankle fractures. Furthermore, given the well-established presence of a podiatry service at our institution, we were also able to demonstrate a detailed comparison between orthopaedics and podiatry as the primary treatment service for these injuries. Based on the results of our study, the podiatry service was a significant risk factor for increased use of postdischarge health care resources and overall postdischarge total costs, as demonstrated by greater than 2-fold risk for 30-day hospital readmission. Furthermore, treatment by podiatry conferred a 1.7-fold risk for hospital readmission at 90 days.

Institution-Based Treatment Service Trends

Since 2004, our institution has had an established podiatry service that has been able to claim an increasing share of the pool of patients for direct primary consultation from our hospital's ED, reaching 58% (41/71) of annual foot and ankle consultations by 2011.[13] Furthermore, although the study sample size reported in our current article seems relatively low, the same study from Jakoi's group found a total of only 19 operative ankle fractures during the 2007–2011 period. Nonetheless, our results at least suggest that the more complex (groups 2 and 3) ankle fracture patterns were managed by the orthopaedic service, whereas podiatry managed two-thirds of the unimalleolar ankle fractures. This also may at least partially explain why nearly one-half of podiatry-managed cases were performed in the outpatient setting (Table 3).

Inpatient Versus Outpatient Surgical Status

Several studies in orthopaedics have already reported significant cost savings without compromising the value of care and patient outcomes when shifting plausible orthopaedic procedures from the inpatient to the outpatient treatment setting. Ferrari et al[14] recently performed a meta-analysis of inpatient versus outpatient anterior cruciate ligament reconstruction and found cost savings up to $7390. In elective TJA, significant cost savings have been recognized for both total hip arthroplasty[15] and total knee arthroplasty[16] procedures. Similarly, Bettin et al[17] reported 30% reduction in total costs in the 90-day period in a retrospective review of operatively managed ankle fractures. Although the aforementioned study did not limit its investigation to isolated, closed injuries, the authors concluded that outpatient cases overall were about 30% cheaper than inpatient cases.[17] Our cost data similarly yield an approximate 36.2% difference between treatment settings (Table 4).

Hospital Readmissions

The URRs at our hospital were 5.4% (16/299) and 6.7% (20/299) at 30 and 90 days, respectively. The URRs observed across our entire cohort are slightly higher than previous a recent study by Basques et al,[10] reporting a 3.2% 30-day readmission rate in over 2500 ankle fracture patients identified in 2011 and 2012 via the American College of Surgeons National Surgical Quality Improvement Program database.[10] However, as demonstrated in Table 3, URRs for the orthopaedic subgroup of patients reached just 1.0% and 2.6% (2/299 and 5/299) at 30 and 90 days, respectively.

Understanding the readmission profile has important implications for developing future cost containment strategies. Approximately, two-thirds of hospital readmissions were infection-related and/or wound-related complications, and all returns to the operating room (9/9) were infection based and involved the primary surgical site. Previous literature has already tagged surgical site infections and subsequent management to be one of the costliest readmission diagnoses.[18,19]

Implications for the Potential Bundled Payment Initiatives

The goal of bundled payment models is to encourage physicians, hospitals, and all health care providers to provide more efficient, cost-effective care over the entire 90-day EOC. Although bundled payments in orthopaedics largely affect elective TJA, some hospitals already experience the triggered bundles for 90-day management of hip fractures.[20] Furthermore, orthopaedic cost containment and cost analysis literature is increasingly including cost reduction methods in isolated extremity injuries, such as distal radius fractures.[21]

Regional and geographical variations in patient populations and treatment practices highlight the importance of the critical assessment of various large, nationwide database-driven studies reporting certain risk factors as generalizable conclusions for all institutions. Varacallo et al[22] previously advocated a similar "institution-based" approach to applying these potential clinical risk factors in elective TJA hospital readmissions. In effect, this has the potential to provide each hospital with its own customized, high-yield clinical risk factor profile that can ultimately facilitate quality improvement strategies in potential future bundled payment models in health care.

Limitations

There are several key limitations in our study. First, our study lacks true randomization by treatment service introducing a selection bias of patients by primary treatment service group. Although Table 2 suggests similar patient demographics and clinical characteristics by treatment service, the selection bias mitigates the overall strength of our cost comparative conclusions. In addition, our data suggest that the more complex injuries were managed by the orthopaedic service.

Second, our results are institution based and lack generalizability. Although this could be considered as a strength when viewed from the institution's perspective in creating a customized high-yield clinical risk factor profile for 90-day EOC management of isolated operative ankle fractures, the patient population treated at our inner-city hospital consists of a disproportionate number of government-based insurance patients. This is certainly influenced by the proximity of several well-respected institutions in not only the city itself but in the nearby suburban communities.

Third, the surrounding institutional competition provides several potential "follow-up" destinations for ED presentations and hospital readmissions. In effect, our results potentially fall victim to underreporting the total postdischarge cost aggregates in addition to artificially low reported hospital readmission rates and incidence of postoperative complications. However, the risk of underreporting is expected to be similar in reference to our comparison between primary treatment services. Finally, we did not include patient outcomes data, and this was solely a retrospective analysis.

CONCLUSIONS

Ankle fractures are common and can be associated with significant health care costs, especially in the setting of postoperative complications and early unplanned hospital readmissions. It is important for individual institutions to understand the relevant clinical variables attributing to the 90-day EOC in the overall management of common, isolated orthopaedic trauma. Based on our findings, patients with an ASA score ≥3 and patients treated by the podiatry service as opposed to the orthopaedic service were at an increased risk of hospital readmission at both 30 and 90 days postdischarge. Furthermore, both the latter and male patients were independently associated with increasing total postdischarge costs in the 90-day EOC. Finally, outpatient cases were associated with two-thirds the total index hospital costs compared to inpatient cases. Given these findings, we suggest careful consideration be given to the primary treatment service in managing operative ankle fractures, and when indicated, these cases should be performed in the outpatient setting.

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Effect of Surgeon Type on Outcomes After Ankle Surgery

Study evaluated whether outcomes for ankle surgery differed between orthopedists and podiatrists performing...

Ankle arthrodesis
n=4,980

Total ankle arthroplasty (TAA)
n=3,674

...by retrospectively reviewing data from a national claims database

Outcomes evaluated:

- **Opioid utilization**
- **Length of hospitalization**
- **Cost of hospitalization**

Proportion of procedures performed by each surgeon type:

Procedures performed by podiatrists were associated with:

- ↑ **Length of hospitalization**
- ↑ **Cost of hospitalization**

As demand for ankle surgeries grows, factors associated with resource utilization such as the type of surgeon may need to be carefully considered on the population level

Surgeon Type and Outcomes After Inpatient Ankle Arthrodesis and Total Ankle Arthroplasty: A Retrospective Cohort Study Using the Nationwide Premier Healthcare Claims Database

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Surgeon Type and Outcomes After Inpatient Ankle Arthrodesis and Total Ankle Arthroplasty

A Retrospective Cohort Study Using the Nationwide Premier Healthcare Claims Database

Jimmy J. Chan, MD, Jesse C. Chan, Jashvant Poeran, MD, PhD, Nicole Zubizarreta, MPH, Madhu Mazumdar, PhD, and Ettore Vulcano, MD

Investigation performed at the Icahn School of Medicine at Mount Sinai, New York, NY

Background: Two main treatments for end-stage ankle arthritis are ankle arthrodesis and total ankle arthroplasty (TAA). While both procedures can be performed either by a foot and ankle orthopaedic surgeon or a podiatrist (when within a particular state's scope of practice), studies comparing the surgical outcomes of the 2 surgeon types are lacking. Therefore, in this study, we compared outcomes by surgeon type for TAA and for ankle arthrodesis.

Methods: This retrospective cohort study utilized data from the nationwide Premier Healthcare claims database (2011 to 2016) regarding TAA (n = 3,674) and ankle arthrodesis (n = 4,980) procedures. Multivariable models estimated associations between surgeon type (podiatrist versus orthopaedic foot and ankle surgeon) and opioid utilization (in oral morphine equivalents [OMEs]), length of stay, and cost of hospitalization. We report percent change (compared with reference) and 95% confidence intervals (CIs).

Results: Overall, 76.5% (n = 2,812) and 18.8% (n = 690) of TAA procedures were performed by orthopaedic foot and ankle surgeons and podiatrists, respectively; surgeon type was unknown for 4.7% (n = 172). For ankle arthrodesis, 75.3% (n = 3,752) and 18.3% (n = 912) of the procedures were performed by orthopaedic foot and ankle surgeons and podiatrists, respectively; surgeon type was unknown for 6.3% (n = 316). The proportion of TAA and ankle arthrodesis procedures performed by podiatrists increased over time, from 12.8% and 13.6% in 2011 to 24.6% and 26.0% in 2016, respectively. When adjusting for relevant covariates, procedures performed by podiatrists (compared with orthopaedic foot and ankle surgeons) were associated with increased length of stay: for TAA, +16.7% (95% CI, 7.6% to 26.5%; median, 2 days in both groups) and for ankle arthrodesis, +14.2% (95% CI, 7.9% to 20.9%; median, 3 compared with 2 days) ($p < 0.05$ for both). In addition, ankle arthrodesis performed by podiatrists was associated with increased cost of hospitalization: +28.5% (95% CI, 22.1% to 35.2%; median, $19,236 compared with $13,433) ($p < 0.05$). Differences in opioid utilization were nonsignificant in the main analysis: +10.9% (95% CI, −3.1% to 26.8%; median, 345 compared with 250 OMEs) and +2.8% (95% CI, −5.9% to 12.4%; median, 351 compared with 315 OMEs) for TAA and ankle arthrodesis, respectively.

Conclusions: An increasing trend in the proportion of procedures performed by podiatrists was coupled with apparent increases in length of stay and cost compared with procedures performed by orthopaedic foot and ankle surgeons. Given the increasing demand for these procedures, factors associated with resource utilization, such as type of surgeon, may be increasingly important on the population level.

Level of Evidence: Therapeutic Level IV. See Instructions for Authors for a complete description of levels of evidence.

While the current gold-standard treatment for end-stage ankle arthritis is ankle arthrodesis[1-5], total ankle arthroplasty (TAA) has become an increasingly popular alternative[6,7], with a 7-fold increase in the utilization rate in the U.S. from 1998 to 2010 and a continuing upward trend (currently, almost double the rate of 2010)[8-10]. With an aging population, the demand for both types of procedures is expected to increase.

Disclosure: No external funding was received in support of this work. The **Disclosure of Potential Conflicts of Interest** forms are provided with the online version of the article (http://links.lww.com/JBJS/F50).

TABLE I Covariates and Outcomes by Type of Provider for TAA Unmatched and Propensity-Score-Matched Cohorts*

	Unmatched				Matched		
	Podiatrist, N = 690	Orthopaedic Foot/Ankle Surgeon, N = 2,812	Unknown, N = 172	STD	Podiatrist, N = 628	Orthopaedic Foot/Ankle Surgeon, N = 1,229	STD
Patient demographics							
Age† *(yr)*	61 (54-70)	65 (58-72)	62 (55-71)	0.216	63 (55-70)	64 (57-70)	0.090
Sex				0.141			0.028
Female	304 (44.1)	1,439 (51.2)	70 (40.7)		289 (46.0)	583 (47.4)	
Male	386 (55.9)	1,373 (48.8)	102 (59.3)		339 (54.0)	646 (52.6)	
Race/ethnicity				0.188			0.037
White	577 (83.6)	2,442 (86.8)	158 (91.9)		530 (84.4)	1,053 (85.7)	
Black	37 (5.4)	78 (2.8)	3 (1.7)		24 (3.8)	42 (3.4)	
Other	76 (11.0)	292 (10.4)	11 (6.4)		74 (11.8)	134 (10.9)	
Insurance type				0.202			0.098
Commercial	285 (41.3)	1,025 (36.5)	81 (47.1)		248 (39.5)	486 (39.5)	
Medicaid	41 (5.9)	81 (2.9)	7 (4.1)		35 (5.6)	45 (3.7)	
Medicare	328 (47.5)	1,545 (54.9)	77 (44.8)		312 (49.7)	635 (51.7)	
Uninsured	2 (0.3)	12 (0.4)	—		2 (0.3)	6 (0.5)	
Unknown	34 (4.9)	149 (5.3)	7 (4.1)		31 (4.9)	57 (4.6)	
Hospital-related							
Hospital location				0.229			0.015
Rural	56 (8.1)	131 (4.7)	2 (1.2)		53 (8.4)	109 (8.9)	
Urban	634 (91.9)	2,681 (95.3)	170 (98.8)		575 (91.6)	1,120 (91.1)	
Hospital size				0.639			0.095
<300 beds	376 (54.5)	1,219 (43.4)	97 (56.4)		346 (55.1)	733 (59.6)	
300-499 beds	286 (41.4)	530 (18.8)	60 (34.9)		254 (40.4)	441 (35.9)	
≥500 beds	28 (4.1)	1,063 (37.8)	15 (8.7)		28 (4.5)	55 (4.5)	
Hospital teaching status				0.544			0.053
Nonteaching	453 (65.7)	1,402 (49.9)	47 (27.3)		413 (65.8)	839 (68.3)	
Teaching	237 (34.3)	1,410 (50.1)	125 (72.7)		215 (34.2)	390 (31.7)	
Annual no. of TAA procedures per hospital†	17 (14-20)	18 (15-26)	16 (15-23)	0.454	17 (14-20)	16 (14-20)	0.076
Procedure-related							
Year of procedure				0.439			0.095
2011	52 (7.5)	306 (10.9)	47 (27.3)		48 (7.6)	109 (8.9)	
2012	80 (11.6)	473 (16.8)	13 (7.6)		78 (12.4)	178 (14.5)	
2013	112 (16.2)	430 (15.3)	27 (15.7)		98 (15.6)	193 (15.7)	
2014	122 (17.7)	512 (18.2)	20 (11.6)		110 (17.5)	226 (18.4)	
2015	148 (21.4)	587 (20.9)	30 (17.4)		142 (22.6)	262 (21.3)	
2016	176 (25.5)	504 (17.9)	35 (20.3)		152 (24.2)	261 (21.2)	
Peripheral nerve block used	58 (8.4)	319 (11.3)	20 (11.6)	0.072	56 (8.9)	111 (9.0)	0.004
Osteoarthritis	229 (33.2)	725 (25.8)	56 (32.6)	0.109	204 (32.5)	383 (31.2)	0.028
Comorbidity-related							
Charlson-Deyo Comorbidity Index category				0.057			0.056
0	442 (64.1)	1,798 (63.9)	105 (61.0)		408 (65.0)	817 (66.5)	
1	171 (24.8)	676 (24.0)	44 (25.6)		156 (24.8)	277 (22.5)	
2	48 (7.0)	211 (7.5)	15 (8.7)		42 (6.7)	89 (7.2)	
≥3	29 (4.2)	127 (4.5)	8 (4.7)		22 (3.5)	46 (3.7)	
Smoking	175 (25.4)	726 (25.8)	50 (29.1)	0.056	155 (24.7)	280 (22.8)	0.045
Obesity	142 (20.6)	392 (13.9)	26 (15.1)	0.118	122 (19.4)	215 (17.5)	0.050
Resource utilization							
Total opioid utilization† *(OME)*	345 (165-640)	250 (143-438)	246 (150-399)	0.175	339 (160-601)	252 (135-452)	0.177
Cost of hospitalization†	$21,472 ($16,339-$28,130)	$21,838 ($18,109-$27,746)	$25,565 ($19,323-$30,485)	0.176	$21,472 ($16,336-$27,782)	$21,427 ($16,947-$27,190)	0.019
Length of stay† *(days)*	2 (1-3)	2 (1-2)	2 (2-3)	0.204	2 (1-3)	2 (1-2)	0.228

continued

TABLE I (*continued*)

	Unmatched				Matched		
	Podiatrist, N = 690	Orthopaedic Foot/Ankle Surgeon, N = 2,812	Unknown, N = 172	STD	Podiatrist, N = 628	Orthopaedic Foot/Ankle Surgeon, N = 1,229	STD
30-day readmission	8 (1.2)	30 (1.1)	2 (1.2)	0.006	8 (1.3)	14 (1.1)	0.012
90-day readmission	16 (2.3)	59 (2.1)	5 (2.9)	0.035	14 (2.2)	28 (2.3)	0.003
Conversion to below-knee amputation	—	3 (0.1)	—	0.031	—	2 (0.2)	0.057

*The values are given as the number, with the percentage in parentheses, except where otherwise noted. STD = standardized difference, and OME = oral morphine equivalent. †The values are given as the median, with the interquartile range in parentheses.

Ankle arthrodesis and TAA can be performed by any qualified orthopaedic surgeon or, when within a particular state's scope of practice, by a podiatrist. Although both are professionals trained in taking care of foot and ankle problems, there are differences in education, training, and board-certification processes. While some studies of spinal surgery have assessed outcomes by provider type (neurosurgeons versus orthopaedic surgeons), there is currently a paucity of studies investigating the association between type of provider and costs and outcomes in foot and ankle surgery[11,12]. Any potential outcome differences may stem from differences in education and training, which have been suggested to influence decision-making (and subsequently outcomes) or surgeon experience[13,14].

The purpose of the current study was to compare outcomes and resource utilization in TAA and ankle arthrodesis performed by either orthopaedic foot and ankle surgeons or podiatrists. We hypothesized that orthopaedic foot and ankle surgeons, in light of longer and more encompassing training in orthopaedics and medicine, would have better outcomes and less resource utilization than podiatrists.

Material and Methods

Data Source, Study Design, and Study Sample

This retrospective cohort study utilized data from the Premier Healthcare Database (Premier Healthcare Solutions)[15], a national all-payer claims database. Hospitals included are concentrated in the South (approximately 40%), with equal distributions among the Northeast, West, and Midwest (approximately 20% each)[16]. Cases were selected using the International Classification of Diseases, Ninth Revision (ICD-9) procedure codes for TAA (81.56) and ankle arthrodesis (81.11) during the period of 2011 to 2016. Cases were excluded on the basis of unknown sex (n = 15), unknown discharge status (n = 57), nonelective procedure (n = 2,229), classification as an outpatient procedure (n = 3,407), and lack of reporting of surgeon type by the hospital (n = 28 hospitals, 62 cases). The database consists of de-identified data, and thus our study was deemed exempt from the Mount Sinai Hospital institutional review board requirements. We applied the criteria of the REporting of studies Conducted using Observational Routinely-collected health Data (RECORD) Statement and statistical reporting criteria of the Statistical Analyses and Methods in the Published Literature (SAMPL) guidelines[17,18].

Study Variables

An analysis plan was created a priori to define all study variables. The main effect was the type of surgeon performing the ankle surgery: either an orthopaedic foot and ankle surgeon or a podiatrist. This information is directly reported by hospitals participating in Premier data collection. While we cannot rule out misclassification, we assume this information (when provided) to be valid, and we did not conduct additional data linkage (i.e., to the American Medical Association Physician Masterfile). Cases with unknown surgeon type were classified as a separate category.

The outcomes of interest were total opioid utilization, cost of hospitalization, length of stay, 30-day readmission, 90-day readmission, and conversion to below-the-knee amputation (as previously defined[19]). Opioid utilization (during the entire hospitalization, including intraoperative use) was calculated from billing for opioids and was expressed in oral morphine equivalents (OMEs) using the Lexicomp[20] "opioid agonist conversion" and GlobalRPh "opioid analgesic converter"[21] calculators. The total cost of hospitalization was adjusted for inflation and expressed in 2016 U.S. dollars. Costs included direct or variable costs (e.g., direct costs for in-hospital services such as procedures, room and board, professional fees, and pharmacy, imaging, and laboratory costs) and overhead or fixed costs for in-hospital services. Hospitals participating in Premier data collection submit their actual cost data. A smaller number of hospitals submit charges, which are then converted into costs using Medicare cost-to-charge ratios[15]. Readmission was defined as any readmission (within the 30-day and 90-day periods post-discharge) to the hospital at which the primary surgical procedure took place.

Patient demographics included age, sex, and race/ethnicity (white, black, other). Insurance and hospital-related variables were insurance type (commercial, Medicaid, Medicare, uninsured, unknown), hospital location (rural, urban), hospital size (<300, 300 to 499, ≥500 beds), hospital teaching status (teaching, nonteaching), and annual number of ankle

TABLE II Covariates and Outcomes by Type of Provider for Ankle Arthrodesis Unmatched and Propensity-Score-Matched Cohorts*

	Unmatched				Matched		
	Podiatrist, N = 912	Orthopaedic Foot/Ankle Surgeon, N = 3,752	Unknown, N = 316	STD	Podiatrist, N = 820	Orthopaedic Foot/Ankle Surgeon, N = 1,845	STD
Patient demographics							
Age† *(yr)*	55 (46-64)	60 (50-68)	58 (49-66)	0.163	56 (46-65)	57 (47-66)	0.057
Sex				0.074			0.043
Female	478 (52.4)	1,774 (47.3)	148 (46.8)		428 (52.2)	923 (50.0)	
Male	434 (47.6)	1,978 (52.7)	168 (53.2)		392 (47.8)	922 (50.0)	
Race/ethnicity				0.100			0.052
White	674 (73.9)	2,987 (79.6)	243 (76.9)		612 (74.6)	1,418 (76.9)	
Black	102 (11.2)	300 (8.0)	27 (8.5)		88 (10.7)	179 (9.7)	
Other	136 (14.9)	465 (12.4)	46 (14.6)		120 (14.6)	248 (13.4)	
Insurance type				0.138			0.044
Commercial	340 (37.3)	1,297 (34.6)	108 (34.2)		303 (37.0)	678 (36.7)	
Medicaid	105 (11.5)	332 (8.8)	42 (13.3)		89 (10.9)	200 (10.8)	
Medicare	398 (43.6)	1,767 (47.1)	138 (43.7)		360 (43.9)	819 (44.4)	
Uninsured	19 (2.1)	55 (1.5)	8 (2.5)		19 (2.3)	32 (1.7)	
Unknown	50 (5.5)	301 (8.0)	20 (6.3)		49 (6.0)	116 (6.3)	
Hospital-related							
Hospital location				0.150			0.071
Rural	85 (9.3)	153 (4.1)	12 (3.8)		68 (8.3)	119 (6.5)	
Urban	827 (90.7)	3,599 (95.9)	304 (96.2)		752 (91.7)	1,726 (93.6)	
Hospital size				0.344			0.103
<300 beds	399 (43.8)	1,257 (33.5)	133 (42.1)		346 (42.2)	738 (40.0)	
300-499 beds	385 (42.2)	1,164 (31.0)	115 (36.4)		349 (42.6)	754 (40.9)	
≥500 beds	128 (14.0)	1,331 (35.5)	68 (21.5)		125 (15.2)	353 (19.1)	
Hospital teaching status				0.061			0.008
Nonteaching	446 (48.9)	1,663 (44.3)	141 (44.6)		404 (49.3)	902 (48.9)	
Teaching	466 (51.1)	2,089 (55.7)	175 (55.)4		416 (50.7)	943 (51.1)	
Annual no. of ankle arthrodesis procedures per hospital†	15 (13-16)	16 (14-20)	14 (12-15)	0.526	15 (13-17)	15 (13-18)	0.088
Procedure-related							
Year of procedure				0.575			0.035
2011	130 (14.3)	680 (18.1)	148 (46.8)		124 (15.1)	276 (15.0)	
2012	183 (20.1)	766 (20.4)	43 (13.6)		166 (20.2)	373 (20.2)	
2013	141 (15.5)	688 (18.3)	21 (6.6)		136 (16.6)	318 (17.2)	
2014	141 (15.5)	639 (17.0)	32 (10.1)		131 (16.0)	301 (16.3)	
2015	149 (16.3)	546 (14.6)	27 (8.5)		133 (16.2)	305 (16.5)	
2016	168 (18.4)	433 (11.5)	45 (14.2)		130 (15.9)	272 (14.7)	
Peripheral nerve block used	38 (4.2)	475 (12.7)	19 (6.0)	0.208	38 (4.6)	97 (5.3)	0.029
Osteoarthritis	168 (18.4)	842 (22.4)	63 (19.9)	0.067	161 (19.6)	385 (20.9)	0.031
Comorbidity-related							
Charlson-Deyo Comorbidity Index category				0.213			0.114
0	359 (39.4)	1,822 (48.6)	140 (44.3)		351 (42.8)	828 (44.9)	
1	186 (20.4)	909 (24.2)	63 (19.9)		180 (22.0)	430 (23.3)	
2	127 (13.9)	469 (12.5)	46 (14.6)		111 (13.5)	269 (14.6)	
≥3	240 (26.3)	552 (14.7)	67 (21.2)		178 (21.7)	318 (17.2)	
Smoking	320 (35.1)	1,119 (29.8)	111 (35.1)	0.076	279 (34.0)	594 (32.2)	0.039
Obesity	308 (33.8)	939 (25.0)	68 (21.5)	0.184	260 (31.7)	543 (29.4)	0.049
Resource utilization							
Total opioid utilization† *(OME)*	351 (165-692)	315 (173-580)	289 (156-551)	0.097	351 (165-692)	315 (165-591)	0.058
Cost of hospitalization†	$19,236 ($13,333-$29,079)	$13,433 ($9,463-$19,549)	$15,895 ($10,264-$22,980)	0.273	$18,898 ($13,091-$28,437)	$13,814 ($9,781-$19,827)	0.248
Length of stay† *(days)*	3 (2-4)	2 (1-3)	2 (1-3)	0.193	3 (2-4)	2 (1-3)	0.223

continued

TABLE II (*continued*)

	Unmatched				Matched		
	Podiatrist, N = 912	Orthopaedic Foot/Ankle Surgeon, N = 3,752	Unknown, N = 316	STD	Podiatrist, N = 820	Orthopaedic Foot/Ankle Surgeon, N = 1,845	STD
30-day readmission	16 (1.8)	43 (1.1)	6 (1.9)	0.041	15 (1.8)	18 (1.0)	0.073
90-day readmission	24 (2.6)	75 (2.0)	11 (3.5)	0.061	22 (2.7)	35 (1.9)	0.053
Conversion to below-knee amputation	3 (0.3)	6 (0.2)	3 (0.9)	0.073	2 (0.2)	2 (0.1)	0.032

*The values are given as the number, with the percentage in parentheses, except where otherwise noted. STD = standardized difference, and OME = oral morphine equivalent. †The values are given as the median, with the interquartile range in parentheses.

procedures per hospital. The year of the procedure, the use of a peripheral nerve block, and diagnosis of osteoarthritis were the procedure-related variables[22]. Comorbidity burden was assessed using the Charlson-Deyo Comorbidity Index as adapted by Quan et al.[23]. Additional comorbidity variables were smoking status and obesity (body mass index [BMI], ≥30 kg/m^2)[22].

Statistical Analysis

TAA and ankle arthrodesis procedures were analyzed separately. We first assessed univariable associations between type of surgeon and the aforementioned study variables; here, we applied standardized differences instead of p values, as group differences easily reach significance with large sample sizes. A standardized difference of 0.1 (or 10%) has been suggested to indicate a meaningful difference in covariate distribution between groups[24,25]. Mixed-effects models measured the association between the type of surgeon and the predefined outcomes and were adjusted for variables on the basis of clinical relevance and/or imbalance between groups; given the relatively large study sample size and decreased need for parsimony, in practice, this resulted in adjustment for all available variables. Two-sided significance was defined with an alpha set at 0.05. Because of the skewed nature of the continuous outcome variables (opioid utilization, length of stay, and cost of hospitalization), these outcomes were modeled using the gamma distribution with a log-link function using PROC GLIMMIX in SAS statistical software (version 9.4; SAS Institute)[26,27]. For these variables, instead of odds ratios (ORs), percent change compared with the reference is reported along with 95% confidence intervals (CIs).

Sensitivity Analyses

Three sensitivity analyses were performed whereby alternative modeling approaches were applied and missing data were addressed (see Appendix). These included a propensity-score analysis[25] with matching (cases performed by a podiatrist matched with up to 3 cases performed by an orthopaedic foot and ankle surgeon), an instrumental variable analysis[28], and multiple imputation[29], whereby missing data on surgeon type were addressed.

Results

TAA: Univariable Results

Overall, 76.5% (n = 2,812) and 18.8% (n = 690) of the total of 3,674 TAA cases were performed by orthopaedic foot and ankle surgeons and podiatrists, respectively; surgeon type was unknown for 4.7% (n = 172) (Table I, unmatched cohort). While most covariates differed between the surgeon groups

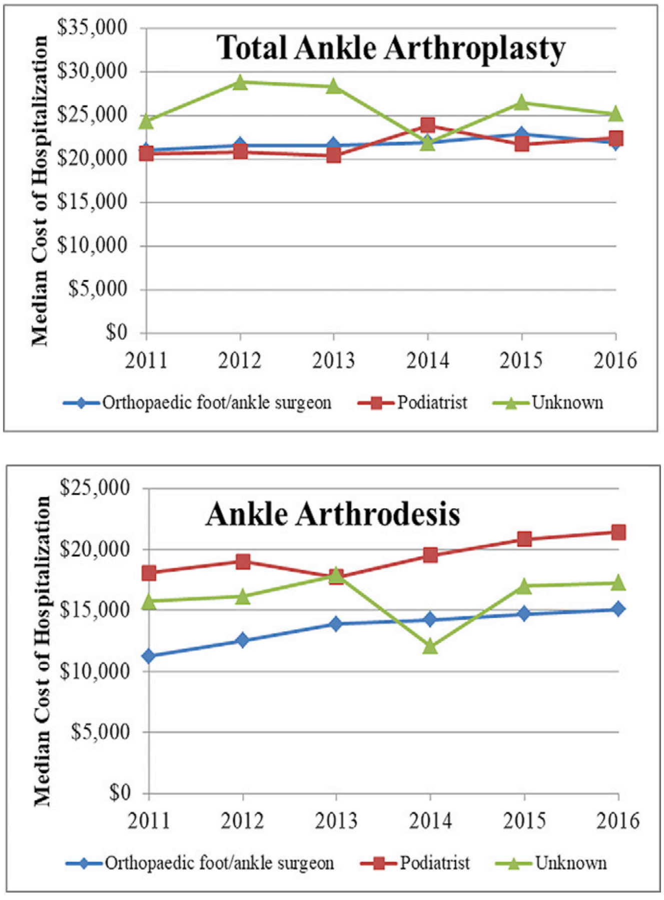

Fig. 1

Trend in median (unadjusted) cost of hospitalization by provider type for TAA (**upper panel**) and ankle arthrodesis (**lower panel**).

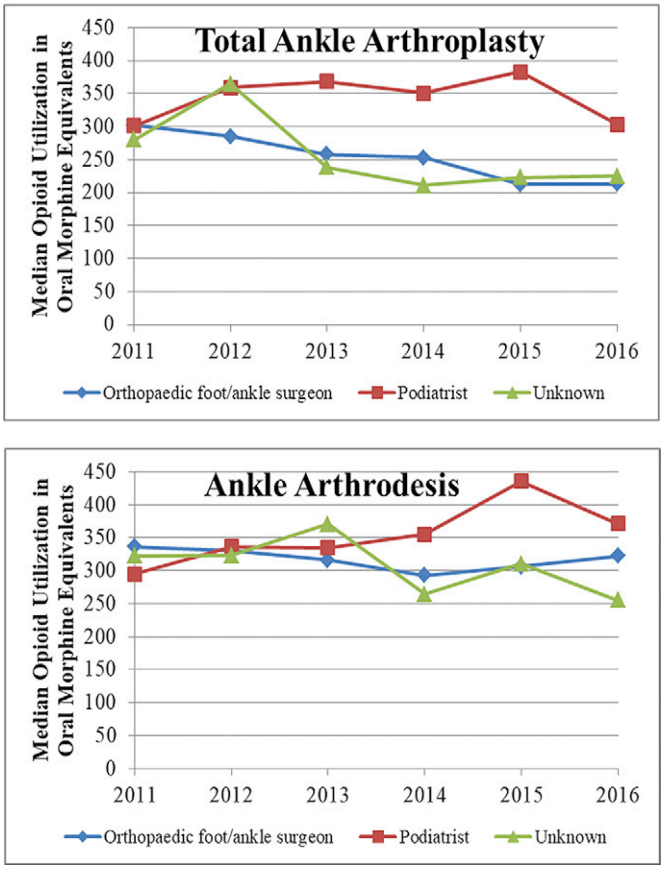

Fig. 2
Trend in median (unadjusted) opioid utilization by provider type for TAA (**upper panel**) and ankle arthrodesis (**lower panel**).

(podiatrist versus orthopaedic foot and ankle surgeon) (standardized difference of >0.1), the most pronounced differences were seen regarding hospital factors; differences in patient characteristics existed but were less pronounced. Interestingly, the proportion of ankle cases performed by podiatrists increased over the years: for TAA, from 12.8% to 24.6% of the total annual number of procedures, and for ankle arthrodesis, from 13.6% to 26.0%, in the period from 2011 to 2016 (row percentages, not column percentages, shown in Tables I and II). The most pronounced unadjusted difference between podiatrists and orthopaedic foot and ankle surgeons in outcomes was seen for opioid utilization: median of 345 compared with 250 OMEs, respectively (standardized difference of 0.175).

Ankle Arthrodesis: Univariable Results

Overall, 75.3% (n = 3,752) and 18.3% (n = 912) of the total of 4,980 ankle arthrodesis cases were performed by orthopaedic foot and ankle surgeons and podiatrists, respectively; surgeon type was unknown in 6.3% (n = 316) (Table II, unmatched cohort). Overall, patterns similar to those for TAA were seen; however, more pronounced group differences in patient characteristics were observed. Patients operated on by podiatrists were younger, had lower utilization of peripheral nerve blocks, and were, on average, sicker, with a higher percentage of patients in the Charlson-Deyo Comorbidity Index group of ≥3 (26.3% versus 14.7% for podiatrists versus orthopaedic foot and ankle surgeons, respectively; standardized difference of 0.213). While differences in opioid utilization were relatively small between the groups, in general, patients operated on by podiatrists had greater cost of hospitalization, length of stay, and readmission rates compared with orthopaedic foot and ankle surgeons.

Trends

Trends in the cost of hospitalization were mainly seen for arthrodesis procedures, with a more pronounced increasing trend in the cost of hospitalization for procedures performed by podiatrists (Fig. 1). There was a decreasing trend in opioid

TABLE III Results from Multivariable Models

	Percent Change (95% CI)			
	Main Analysis (Mixed-Effects Modeling)	Propensity-Score-Matched Analysis	Instrumental Variable Analysis	Main Analysis with Multiple Imputation
TAA*				
Total opioid utilization	10.9% (−3.1%, 26.8%)	20.3% (10.8%, 30.7%)†	3.9% (−11.6%, 22.2%)	10.1% (−3.9%, 26.1%)
Cost of hospitalization	2.4% (−4.3%, 9.6%)	0.6% (−3.5%, 4.9%)	−3.4% (−11.5%, 5.5%)	1.0% (−6.2%, 8.7%)
Length of stay	16.7% (7.6%, 26.5%)†	15.4% (9.7%, 21.3%)†	11.8% (1.5%, 23.1%)†	14.1% (5.6%, 23.3%)†
Ankle arthrodesis*				
Total opioid utilization	2.8% (−5.9%, 12.4%)	12.1% (3.2%, 21.8%)†	2.4% (−9.2%, 15.4%)	1.8% (−7.2%, 11.6%)
Cost of hospitalization	28.5% (22.1%, 35.2%)†	30.3% (24.1%, 36.7%)†	16.2% (8.0%, 25.0%)†	26.1% (19.5%, 33.1%)†
Length of stay	14.2% (7.9%, 20.9%)†	21.0% (15.2%, 27.2%)†	21.5% (13.3%, 30.3%)†	13.6% (7.3%, 20.3%)†

*Effect estimates (exponentiated coefficients) from the log model depicting percent change (for podiatrist) compared with reference (orthopaedic foot and ankle surgeon). Models adjusted for age, sex, race/ethnicity, insurance type, hospital location, hospital size (number of beds), hospital teaching status, hospital annual volume of ankle arthroplasty and ankle arthrodesis, year of procedure, peripheral nerve block use, diagnosis of osteoarthritis, Charlson-Deyo Comorbidity Index, smoking, and obesity. Analysis was conducted using PROC GLIMMIX in SAS (version 9.4). †P < 0.05.

utilization for procedures (particularly TAA) performed by orthopaedic foot and ankle surgeons, while no clear (or a reversed) pattern emerged when evaluating procedures performed by podiatrists (Fig. 2).

Multivariable Results

After adjustment for relevant covariates in the mixed-effects models, we observed that procedures performed by podiatrists (compared with orthopaedic foot and ankle surgeons) were associated with increased length of stay: for TAA, +16.7% (95% CI, 7.6% to 26.5%), and for ankle arthrodesis, +14.2% (95% CI, 7.9% to 20.9%) ($p < 0.05$ for both) (Table III). In addition, ankle arthrodesis performed by podiatrists was significantly associated with increased cost of hospitalization: +28.5% (95% CI, 22.1% to 35.2%). We were not able to model 30 and 90-day readmission and conversion to below-the-knee amputation, given their low prevalence.

Sensitivity Analyses

The "Matched" columns of Table I and II show balance in covariate distribution between the propensity-score-matched cohorts (standardized differences generally of ≤0.1). The results of all sensitivity analyses presented in Table III further corroborate the results from the main analysis: surgeon type was associated with length of stay for TAA, with significant effects for length of stay and cost of hospitalization in ankle arthrodesis cases. Additionally, the propensity-score analysis demonstrated significant associations between surgeon type and opioid utilization; however, this was not consistent across analyses.

Discussion

To our knowledge, this was the first national study to compare outcomes by surgeon type in TAA and ankle arthrodesis. We found substantial differences in patient demographics and hospital-related factors between patients undergoing procedures performed by orthopaedic foot and ankle surgeons and podiatrists. Particularly in ankle arthrodesis, podiatrists appeared to treat patients who were sicker, on average, and treated a greater rate of obese patients. In terms of hospital factors, podiatrists appeared to work more often in smaller and non-teaching hospitals. Our data also illustrated slightly increasing trends in overall costs for both procedures; these were most pronounced for ankle arthrodesis performed by podiatrists. Conversely, decreasing trends in opioid utilization were observed, particularly in TAA by orthopaedic foot and ankle surgeons. Most importantly, both TAA and ankle arthrodesis performed by podiatrists were associated with an increased adjusted length of stay (+16.7% and +14.2%, respectively), while ankle arthrodesis performed by podiatrists was associated with an increased adjusted cost of hospitalization (+28.5%). Several sensitivity analyses demonstrated robustness of these results. With a median length of stay of 2 days for all procedures, increased length-of-stay percentages may not signify important differences for individual patients. However, given the growing demand for TAA and ankle arthrodesis, this may translate to an important difference on the population level.

Both podiatrists and orthopaedic foot and ankle surgeons undergo training pertaining to foot and ankle conditions. However, there are differences in training focus. Orthopaedic foot and ankle surgeons undergo general medicine and surgical training in medical school and then progress to a 5-year orthopaedic surgery residency with a focus on all musculoskeletal problems. Most orthopaedic surgeons then complete a 1-year dedicated fellowship in a specialized field, such as foot and ankle surgery. Orthopaedic surgery residency is regarded as one of the most competitive residencies in the U.S., with residents' USMLE (United States Medical Licensing Examination) Step 1 and Step 2 scores among the highest of all specialties[30]. In comparison, podiatrists complete 4 years in a college of podiatric medicine followed by 0 to 3 years of residency (as of 2013, podiatry residencies are mandated to be 3 years). This may be followed by a fellowship[31,32].

We found differences in patient comorbidity burden between surgeon types, particularly in ankle arthrodesis, suggesting that, in general, podiatrists operate on sicker patients, i.e., those with higher Charlson-Deyo comorbidity scores, and a higher rate of obese patients (these differences were adjusted for in the multivariable analyses). This rather unexpected result does not follow the few previous studies that have addressed theoretical differences between orthopaedic foot and ankle surgeons and podiatrists[33,34]. While conducted in the U.K., 1 qualitative study assessing interprofessional relationships and views demonstrated that podiatrists' outcomes were viewed more negatively by orthopaedic foot and ankle surgeons than vice versa. Moreover, differences in professional opinions existed regarding the type of procedure suitable to be performed by podiatrists[34]. Interestingly, however, there appears to be no study directly comparing outcomes between surgeon type after TAA or ankle fusion. The dichotomy between surgeon types in foot and ankle surgery may be likened to spine surgery, in that both orthopaedic surgeons and neurosurgeons may perform the same procedures. However, a recent study looking into anterior cervical discectomy and fusion operations did not find any outcome difference between surgeon types[12]. Compared with the context of the current study, however, neurosurgeons (as opposed to podiatrists) are medical school graduates who go through a (minimum) 5-year residency and are board-certified by the American Board of Medical Specialties.

Recent government legislative efforts in health care have been focusing on containing health-care costs while optimizing outcomes[35,36]. As TAA is also included in the recently incorporated "Comprehensive Care for Joint Replacement" (CJR) bundled-payment model by the U.S. Centers for Medicare & Medicaid Services[37], it is crucial to identify the main drivers of the costs per episode for these procedures. Indeed, our study proposes an additional factor for consideration as a driver of outcomes: type of surgeon. Interestingly, however, while we did find differences in length of stay according to the type of surgeon performing the procedures, this did not always translate into similar differences in other outcomes, which may also have indirect effects on episode costs (e.g., opioid utilization and readmission rates).

Our study also showed that podiatrists more often perform procedures in smaller and nonteaching hospitals, suggesting that hospital factors may play a role in differences observed. Indeed, characteristics of treating facilities may be partly behind differences in patient and financial outcomes. While there is a gap in recent studies assessing specifically the effect of hospital volume on length of stay in foot and ankle surgery, several studies of other orthopaedic cohorts have demonstrated such an association[38,39].

Our study had limitations. First, several confounding variables, such as operative time and preoperative opioid utilization, were not available. Moreover, while we adjusted for the year of the procedure, we were not able to fully account for temporal practice differences regarding, for example, the number and type of implants available, providers becoming more facile with these procedure(s), and the management of these patients in the acute postoperative setting. Another important missing variable was the state in which each hospital is located; some states may prohibit podiatrists from performing these procedures. This would only have affected our results if regional patterns in the proportion of cases performed by podiatrists coincided with regional patterns in outcomes; this did not appear to be the case (see Appendix). A second limitation was that our findings are contingent on the quality and accuracy of the data collector and coder, which may vary by hospital. Indeed, approximately 6% of cases did not have information on surgeon type; however, our sensitivity analyses resulted in outcomes comparable to those of our main analysis. Third, by using a database that only draws from inpatient data, we were not able to keep track of all post-discharge events; we were only able to track those readmitted to the hospital at which the primary surgical procedure took place. In addition, our study did not allow the assessment of postoperative radiographic and functional outcomes. From a surgical perspective, having well-positioned implants with appropriate alignment is arguably the most important piece of information when considering the quality of the operation. The rate of union, ankle range of motion, and patients' self-reported scores on validated outcome measures would be among functional outcomes that are of substantial interest to both providers and patients. Last and most importantly, it must be recognized that database studies can only report on associations, and not causation. Our results call for validation in future studies using alternative data sources while further exploring drivers behind differential outcomes by surgeon type in foot and ankle surgery.

In summary, in this large nationwide study on the effect of surgeon type on outcomes of TAA and ankle arthrodesis, we demonstrated differences in patient and hospital characteristics between surgeon types. Furthermore, patients undergoing TAA and ankle arthrodesis treated by podiatrists had a longer length of stay, with a cost difference specifically noted for arthrodesis. Hospitalization costs increased over time, particularly for ankle arthrodesis performed by podiatrists, suggesting an increasing cost burden on the population level. Podiatry and orthopaedic surgery are complementary specialties, and increased exposure to orthopaedics during podiatric training may help address the discrepancies in terms of costs and length of stay found in this study. Our study proposes an additional factor for consideration as a driver of outcomes: the type of surgeon. Further research is needed to validate these results and explore potential underlying causes of these surgeon-type differences.

Appendix

eA Additional details of the sensitivity analyses performed and a table showing the mean cost, length of stay, and percentage of procedures performed by podiatrists by geographic region is available with the online version of this article as a data supplement at jbjs.org (http://links.lww.com/JBJS/F51). ■

Jimmy J. Chan, MD[1]
Jesse C. Chan[1]
Jashvant Poeran, MD, PhD[1]
Nicole Zubizarreta, MPH[1]
Madhu Mazumdar, PhD[1]
Ettore Vulcano, MD[1]

[1]Leni and Peter W. May Department of Orthopaedic Surgery (J.J.C., J.C.C., J.P., N.Z., M.M., and E.V); Institute for Healthcare Delivery Science, Department of Population Health Science and Policy (J.P., N.Z., and M.M.); and Department of Medicine (J.P.), Icahn School of Medicine at Mount Sinai, New York, NY

E-mail address for J.J. Chan: Jimmy.chan@mountsinai.org

ORCID iD for J.J. Chan: 0000-0003-2154-4480
ORCID iD for J.C. Chan: 0000-0003-2077-3636
ORCID iD for J. Poeran: 0000-0001-7058-5102
ORCID iD for N. Zubizarreta: 0000-0003-3823-7348
ORCID iD for M. Mazumdar: 0000-0003-1725-1706
ORCID iD for E. Vulcano: 0000-0002-0780-2159

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Increased Complication Rate Associated with Podiatric Surgery

Caroline P. Hoch; Daniel J. Scott, MD, MBA; Daniel L. Brinton; Lizmarie Maldonado; Christopher E. Gross, MD

Category: Other; Ankle; Bunion; Diabetes; Hindfoot; Midfoot/Forefoot

Keywords: Complications; Diabetes; Plantar Fasciitis

Introduction/Purpose: Nationally, there has been an increase in the scope of practice between orthopaedic surgeons and podiatrists. However, there is a paucity of studies in the literature comparing outcomes between orthopaedic and podiatric surgeons in different areas of foot and ankle surgery.

Methods: A retrospective analysis was conducted using 2016-2017 5% US national sample of the Medicare limited dataset (LDS). This included a total of 527 patients undergoing one of 14 CPT foot and ankle specific codes. Basic demographics, medical comorbidities, and 1-year post-surgical complications were reviewed. One-hundred and eighteen patients were operated on by a podiatrist versus 409 who were operated on by a physician. Mean age was 69. Common procedures included gastrocnemius recession (n=168), ankle fracture open reduction internal fixation (168), and Achilles tendon repair (72). Continuous variables were compared using Wilcoxon-Mann Whitney test and categorical variables with chi-squared test. In addition, a multivariable regression was performed, evaluating the impact of various factors on odds of complication.

Results: Between cohorts, there were no statistically significant differences in demographics, Charlson Score, COPD, hypothyroidism, hypertension, or obesity. There was a higher rate of peripheral vascular disease in patients treated by a podiatrist versus a physician (8.5% vs. 2.4%; P=.0025). Univariate analysis showed complication rates were higher among podiatrist compared to physicians (29.7% vs. 18.8%; P=.0113). Specifically, there were high rates of complications for bunion correction (4.2% vs. 1.0%; P=.0160), diabetic wound infection (11.0% vs. 1.5%; P<0.0001), and plantar fascia release (7.6% vs. 0.1%; P=.0001). Multivariable logistic regression showed patients operated on by a podiatrist had 84.1% greater odds of suffering a complication than those operated on by a physician (OR: 1.84, 95% CI: 1.15-2.96).

Conclusion: Surgical treatment of multiple types of foot and ankle conditions by orthopaedic surgeons was associated with lower complication rates when compared with podiatrists. The reasons for these differences are likely multifactorial, but warrants further investigation. Our findings have important implications for policymakers, as well as for large healthcare systems and patients when selecting a treating provider for surgical problems.

Table 1. Demographics and characteristics

Characteristic		DPM	MD	p-value	Comments
n		118	409		
Age		69.1 ± 2.9	69.3 ± 3.1		
		68.5 [67.0 - 71.0]	69.0 [67.0 - 72.0]	0.5927	Wilcoxon-Mann Whitney test
Age category				0.6467	Chi-Squared test
	65-67	43 (36.4)	147 (35.9)		
	68-71	48 (40.7)	152 (37.2)		
	72-75	27 (22.9)	110 (26.9)		
Female		75 (63.6)	281 (68.7)	0.293	Chi-Squared test
Race				0.9696	Chi-Squared test
	Non-White	14 (11.9)	48 (11.7)		
	White	104 (88.1)	361 (88.3)		
Dual-enrolled		10 (8.5)	37 (9.0)	0.8477	Chi-Squared test
Comorbidities					
Charlson Score				0.9863	Chi-Squared test
	0	109 (92.4)	378 (92.4)		
	1+	9 (7.6)	31 (7.6)		
Elixhauser: COPD		12 (10.2)	36 (8.8)	0.6492	Chi-Squared test
Elixhauser: Hypothyroidism		14 (11.9)	27 (6.6)	0.0601	Chi-Squared test
Elixhauser: Obesity		9 (7.6)	24 (5.9)	0.4872	Chi-Squared test
Elixhauser: PVD		10 (8.5)	10 (2.4)	0.0025	Chi-Squared test
Hypertension		36 (30.5)	158 (38.6)	0.107	Chi-Squared test
Surgeries					
CPT code (primary procedure)				<0.0001	Chi-Squared test
27650		28 (23.7)	44 (10.8)		
27659		2 (1.7)	4 (1.0)		
27685		9 (7.6)	16 (3.9)		
27687		8 (6.8)	29 (7.1)		
27792		16 (13.6)	104 (25.4)		
27814		5 (4.2)	163 (39.9)		
27870		2 (1.7)	5 (1.2)		
28003		14 (11.9)	1 (0.2)		
28299		1 (0.8)	—		
28300		1 (0.8)	7 (1.7)		
28715		—	3 (0.7)		
28725		2 (1.7)	6 (1.5)		
28750		24 (20.3)	21 (5.1)		
29891		3 (2.5)	3 (0.7)		
29898		3 (2.5)	3 (0.7)		
Outcomes					
Any complication		35 (29.7)	77 (18.8)	0.0113	Chi-Squared test
Ankle instability		2 (1.7)	3 (0.7)	0.3426	Chi-Squared test
Ankle osteoarthritis		11 (9.3)	38 (9.3)	0.9918	Chi-Squared test
Ankle sprain		3 (2.5)	12 (2.9)	0.8217	Chi-Squared test
Ankle/pilon fracture		2 (1.7)	33 (8.1)	0.0143	Chi-Squared test
Bunion		5 (4.2)	4 (1.0)	0.0161	Chi-Squared test
Diabetic wound infection		13 (11.0)	6 (1.5)	<0.0001	Chi-Squared test
Plantar fasciitis		9 (7.6)	1 (0.2)	<0.0001	Chi-Squared test

All values expressed as n(%), mean ±s.d., or median[Q1 - Q3]

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Cost of Operative Fixation of Ankle Fractures: Comparing Orthopaedics and Podiatry

Joshua C. Luginbuhl, MD; Alexa R. Deemer; Eric C. Gokcen, MD

Category: Trauma; Other

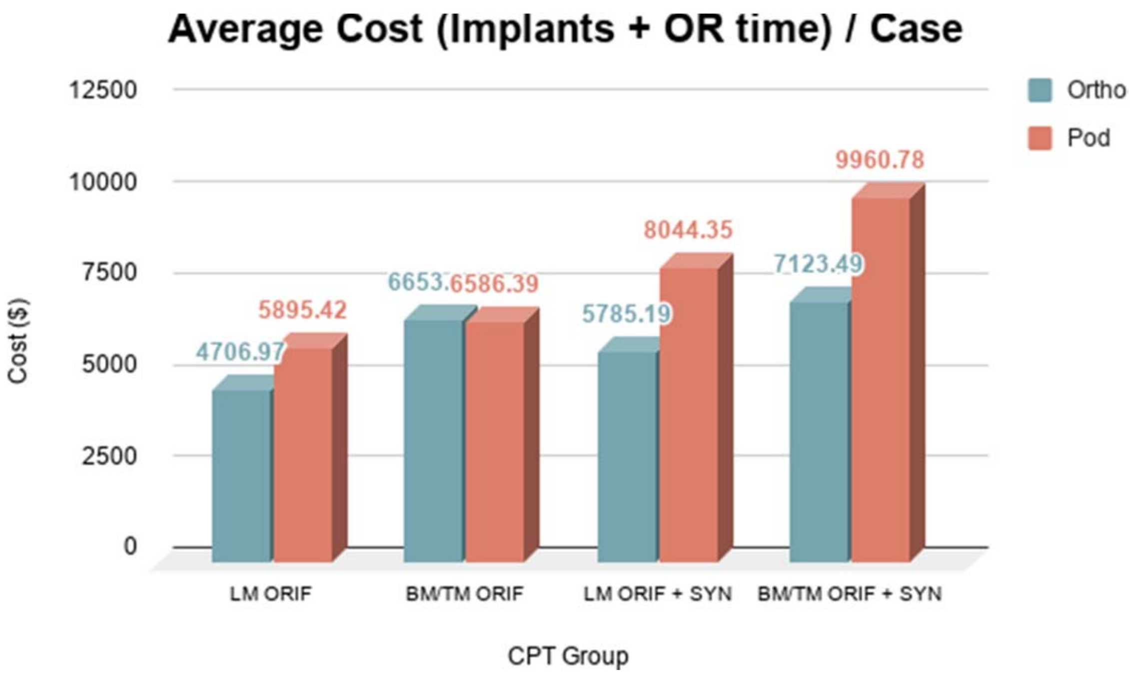
Keywords: Ankle Fracture; Cost; ORIF

Introduction/Purpose: Ankle fractures pose a unique situation as both podiatrists and orthopaedic surgeons are licensed to treat them. Despite increasing emphasis on value-based medical care, there are few cost analyses focused on the treatment of ankle fractures. The goal of this study is to determine if there are cost differences between an orthopaedic surgeon and podiatrist to operatively manage an ankle fracture.

Methods: Retrospective cohort study of patients who underwent ankle fracture fixation over a 22 month period at an academic level 1 trauma center. Patient data was subcategorized by surgeon type and treatment groups. Four treatment groups were included: lateral malleolus open reduction and internal fixation (ORIF), bimalleolar/trimalleolar ORIF (no posterior malleolus fixation), lateral malleolus ORIF with syndesmotic fixation, bimalleolar/trimalleolar ORIF (no posterior malleolus fixation) with syndesmotic fixation. Primary outcome was total (OR time cost + Implant cost) cost per case.

Results: A total of 134 cases met criteria. Eighty-five cases were treated by a total of 4 orthopaedic surgeons while 49 were treated by 8 podiatrists. There was significantly longer OR time (minutes) for lateral malleolus ORIF (111 vs 134.92), lateral malleolus ORIF with syndesmotic fixation (130.53 vs 156.7), and bimalleolar/trimalleolar ORIF (no posterior malleolus fixation) with syndesmotic fixation (162.13 vs 208) when podiatry was the treating team. Average total cost per case was significantly more for lateral malleolus ORIF (+$1188.45), lateral malleolus ORIF with syndesmotic fixation (+$2259.16), and bimalleolar/trimalleolar ORIF with syndesmotic fixation (+$2837.29) when podiatry was the treating team.

Conclusion: Lateral malleolus ORIF, lateral malleolus ORIF with syndesmotic fixation, and bimalleolar/trimalleolar ORIF with syndesmotic fixation costs less per case when performed by an orthopaedic surgeon based on OR time costs and implant costs.



Foot & Ankle Orthopaedics, 7(1)
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ORIGINAL CONTRIBUTION

"I Broke My Ankle": Access to Orthopedic Follow-up Care by Insurance Status

Laura N. Medford-Davis, MD, MS, Fred Lin, MD, Alexandra Greenstein, and Karin V. Rhodes, MD, MS

ABSTRACT

Objectives: While the Affordable Care Act seeks to reduce emergency department (ED) visits for outpatient-treatable conditions, it remains unclear whether Medicaid patients or the uninsured have adequate access to follow-up care. The goal of this study was to determine the availability of follow-up orthopedic care by insurance status.

Methods: Using simulated patient methodology, all 102 eligible general orthopedic practices in Dallas-Fort Worth, Texas, were contacted twice by a caller requesting follow-up for an ankle fracture diagnosed in a local ED using a standardized script that differed by insurance status. Practices were randomly assigned to paired private and uninsured or Medicaid and uninsured scenarios.

Results: We completed 204 calls: 59 private, 43 Medicaid, and 102 uninsured. Appointment success rate was 83.1% for privately insured (95% confidence interval [CI] = 73.2% to 92.9%), 81.4% for uninsured (95% CI = 73.7% to 89.1%), and 14.0% for Medicaid callers (95% CI = 3.2% to 24.7%). Controlling for paired calls to the same practice, an uninsured caller had 5.7 times higher odds (95% CI = 2.74 to 11.71) of receiving an appointment than a Medicaid caller ($p < 0.001$), but the same odds as a privately insured caller (odds ratio = 1.0, 95% CI = 0.19 to 5.37, $p = 1.0$). Uninsured patients had to bring a median of $350 (interquartile range = $250 to $400) to their appointment to be seen, and only two uninsured patients were able to obtain an appointment for $100 or less up front. In comparison, typical total payments collected for privately insured patients were $236 and for Medicaid patients $128. When asked where else they could go, 49 (48%) uninsured callers and one Medicaid caller (2%) were directed to local public hospital EDs as alternative sources of care. Of the practices that appeared on Medicaid's published list of orthopedic providers accepting new patients, 15 told callers that they did not accept Medicaid, 11 did not treat ankles, nine listed nonworking phone numbers, and only three actually scheduled an appointment for the Medicaid caller.

Conclusions: Less than one in seven Medicaid patients could obtain orthopedic follow-up after an ED visit for a fracture, and prices quoted to the uninsured were 30% higher than typical negotiated rates paid by the privately insured. High up-front costs for uninsured patients and low appointment availability for Medicaid patients may leave these patients with no other option than the ED for necessary care.

The Emergency Medical Treatment and Labor Act (EMTALA) is a federal law that guarantees emergency care to anyone presenting to an emergency department (ED) in the United States that accepts federal funding.[1] For a fracture, the standard for emergency care includes reduction and splinting of the fracture. After an ED visit for a fracture, orthopedic follow-up care is important to convert splints to casts, determine the need for surgery, and ensure optimal healing to prevent nonunion or other complications.[2,3]

However, access to nonemergent care in the outpatient setting is limited by financial and insurance

From the Department of Emergency Medicine, Perelman School of Medicine, University of Pennsylvania (LNMD, FL), Philadelphia, Pennsylvania; the University of Pennsylvania (AG), Philadelphia, Pennsylvania; and the Office of Population Health Management, Northwell Health Solutions & Emergency Medicine Service Line, Hofstra Northwell School of Medicine (KVR), Hempstead, New York.
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Supervising Editor: Lowell W. Gerson, PhD.
Address for correspondence and reprints: Laura Medford-Davis, MD, MS; e-mail: medford.davis@gmail.com.
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barriers.[4,5] In 2012, only 58% of Medicaid patients, compared to 85% of privately insured, were able to schedule a new-patient primary care appointment.[6] A study in in North Carolina found that only 59% of Medicaid patients are able to schedule an appointment with an orthopedist.[7] Only 19% of Medicaid patients could schedule an orthopedic office evaluation for an ankle replacement across eight states.[8]

Less is known about access to orthopedic care for the uninsured, and Texas has the highest uninsured rate in the nation.[9–11] A public ED in Texas reported that 20% of their orthopedic patient population is seeking follow-up care after visiting another ED, suggesting possible barriers to orthopedic care access in this area.[12] For the uninsured seeking primary care, the mean price for an appointment is $160, with only 15% of patients able to obtain an appointment for less than $75, and only 18% of primary care practices offering delayed payment plans.[6,13] The price of orthopedic follow-up care for the uninsured is not known.

Goals

The goal of this study was to compare appointment price and availability of ED follow-up orthopedic care for patients with different insurances, focusing on Dallas-Fort Worth as an area with large disparities in socioeconomic and insurance status.

METHODS

Study Design

Trained research assistants posing as new patients who had been diagnosed with an ankle fracture in a local ED and instructed to see an orthopedic surgeon for follow-up care made paired calls to the same orthopedic practices to attempt to schedule an emergency follow-up visit. Two calls, separated by 3–4 weeks, were placed to each practice by the same caller with the use of a standardized script that differed by insurance status. Uninsured callers also asked about price of the visit. Calls were made in February and March 2016. The local institutional review board approved this study including the use of deception with a waiver of consent. The identity of individual physicians and practices is confidential and will not be disclosed.

Population

A comprehensive list of potentially eligible orthopedic practices in the Dallas-Fort Worth metro area of Texas was compiled from an online public database that extracts physician data from at least two of the following data sets then cross-checks and matches them for accuracy with multiple updates per year: state medical boards, state licensing boards, national provider identification (NPI) numbers, the Centers for Medicare and Medicaid Services, and a private healthcare provider information company.[14] Because several orthopedists may practice at the same clinic, and some may practice at multiple clinics, we sampled unique clinic practice sites rather than unique providers. This search identified 397 practice sites with a unique (unduplicated) address and phone number combination. Orthopedic clinics specializing in spine, oncology, hand or shoulder, hip, and pediatrics that would be out-of-scope for ankle fractures were excluded, leaving 210 practices. Unclear practices were resolved using an Internet search. All included practices with the exception of two were affiliated with a local hospital, although their call rotation at that hospital was unknown. In practices with multiple physicians, callers asked for an appointment with the first-listed physician.

Protocol

The independent variable was the caller's reported insurance type. Callers reported having private insurance, regular Medicaid, or no insurance. Blue Cross Blue Shield was selected as the private insurer because they have the largest market share in the area.[15] Prior to the call period, each caller made two pilot calls with each of the three insurance types to orthopedic practices in a different geographic area to refine the sampling methodology and final call script. Two callers then divided the practice list for calls and the same caller called the same practice twice with a 3- to 4-week gap between calls. The Excel random number generator was used to randomly assign practices to receive an uninsured and a Medicaid call, or an uninsured and a privately insured call, and then again to randomly assign the order of the two calls within each practice.

To avoid geographic, racial, or age discrimination, the callers used generic American names selected from a list of the most common baby names in the late 1980s, a birthdate placing them in their late 20s, Caucasian race if asked, and an address at a moderately priced apartment complex in the vicinity of each practice. If asked which ED they had attended, callers reported an ED in the vicinity of the practice or the hospital reported to be affiliated with the practice.

They requested the next available appointment time. The callers did not volunteer their insurance type but provided it when they were asked or when they confirmed the appointment. All appointments were canceled before the call ended or immediately thereafter. Caller scripts are provided in Data Supplement S1 (available as supporting information in the online version of this paper).

Outcomes

The primary outcomes of interest were appointment availability and appointment price for the uninsured. An appointment was defined as available if the scheduler offered the caller a specific date and time. A secondary outcome was the wait time between the call and the next available appointment for practices that provided an appointment to both callers. Callers who could not obtain an appointment asked where else they could go for care.

Uninsured callers also asked for the total price of the appointment, the amount of money they needed to bring to the appointment in order to be seen, and the availability of any discounts or payment plans. To compare prices charged to the uninsured with prices paid by patients with private insurance, we examined average prices for the Dallas-Fort Worth metro statistical area from a publicly available large multipayer commercial claims database.[16] The data include the amount paid by the insurer plus any copayments or other payments made by the patient.[17] We also compared to Medicaid physician reimbursement rates publicly reported by the Texas Medicaid program based on new office visit CPT codes 99203–99205 for orthopedic surgeons.[18]

Analysis

For all calls, we calculated the relative risk that patients with Medicaid or who were uninsured would receive an appointment compared with privately insured patients. Paired McNemar's tests using the orthopedic practice as the unit of analysis assessed whether practices provided equal appointment availability to Medicaid and uninsured or private and uninsured patients. Descriptive statistics on the rate of appointment availability are also presented.

For uninsured calls, we calculated the mean, standard deviation (SD), range, median and interquartile range (IQR) of the price for the appointment and the amount of money uninsured patients needed to bring to the appointment in order to be seen. Descriptive statistics on the availability of discount payment plans and alternative sources of follow-up care are also presented.

For practices that scheduled appointments for both insurance types, we calculated the difference between median appointment wait times (in number of days) using Wilcoxon matched-pairs signed-rank test. All tests were two-sided, and p values < 0.05 were considered to indicate statistical significance. All statistical analyses were performed with Stata software (version 13.1).

RESULTS

During the calls, an additional 28 of the 210 initially identified practices reported to both callers that ankle fractures were out of the physician's scope of practice. Sixty-eight practices were excluded due to nonworking phone numbers, and six more were excluded because the calls revealed they were duplicates of other practices that had already been called, leaving 102 orthopedic practices included to whom 204 paired calls were successfully completed (Figure 1). All 102 received an uninsured call; 43 (42.2%) received a Medicaid call and 59 (57.8%) received a privately insured call. Appointment success rate was 83.1% for privately insured (95% confidence interval [CI] = 73.2% to 92.9%), 81.4% for uninsured (95% CI 73.7%-89.1%), and 14.0% for Medicaid callers (95% CI = 3.2% to 24.7%; Figure 2). For all calls, the relative risk of being refused an appointment was no different for uninsured and private patients, but was 5.08 (95% CI = 2.85 to 9.04, $p < 0.001$) for Medicaid patients compared to privately insured. Controlling for paired calls to the same practice, an uninsured caller had 5.7 times higher odds (95% CI = 2.74 to 11.71) of receiving an appointment than a Medicaid caller ($p < 0.001$), but the same odds as a privately insured caller (odds ratio = 1.0, 95% CI = 0.19 to 5.37, $p = 1.0$).

Reasons stated for refusing appointments included that a review of the ED records or x-rays and/or receipt of a formal referral was required ($n = 14$), providers were not accepting new patients or had a full schedule ($n = 9$), or more detailed insurance information was required ($n = 3$). One clinic told the uninsured caller that the physician did not treat ankle fractures and another told the uninsured caller that the practice was not accepting new patients, yet both scheduled the privately insured patient with the

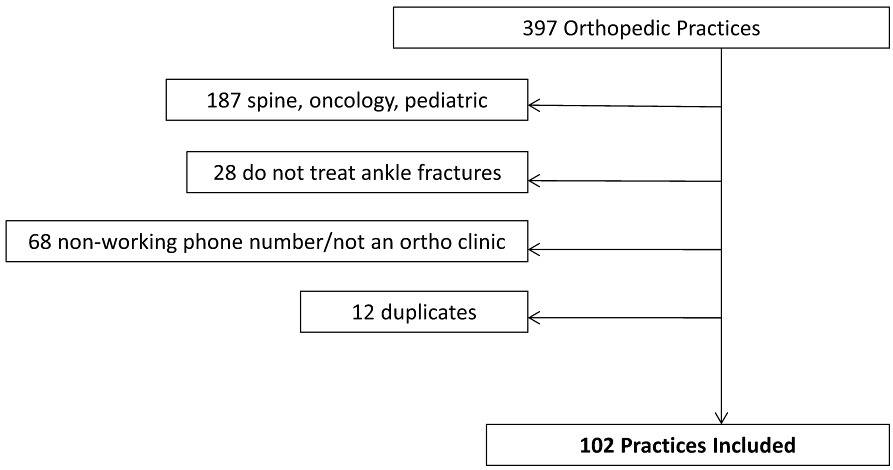

Figure 1. Provider inclusion algorithm.

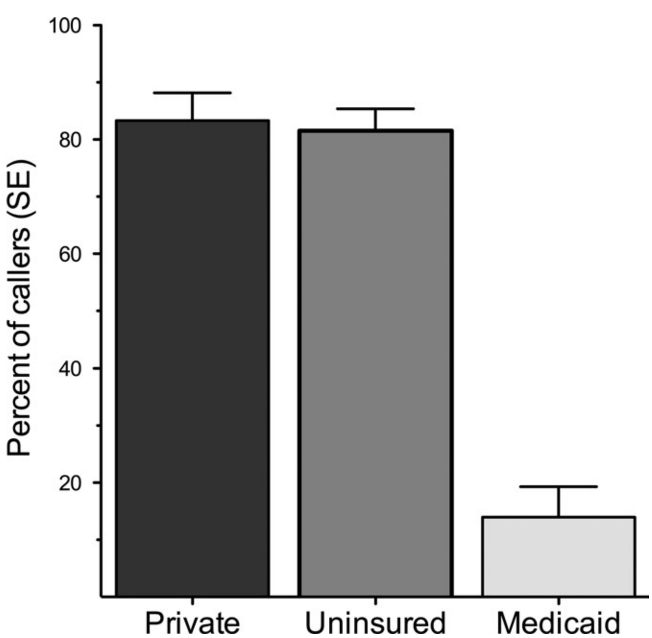

Figure 2. Percent of callers receiving an orthopedic follow-up appointment by insurance. SE = standard error.

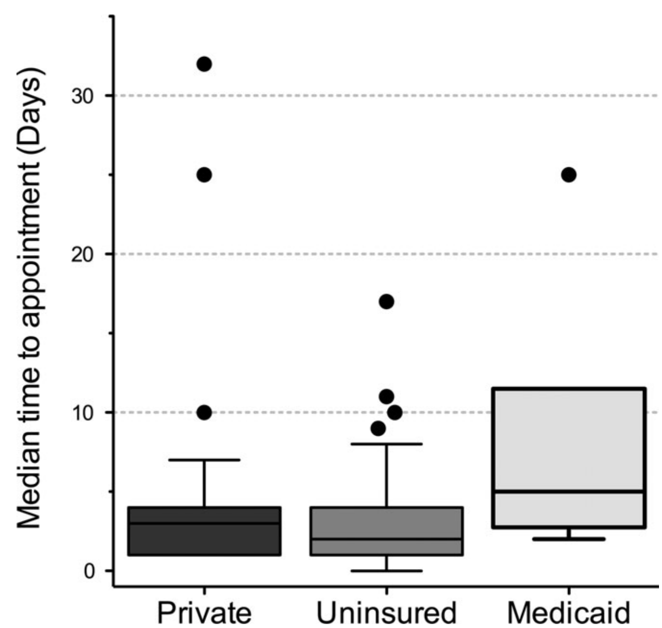

Figure 3. Box and whisker plot of median days to appointment by insurance, *n = 6; box shows IQR with median as line, whiskers show maximum and minimum values, and dots show outliers.

physician and both asked for the caller's insurance before stating the reason an appointment could not be made. Medicaid patients were much more likely to be told their insurance was not accepted by the practice (Medicaid n = 29/43, 78%; vs. uninsured n = 5/19, 26%; and private n = 2/10, 20%).

The median wait time for an appointment for those who received an appointment was 3 days for privately insured (IQR = 1–4 days), 2 days for uninsured (IQR = 1–4 days), and 5 days for Medicaid (IQR = 3 to 7; Figure 3). For practices that scheduled appointments for both callers (45 practices for private/uninsured pairs, six practices for Medicaid/uninsured pairs), there was no significant difference in median wait times between private and uninsured callers (median difference = 0 days, IQR = 1 to 2 days, p = 0.97) or between Medicaid and uninsured callers (median difference = 2 days, IQR = 2 to 6 days, p = 0.08).

All practices that scheduled appointments for uninsured patients asked them to bring an up-front payment to their appointment. Three practices stated that patients would need to bring a payment, but that they could not estimate the amount of the payment until after the appointment, so price data are not available for these practices. One practice offered free follow-up if the physician was on call at the hospital when the patient made the ED visit. The mean (±SD) amount that uninsured patients were asked to bring to the appointment was \$353.74 (±\$174.91; range = \$85 to \$1,375, median = \$350, IQR = \$250 to \$400). Only two patients were able to obtain an appointment for \$100 or less up front. Only 15 (of 61; 24.6%) of practices offered discounts ranging from \$20 to 60%, typically for cash payments, and only five (of 64; 7.8%) offered payment plans. The practice stating that the self-pay price was 60% discounted quoted the up-front cost postdiscount to be \$300. Six (of 82; 7.3%) practices estimated a total price higher than the up-front payment patients were asked to bring to the appointment, but 15 (of 82; 18.3%) asked for an up-front deposit larger than the estimated total price and were told that any unused portion of the payment would be returned after the visit.

In comparison, typical payments received by an orthopedic specialist for a privately insured patient making an office visit in the Dallas-Fort Worth area are \$236, and typical payments for a three-view ankle x-ray are \$36 in the area.[16] This represents all payments received by the orthopedic provider, including copays, deductibles, and insurance payments. Medicaid orthopedic provider reimbursement rates in Texas are \$55.52 to \$101.00 for the office visit and \$26.73 for a three-view ankle x-ray.[18]

When asked where else they could go, 49 (48%) uninsured callers were directed to local public hospital systems and the rest were offered no alternative destination. However, there appeared to be some confusion on the part of orthopedic practices as to whether the public hospital would provide follow up orthopedic care for a Medicaid patient, as only one Medicaid caller was directed to the public hospital system. Most Medicaid callers were offered no specific alternative and instead were told to call the number on the back of their Medicaid card. When we referenced the practices we called against Medicaid's published list of orthopedic providers accepting new patients,[19] 15 said they did not accept Medicaid, 11 did not treat ankles, nine listed nonworking phone numbers, and only three actually scheduled an appointment for the Medicaid caller.

DISCUSSION

Ankle fractures require casting and approximately 40% require surgery, making orthopedic follow-up critical for these injuries.[20] However, we found that less than one in seven Medicaid patients in the Dallas-Fort Worth area could obtain a follow-up orthopedic appointment. While uninsured patients were no less likely to receive an orthopedic follow-up appointment than privately insured patients, payments required at the time of the visit were higher than typical payments from privately insured and would likely be prohibitive for most uninsured patients. All practices in the Dallas-Fort Worth area required uninsured patients to bring their payment up front, and it was rare for practices to allow patients to pay less than the total price up front.

Uninsured rates have declined since implementation of the main provisions of the Affordable Care Act in 2014, but over 10% of nonelderly adults remain uninsured nationwide, and nearly half of the remaining uninsured say that cost is a barrier to obtaining insurance.[9] Inability to obtain follow-up care for less than \$100, which only one practice offered, may limit follow-up of uninsured patients with serious orthopedic injuries, as 54% of the uninsured earn < 200% of the federal poverty level (\$23,760 for an individual), and 85% earn < 400% of the federal poverty level (\$47,520). One-third of the uninsured report delayed healthcare and one-quarter have foregone needed care entirely due to concerns about costs.[21] In the case of an ankle fracture or other orthopedic injury, delaying or forgoing care could lead to nonunion and long-term disability.[3]

The mean \$354 price charged to uninsured patients found in our study is 30% higher than the total amount that an orthopedist would receive if providing the same care to a privately insured patient (\$272). Other studies have found that the uninsured pay higher prices for care.[22,23] However, the higher price quoted in our study might reflect a practice's concern about costs that are either not covered by negotiated rates or not identified by our research team. For example, the cost for a cast may vary by type and was not available in private market data. Importantly, our study also did not include the costs for the 40% of ankle fractures that require surgery. Costs for ankle surgery and follow-up rehabilitation can range from \$11,000 to \$20,000 and unpaid medical debt is the chief reason for bankruptcy in the United States.[24,25]

Interviews with specialist physicians reveal that economic pressures and direct pressures from their affiliated hospitals motivate their refusal to treat underinsured patients, and the prices charged to these patients up front may represent an attempt to make up the equivalent revenue from care provided to a privately insured patient.[26] Nevertheless, the private market costs are shared by both the patient and the insurer and many insurance payments are significantly delayed from the time of service due to claims processing periods, whereas the uninsured patient must bring the entire cost up front in order to receive care.

Our study found much lower access to orthopedic care for Medicaid patients than previously documented for primary care[6] and lower than documented for orthopedic care in North Carolina[7] or an eight-state sample of ankle-specific orthopedic care that included Texas.[8] This could be due to low Medicaid reimbursement rates in the area which are less than one-third of private rates, as research shows that increasing Medicaid reimbursement increases availability of appointments for Medicaid patients.[27] Texas is choosing not to expand Medicaid under the Affordable Care Act, and our study suggests that expansion of Medicaid may not help patients gain access to outpatient orthopedic care in the state, at least not at current Medicaid physician rates.

High up-front costs for uninsured patients and low appointment availability for Medicaid patients may leave these patients with few options for necessary care. Our study found that the only specific alternative option offered to patients was a county-based public hospital. This may explain why one such public hospital in Houston, Texas, reported that 20% of its orthopedic patients had been seen initially at other hospitals' EDs.[12] Interestingly in that study 89% of the patients were uninsured, and Medicaid patients were not differentially affected despite the low availability of follow-up for Medicaid patients found in the current study. This could be because practice staff perceive the public hospital as a site of care for the uninsured, but not for Medicaid patients, which may reflect common community perception.

Prior research on access to orthopedic care for Medicaid patients also found that urban practices and ones closer to academic hospitals were less likely than rural practices to give appointments to Medicaid patients.[7] This may indicate that the presence of safety net providers such as the county-based public hospitals in Dallas-Fort Worth is viewed by local specialty physicians as relieving them of the burden of caring for the uninsured or underinsured. The EMTALA requires EDs to screen for emergency conditions and stabilize patients but does not obligate an on-call physician to see a patient in follow-up after initial stabilization. Therefore, the difficulty these patients have in accessing follow-up orthopedic care is not an EMTALA violation and is not addressed by any current laws.

Finally, these findings may also be relevant for patients with high-deductible plans in the private insurance market. High-deductible plans have been increasing in prevalence over the past several years and now make up 34% of the employer-sponsored market and 53% of the Affordable Care Act Marketplace plans.[28] Due to the rise in unpaid deductibles, which may account for the entire cost of care, many providers are starting to ask patients with high-deductible plans to pay in full up front for their care as well.[29]

LIMITATIONS

While we attempted to generate a comprehensive list of all possible orthopedic practices through the use of publically available data sources, it is possible that some practices were missed that may have been more or less willing to see Medicaid or uninsured patients. Some clinics have multiple orthopedic physicians working in the same clinic who may have separate appointment availability or protocols for handling patients with different types of insurance. Indeed, two schedulers volunteered another physician in the same practice who would accept Medicaid. To standardize our approach, all calls were coded for whether or not the assigned physician (first-listed in practices with multiple providers) would schedule the appointment. However, it is possible that this decision resulted in an underestimate of the number of orthopedic practices that were willing to see a Medicaid patient.

This study was conducted in a single city of a single state. Although the Affordable Care Act has significantly decreased uninsured rates across the United States, the number of uninsured remains high in Texas because the state has chosen not to expand Medicaid, excluding most impoverished people from coverage, and the state has a high number of undocumented immigrants who are not eligible for coverage under the Affordable Care Act.[9,10] In Texas, the majority of indigent and uncompensated care is delivered through county-based services, and most major cities including Dallas-Fort Worth have public hospitals that fulfill this role.[11] Dallas-Fort Worth is the largest metropolitan area in Texas with over six million residents.[10] As such our results cannot be generalized to other states or other areas in Texas that do not have safety net hospitals. However, healthcare costs in Texas are generally near or slightly below national averages.[17] Dallas in particular has the highest costs of any metropolitan area in Texas for knee replacements, which may indicate that its costs for orthopedic care are higher than average.[17] Texas also has the highest uninsured rate in the nation, which may exacerbate access difficulties and health disparities in this state.[9]

CONCLUSIONS

High up-front costs for uninsured patients and low appointment availability for Medicaid patients may leave these patients with few options for necessary care. Uninsured patients were able to obtain follow-up orthopedic care after an ED visit at the same rates as privately insured patients, but were asked to pay an average of $354 up front prior to care, a cost that may be prohibitive for uninsured patients who are predominantly low income. Only 14% of Medicaid patients could obtain follow-up orthopedic care at all. County hospitals were the only alternative destination for care offered to patients and may serve as Medicaid and uninsured patients' only source of care in areas where they exist. Further research should document access to other types of specialty care for uninsured and Medicaid patients in other areas of the country and compare areas where public safety net hospitals do or do not exist.

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Supporting Information

The following supporting information is available in the online version of this paper:

Data Supplement S1. Secret shopper script.

Arkansas Code § 17-96-101 (2020) - Definitions :: 2020 Arkansas Code :: US Codes and Statutes :: US Law :: Justia

2020 Arkansas Code
Title 17 - Professions, Occupations, and Businesses
Subtitle 3 - Medical Professions
Chapter 96 - Podiatric Medicine
Subchapter 1 - General Provisions
§ 17-96-101. Definitions

Universal Citation: AR Code § 17-96-101 (2020)

As used in this chapter:

1. (1) “Podiatric medicine” means the diagnosis and medical, mechanical, and surgical treatment of ailments of the human foot and ankle; and
2. (2) “Podiatrist” means a physician legally licensed to practice podiatric medicine. However, no podiatrist shall amputate the human foot or perform nerve or vascular grafting or administer any anesthetic other than a local anesthetic. All ankle surgery performed above the level of the foot other than skin and skin structures shall be performed in a facility accredited by either Medicare or by The Joint Commission.

https://statutes.capitol.texas.gov/Docs/OC/htm/OC.202.htm

OCCUPATIONS CODE

TITLE 3. HEALTH PROFESSIONS

SUBTITLE C. OTHER PROFESSIONS PERFORMING MEDICAL PROCEDURES

CHAPTER 202. PODIATRISTS

SUBCHAPTER A. GENERAL PROVISIONS

Sec. 202.001. DEFINITIONS. (a) In this chapter:

(1) "Advisory board" means the Podiatric Medical Examiners Advisory Board.

(1-a) "Commission" means the Texas Commission of Licensing and Regulation.

(1-b) "Department" means the Texas Department of Licensing and Regulation.

(2) "Executive director" means the executive director of the Texas Department of Licensing and Regulation.

(3) "Podiatrist" means a person who:

(A) is licensed under this chapter to practice podiatry and who directly or indirectly charges money or other compensation for podiatric services; or

(B) publicly professes or claims to be a podiatrist, foot specialist, or doctor or uses any title, degree, letter, syllable, or word that would lead the public to believe that the person is a practitioner authorized to practice or assume the duties incident to the practice of podiatry.

(4) "Podiatry" means the treatment of or offer to treat any disease, disorder, physical injury, deformity, or ailment of the human foot by any system or method. The term includes podiatric medicine.

(b) In the laws of this state:

(1) "chiropody" means podiatry; and

(2) "chiropodist" means podiatrist.

NRS: CHAPTER 635 - PODIATRIC PHYSICIANS AND PODIATRY HYGIENISTS (state.nv.us)

NRS 635.085 Authorized and unauthorized activities of licensed podiatric physician.

1. Except as otherwise provided in subsection 2, a podiatric physician licensed by the Board may:

(a) Administer electricity to the foot or leg by means including electrodes, machinery and rays.

(b) Use his or her hands and machinery to work upon the foot or leg and its articulations.

(c) Apply any mechanical appliance to the foot or leg or in the shoe to treat any disease, deformity or ailment.

(d) Apply pads, adhesives, felt, plasters and any medicine to the foot and leg.

(e) Prescribe and dispense controlled substances and dangerous drugs.

(f) Construct models of the feet.

(g) Administer a local anesthetic.

(h) Use any cutting instrument to treat a disease, ailment or condition.

(i) Treat the effects of a systemic disease upon the foot or leg.

(j) Amputate a toe if the podiatric physician:

(1) Performs the amputation in a hospital as defined in NRS 449.012 or a surgical center for ambulatory patients as defined in NRS 449.019;

(2) Is authorized by the hospital or surgical center to perform the amputation;

(3) Has completed a program of surgical training as a resident and provides proof satisfactory to the hospital or surgical center of completion of the program;

(4) Complies with any other requirements established by the hospital or surgical center; and

(5) Performs the amputation in accordance with the standard of care required for a physician licensed pursuant to chapter 630, 630A or 633 of NRS.

2. A podiatric physician shall not:

(a) Treat any other effect of a systemic disease unless the disease originates in the foot or leg.

(b) Amputate a leg or foot.

(Added to NRS by 1983, 377; A 1985, 494; 1993, 2221; 2001, 1829)

Podiatry Residency Resource

Surgical Procedure Summary Report

[redacted]

Category : [redacted]

Attending :

Institution:

Date Range : [redacted]

Procedure	2nd	1st	Total 1st+2nd
11 - Partial Ostectomy/Exostectomy	0	6	6
111 - Open Management of Digital Fracture/Dislocation	0	2	2
112 - Revision/Repair of Surgical Outcome	0	2	2
12 - Phalangectomy	0	1	1
13 - Arthroplasty (Interphalangeal Joint [IPJ])	0	19	19
14 - Implant (IPJ) (silastic implant or spacer)	1	1	2
17 - Fusion (IPJ)	4	87	91
18 - Amputation	5	33	38

211 - Bunionectomy (partial ostectomy/Silver procedure), with or without capsulotendon balancing procedure	0	3	3
2110 - Bunionectomy double correction with osteotomy and/or arthrodesis	0	1	1
213 - Bunionectomy with Phalangeal Osteotomy	0	1	1
214 - Bunionectomy with Distal First Metatarsal Osteotomy	1	24	25
216 - Bunionectomy with First Metatarsocuneiform Fusion	3	42	45
217 - Metatarsophalangeal Joint (MPJ) Fusion	1	31	32
221 - Cheilectomy	0	11	11
223 - Joint Salvage with Distal Metatarsal Osteotomy	0	1	1
226 - MPJ Fusion	2	34	36
2310 - Other First Ray Procedure Not Listed Above	1	1	2
232 - Osteotomy (e.g., Dorsiflexory)	0	2	2
233 - Metatarsocuneiform Fusion (Other Than For Hallux Valgus or Hallux Limitus)	2	1	3
234 - Amputation	6	24	30
236 - Management of Bone/Joint Infection (With or Without Bone Graft)	1	1	2
237 - Open Management of Fracture or MPJ Dislocation	0	8	8
239 - Revision/Repair of Surgical Outcome (e.g., non-union, hallux varus)	2	4	6
310 - Excision of soft tissue tumor/mass (without reconstructive surgery: includes foot, ankle or leg)	1	44	45
312 - Plastic Surgery Techniques (Including Skin Graft, Skin Plasty, Flaps, Syndactylization, Desyndactylization, and Debulking Procedures Limited to The Forefoot)	1	17	18

314 - Other Soft Tissue Procedures not Listed Above (Limited to The Foot)	0	7	7
32 - Excision of Neuroma	0	12	12
33 - Removal of Deep Foreign Body (Excluding Hardware Removal)	0	3	3
34 - Plantar Fasciotomy	0	7	7
35 - Lesser MPJ Capsulotendon Balancing	0	6	6
36 - Tendon Repair, Lengthening, or Transfer Involving the Forefoot (Including Digital Flexor Digitorum Longus Transfer)	1	12	13
38 - Incision and drainage/wide debridement of soft tissue infection(includes foot, ankle or leg)	3	53	56
39 - Plantar fasciectomy/plantar fibroma resection	0	1	1
41 - Partial Ostectomy (including the talus and calcaneus) (includes foot, ankle or leg)	0	19	19
410 - Amputation (Lesser Ray, Transmetatarsal Amputation)	2	42	44
411 - Management of Bone/Joint Infection Distal to The Tarsometatarsal Joints (With or Without Bone Graft)	0	2	2
413 - Open Management of Tarsometatarsal Fracture/Dislocation	1	1	2
415 - Tarsometatarsal Fusion	1	4	5
417 - Revision/Repair of Surgical Outcome in The Forefoot	0	1	1
419 - Detachment/Reattachment of Achilles Tendon with Partial Ostectomy	0	1	1
42 - Lesser MPJ Arthroplasty	0	3	3
43 - Bunionectomy of The Fifth Metatarsal Without Osteotomy	0	2	2
44 - Metatarsal Head Resection (Single or Multiple)	0	5	5

46 - Central Metatarsal Osteotomy	0	16	16
47 - Bunionectomy of The Fifth Metatarsal With Osteotomy	0	6	6
48 - Open Management of Lesser Metatarsal Fracture(s)	2	5	7
49 - Harvesting of bone graft (includes foot, ankle or leg)	1	3	4
512 - Tendon Transfer Involving the Midfoot, Rearfoot, Ankle, or Leg	2	2	4
513 - Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	2	11	13
514 - Soft Tissue Repair of Complex Congenital Foot/Ankle Deformity (Clubfoot, Vertical Talus)	1	0	1
515 - Delayed Primary or Secondary Repair of Ligamentous Structures	2	13	15
516 - Tendon Augmentation/Supplementation/Restoration	1	21	22
521 - Operative Arthroscopy	5	11	16
521 - Operative Arthroscopy Without Removal of Loose Body or Other Osteochondral Debridement	0	9	9
5211 - Other Elective Rearfoot Reconstructive/Ankle Osseous Surgery not Listed Above	3	0	3
524 - Midfoot, Rearfoot, or Ankle Fusion	12	34	46
525 - Midfoot, Rearfoot, or Tibial Osteotomy	1	5	6
526 - Coalition Resection	0	3	3
527 - Open Management of Talar Dome Lesion (With or Without Osteotomy)	1	0	1
528 - Ankle Arthrotomy With Removal of Loose Body or Other Osteochondral Debridement	3	1	4
528 - Ankle Arthrotomy/Arthroscopy with Removal of Loose Body or Other Osteochondral Debridement	4	6	10

529 - Ankle Implant	29	36	65
531 - Repair of Acute Tendon Injury	0	27	27
532 - Repair of Acute Ligament Injury	0	3	3
541 - Open Repair of Adult Midfoot Fracture	1	6	7
542 - Open Repair of Adult Rearfoot Fracture	8	15	23
543 - Open Repair of Adult Ankle Fracture	27	101	128
544 - Open Repair of Pediatric Rearfoot/Ankle Fractures or Dislocations	1	7	8
546 - Management of Bone/Joint Infection (With or Without Bone Graft)	0	2	2
548 - Other Non-elective Rearfoot Reconstructive/Ankle Osseous Surgery not Listed Above	1	0	1
549 - Application of multiplanar external fixation midfoot, rearfoot, ankle (does not include mini or mono rails)	0	2	2
61 - Debridement of Superficial Ulcer or Wound	0	2	2
613 - Other Clinical Experiences	0	1	1
62 - Excision or Destruction of Skin Lesion (Including Skin Biopsy and Laser Procedures)	1	4	5
63 - Nail Avulsion (partial or complete)	0	1	1
64 - Matrixectomy (Partial or Complete, by Any Means)	0	1	1
65 - Removal of Hardware (Internal or External Fixation)	6	68	74
67 - Biological Dressings	0	1	1
71 - Biomechanical Case; Must Include Diagnosis, Evaluation (Biomechanical and Gait Examination), and Treatment.	0	80	80
81 - Comprehensive History and Physical Examination	0	53	53

92 - Orthopedic Surgery	8	42	50
93 - Plastic Surgery	1	0	1
94 - Vascular Surgery	2	0	2
Total Procedures	164	1180	1344

Podiatry Residency Resource

Clinical Log Report

View : Show Verified
Category : Reconstructive Rearfoot/Ankle Surgery
Date Range : 07/01/2017 - 11/17/2023

Fleck, Joseph (PGY-3)

ABFAS ID : 117017
ABPM ID : 131888
Residency Programs Attended : 50407-Saint Francis Hospital and Medical Center
Total Patients Reported : 245
Total Number of Activities : Role 1 - 316 Role 2 - 65
Total Procedures Reported : 381

Verified Date	Verified By	Case Date	Case Number	Institution	Patient Id	Age	Gender	Trauma	Role	Category	Procedure No	Procedure	Procedure Notes	Side/Digit	Faculty	Faculty Degree
12/31/2018	Gonzalez, Rafael	07/29/2018	6	Saint Francis Hospital and Medical Center	00576453	58	Male	No	2	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	Tendo-Achilles lengthening of left Achilles	Left	Wagner, Brian	DPM
08/02/2018	Gonzalez, Rafael	07/26/2018	8	Saint Francis Hospital and Medical Center	03905453	62	Female	No	1	5	546	Management of Bone/Joint Infection (With or Without Bone Graft)	partial L calcectomy due to OM	Left	Thompson, Erik	DPM
08/02/2018	Gonzalez, Rafael	07/26/2018	8	Saint Francis Hospital and Medical Center	03905453	62	Female	No	1	5	511	Plastic Surgery Techniques Involving The Midfoot, Rearfoot, or Ankle	application of allograft and wound vac to open wound on L calcaneus	Left	Thompson, Erik	DPM
09/10/2018	Gonzalez, Rafael	07/26/2018	26	Saint Francis Hospital and Medical Center	11210279	46	Male	No	2	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	Gastroc recession to left ankle for equinus deformity	Left	Gambardella, Gabriel	DPM
09/10/2018	Gonzalez, Rafael	08/02/2018	37	Saint Francis Hospital and Medical Center	00431319	59	Male	No	2	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	gastroc lengthening for equinus and arthrodesis procedure	Right	Gambardella, Gabriel	DPM
09/10/2018	Gonzalez, Rafael	08/02/2018	37	Saint Francis Hospital and Medical Center	00431319	59	Male	No	2	5	524	Midfoot, Rearfoot, or Ankle Fusion	Medial column triple arthrodesis (NC jt, TN jt, ST jt), right foot	Right	Gambardella, Gabriel	DPM
09/10/2018	Gonzalez, Rafael	08/09/2018	44	Johnson Surgery Center	00323744	83	Female	No	1	5	546	Management of Bone/Joint Infection (With or Without Bone Graft)	calcaneal ostectomy of the left due to irritation/infection, also sent for cultures/path	Left	Donegan, Ryan	DPM

09/10/2018	Gonzalez, Rafael	08/15/2018	55	Saint Francis Hospital and Medical Center	11305367	66	Female	Yes	2	5	543	Open Repair of Adult Ankle Fracture	ORIF of tri-mal ankle fracture, Left. trauma	Left	Gambardella, Gabriel	DPM
09/10/2018	Gonzalez, Rafael	08/18/2018	59	Saint Francis Hospital and Medical Center	00744518	60	Female	No	1	5	546	Management of Bone/Joint Infection (With or Without Bone Graft)	partial excision of right calcaneus due to OM, cultures/path sent. Extensive excision of soft tissue due to non-viable necrotic nature around right heel	Right	Gambardella, Gabriel	DPM
09/10/2018	Gonzalez, Rafael	08/29/2018	72	Saint Francis Hospital and Medical Center	11310231	70	Female	Yes	2	5	543	Open Repair of Adult Ankle Fracture	Tri-mal ankle fracture ORIF with syndesmotic fixation using synchfix	Left	Adeleke, Adebola	DPM
12/31/2018	Gonzalez, Rafael	09/27/2018	106	Saint Francis Hospital and Medical Center	00553108	82	Female	No	1	5	546	Management of Bone/Joint Infection (With or Without Bone Graft)	right partial calcanectomy due to OM, then full thickness flap translated posterior to cover heel defect	Right	Gambardella, Gabriel	DPM
11/11/2018	Gonzalez, Rafael	10/04/2018	110	Saint Francis Hospital and Medical Center	03038876	39	Male	No	2	5	527	Open Management of Talar Dome Lesion (With or Without Osteotomy)	talar ocd excision with grafting, LEFT	Left	Gambardella, Gabriel	DPM
11/11/2018	Gonzalez, Rafael	10/04/2018	112	Saint Francis Hospital and Medical Center	11300904	56	Female	No	2	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastroc recession, left	Left	Gambardella, Gabriel	DPM
11/11/2018	Gonzalez, Rafael	10/04/2018	112	Saint Francis Hospital and Medical Center	11300904	56	Female	No	2	5	512	Tendon Transfer Involving the Midfoot, Rearfoot, Ankle, or Leg	transfer of the PL to the PB due to peroneal overdrive, LEFT	Left	Gambardella, Gabriel	DPM
11/11/2018	Gonzalez, Rafael	10/04/2018	115	Saint Francis Hospital and Medical Center	00679926	64	Female	No	2	5	521	Operative Arthroscopy	ankle arthroscopy	Left	Gambardella, Gabriel	DPM
11/11/2018	Gonzalez, Rafael	10/04/2018	115	Saint Francis Hospital and Medical Center	00679926	64	Female	No	2	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastroc recession, left	Left	Gambardella, Gabriel	DPM
11/11/2018	Gonzalez, Rafael	10/04/2018	115	Saint Francis Hospital and Medical Center	00679926	64	Female	No	2	5	524	Midfoot, Rearfoot, or Ankle Fusion	triple arthrodesis, left	Left	Gambardella, Gabriel	DPM
11/11/2018	Gonzalez, Rafael	10/12/2018	134	Saint Francis Hospital and Medical Center	11321757	52	Female	Yes	2	5	531	Repair of Acute Tendon Injury	repair of ruptured Achilles tendon, R	Right	Gonzalez, Rafael	
11/11/2018	Gonzalez, Rafael	09/14/2018	153	Saint Francis Hospital and Medical Center	03542577	45	Female	No	2	5	511	Plastic Surgery Techniques Involving The Midfoot, Rearfoot, or Ankle	division and inset of pedicled sural flap, RIGHT	Right	Perakis, Helen	MD

11/11/2018	Gonzalez, Rafael	10/25/2018	183	Saint Francis Hospital and Medical Center	03028523	74	Male	No	1	5	546	Management of Bone/Joint Infection (With or Without Bone Graft)	septic ankle joint I&D, medial column I&D	Left	Rode, Kurt	DPM
11/11/2018	Gonzalez, Rafael	10/26/2018	184	Saint Francis Hospital and Medical Center	11325260	21	Male	Yes	2	5	543	Open Repair of Adult Ankle Fracture	ORIF tri mal ankle	Right	Adeleke, Adebola	DPM
11/11/2018	Gonzalez, Rafael	10/28/2018	191	Saint Francis Hospital and Medical Center	11325589	54	Female	Yes	2	5	543	Open Repair of Adult Ankle Fracture	ORIF L ankle fracture, medial mal, posterior mal	Left	Adeleke, Adebola	DPM
12/31/2018	Gonzalez, Rafael	12/07/2018	225	Saint Francis Hospital and Medical Center	00941237	59	Male	No	2	5	512	Tendon Transfer Involving the Midfoot, Rearfoot, Ankle, or Leg	EGR	Right	Butto, Danielle	DPM
12/31/2018	Gonzalez, Rafael	12/08/2018	227	Saint Francis Hospital and Medical Center	11335062	31	Male	Yes	2	5	549	Application of multiplanar external fixation midfoot, rearfoot, ankle (does not include mini or mono rails)	delta frame	Right	Balloch, Rachel	DPM
02/25/2019	Gonzalez, Rafael	12/28/2018	245	Saint Francis Hospital and Medical Center	00705246	52	Female	No	2	5	524	Midfoot, Rearfoot, or Ankle Fusion	triple arthrodesis with medial column fusion	Left	Gambardella, Gabriel	DPM
02/25/2019	Gonzalez, Rafael	12/28/2018	245	Saint Francis Hospital and Medical Center	00705246	52	Female	No	2	5	549	Application of multiplanar external fixation midfoot, rearfoot, ankle (does not include mini or mono rails)	application of external fixation, left foot/leg	Left	Gambardella, Gabriel	DPM
02/25/2019	Gonzalez, Rafael	01/03/2019	252	Saint Francis Hospital and Medical Center	03689120	52	Male	No	2	5	516	Tendon Augmentation/Supplementation/Restoration	repair of tibialis anterior and replacement of TA into medial cuneiform with bone anchor	Right	Gambardella, Gabriel	DPM
02/25/2019	Gonzalez, Rafael	01/12/2019	264	Manchester Memorial Hospital	Z108093	66	Female	No	1	5	547	Amputation Proximal to The Tarsometatarsal Joints	partial calcaneal amputation secondary to OM with large debridement	Left	Thompson, Erik	DPM
02/25/2019	Gonzalez, Rafael	01/11/2019	271	Saint Francis Hospital and Medical Center	00566731	35	Male	Yes	2	5	531	Repair of Acute Tendon Injury	repair of acutely ruptured Achilles tendon	Right	Gambardella, Gabriel	DPM
02/25/2019	Gonzalez, Rafael	01/23/2019	290	Saint Francis Hospital and Medical Center	00324422	55	Male	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	Hokes TAL	Right	Butto, Danielle	DPM
02/25/2019	Gonzalez, Rafael	02/04/2019	311	Saint Francis Hospital and Medical Center	03063700	57	Female	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	Achilles tenotomy	Left	Balloch, Rachel	DPM

05/12/2019	Gonzalez, Rafael	03/11/2019	347	Saint Francis Hospital and Medical Center	10273783	69	Female	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	Achilles tenotomy	Left	Balloch, Rachel	DPM
05/12/2019	Gonzalez, Rafael	03/12/2019	351	Saint Francis Hospital and Medical Center	00771710	65	Female	No	2	5	543	Open Repair of Adult Ankle Fracture	ORIF trimalleolar ankle fx	Right	Gambardella, Gabriel	DPM
05/12/2019	Gonzalez, Rafael	03/20/2019	365	Bloomfield Ambulatory Surgery Center	6184	48	Male	No	1	5	524	Midfoot, Rearfoot, or Ankle Fusion	charcot reconstruction: 1st TMTJ and navicular cuneiform jt fusion	Right	Wagner, Brian	DPM
05/12/2019	Gonzalez, Rafael	03/20/2019	368	Bloomfield Ambulatory Surgery Center	6368	52	Female	No	1	5	515	Delayed Primary or Secondary Repair of Ligamentous Structures	ATFL repair 2/2 lateral ankle stability	Left	Wagner, Brian	DPM
05/12/2019	Gonzalez, Rafael	03/25/2019	375	Saint Francis Hospital and Medical Center	03762283	82	Male	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	Hoke's TAL	Left	Vander Poel, Laura	DPM
05/12/2019	Gonzalez, Rafael	03/28/2019	383	Saint Francis Hospital and Medical Center	03780930	52	Male	No	1	5	546	Management of Bone/Joint Infection (With or Without Bone Graft)	debridement of fibula with application of stravix and wound vac	Left	Gambardella, Gabriel	DPM
05/12/2019	Gonzalez, Rafael	03/29/2019	387	Saint Francis Hospital and Medical Center	03856240	60	Male	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	endoscopic gastroc recession	Left	Balloch, Rachel	DPM
05/12/2019	Gonzalez, Rafael	03/29/2019	388	Saint Francis Hospital and Medical Center	00532773	90	Female	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	Achilles tenotomy	Right	Balloch, Rachel	DPM
05/12/2019	Gonzalez, Rafael	04/19/2019	424	Manchester Memorial Hospital	D05444274	64	Male	No	2	5	516	Tendon Augmentation/Supplementation/Restoration	PT tendon repair secondary to chronic partial tear	Right	Boccelli, Donna	DPM
05/12/2019	Gonzalez, Rafael	05/01/2019	437	Saint Francis Hospital and Medical Center	11369627	55	Male	No	2	5	543	Open Repair of Adult Ankle Fracture	deltoid ligament repair and ORIF distal tibiofibular syndesmosis	Right	Litchfield, Andrew	DPM
05/12/2019	Gonzalez, Rafael	05/07/2019	438	Saint Francis Hospital and Medical Center	00377311	58	Female	No	1	5	546	Management of Bone/Joint Infection (With or Without Bone Graft)	partial calcanectomy 2/2 OM	Left	Gonzalez, Rafael	DPM
05/12/2019	Gonzalez, Rafael	05/08/2019	439	Saint Francis Hospital and Medical Center	00357536	57	Female	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	endoscopic gastroc recession	Right	Balloch, Rachel	DPM
05/12/2019	Gonzalez, Rafael	05/08/2019	440	Saint Francis Hospital and Medical Center	00488885	40	Male	No	2	5	512	Tendon Transfer Involving the Midfoot, Rearfoot, Ankle, or Leg	peroneal longus tendon transfer, tenodesis, removal of accessory bone	Left	Balloch, Rachel	DPM

05/12/2019	Gonzalez, Rafael	05/09/2019	443	Saint Francis Hospital and Medical Center	00284643	46	Male	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	Hoke's TAL LLE	Left	Kosofsky, Eric	DPM
06/26/2019	Gonzalez, Rafael	06/12/2019	503	Saint Francis Hospital and Medical Center	11377595	52	Female	No	2	5	521	Operative Arthroscopy	ankle scope for synovectomy	Right	Litchfield, Andrew	DPM
06/26/2019	Gonzalez, Rafael	06/12/2019	503	Saint Francis Hospital and Medical Center	11377595	52	Female	No	2	5	516	Tendon Augmentation/Supplementatio n/Restoration	Peroneus brevis repair	Right	Litchfield, Andrew	DPM
06/26/2019	Gonzalez, Rafael	06/12/2019	503	Saint Francis Hospital and Medical Center	11377595	52	Female	No	2	5	515	Delayed Primary or Secondary Repair of Ligamentous Structures	brostrum gould procedure with sonic anchors	Right	Litchfield, Andrew	DPM
06/26/2019	Gonzalez, Rafael	06/13/2019	506	Saint Francis Hospital and Medical Center	03555774	60	Male	Yes	1	5	549	Application of multiplanar external fixation midfoot, rearfoot, ankle (does not include mini or mono rails)	application of stryker delta frame secondary to acute ankle dislocation and charcot deformity	Right	Butto, Danielle	DPM
06/26/2019	Gonzalez, Rafael	06/19/2019	519	Blue Back Surgery Center	7373	64	Female	No	1	5	516	Tendon Augmentation/Supplementatio n/Restoration	repair (tenodesis) of peroneal tendons with synovectomy	Left	Wagner, Brian	DPM
06/26/2019	Gonzalez, Rafael	06/24/2019	524	Saint Francis Hospital and Medical Center	10028288	57	Female	Yes	2	5	531	Repair of Acute Tendon Injury	repair of Achilles tendon after a laceration rupture	Right	Gambardella, Gabriel	DPM
06/26/2019	Gonzalez, Rafael	06/20/2019	528	Saint Francis Hospital and Medical Center	11284212	55	Male	No	2	5	524	Midfoot, Rearfoot, or Ankle Fusion	triple arthrodesis with medial column fusion, right foot	Right	Gambardella, Gabriel	DPM
06/26/2019	Gonzalez, Rafael	06/20/2019	528	Saint Francis Hospital and Medical Center	11284212	55	Male	No	2	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	Hoke's TAL	Right	Gambardella, Gabriel	DPM
08/27/2019	Gonzalez, Rafael	06/17/2019	535	Saint Francis Hospital and Medical Center	10328137	40	Female	Yes	2	5	543	Open Repair of Adult Ankle Fracture	ORIF of medial malleolus and distal tib/fib syndesmosis	Right	Litchfield, Andrew	DPM
08/27/2019	Gonzalez, Rafael	06/17/2019	535	Saint Francis Hospital and Medical Center	10328137	40	Female	Yes	2	5	521	Operative Arthroscopy	right ankle scope and debridement	Right	Litchfield, Andrew	DPM
08/27/2019	Gonzalez, Rafael	06/26/2019	536	Saint Francis Hospital and Medical Center	10768610	28	Female	Yes	2	5	543	Open Repair of Adult Ankle Fracture	ORIF distal fibular fracture	Right	Litchfield, Andrew	DPM
08/27/2019	Gonzalez, Rafael	06/27/2019	537	Saint Francis Hospital and Medical Center	00558480	40	Male	Yes	1	5	546	Management of Bone/Joint Infection (With or Without Bone Graft)	gun shot wound to left distal fibula. removal of shrapnel. evacuation of infected hematoma	Left	Gambardella, Gabriel	DPM

08/27/2019	Gonzalez, Rafael	06/27/2019	538	Saint Francis Hospital and Medical Center	10123330	62	Male	No	1	5	546	Management of Bone/Joint Infection (With or Without Bone Graft)	partial calcanectomy secondary to OM. Creation of flap for later closure	Left	Gambardella, Gabriel	DPM
08/27/2019	Gonzalez, Rafael	07/11/2019	553	Rockville General Hospital	M331171	21	Female	No	1	5	512	Tendon Transfer Involving the Midfoot, Rearfoot, Ankle, or Leg	kidner procedure	Right	Deschamps, Brian	DPM
08/27/2019	Gonzalez, Rafael	07/05/2019	565	Saint Francis Hospital and Medical Center	11368623	52	Male	Yes	2	5	543	Open Repair of Adult Ankle Fracture	ORIF right fibular fracture	Right	Gambardella, Gabriel	DPM
08/27/2019	Gonzalez, Rafael	07/18/2019	580	Saint Francis Hospital and Medical Center	11237899	44	Female	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	Hokes TAL	Right	Kosofsky, Eric	DPM
08/27/2019	Gonzalez, Rafael	07/24/2019	585	Saint Francis Hospital and Medical Center	03837752	60	Female	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	endoscopic gastroc recession	Left	Balloch, Rachel	DPM
11/11/2019	Gonzalez, Rafael	08/28/2019	619	Middlesex Hospital	253743	58	Male	No	1	5	546	Management of Bone/Joint Infection (With or Without Bone Graft)	R partial calcanectomy with wound excision, application of wound vac	Right	Mucinskas, Adam	DPM
11/11/2019	Gonzalez, Rafael	08/28/2019	622	Middlesex Hospital	412819	79	Male	No	1	5	546	Management of Bone/Joint Infection (With or Without Bone Graft)	partial cuboidectomy with excision of soft tissue mass	Left	Mucinskas, Adam	DPM
11/11/2019	Gonzalez, Rafael	09/05/2019	624	Saint Francis Hospital and Medical Center	00875551	63	Female	Yes	2	5	516	Tendon Augmentation/Supplementation/Restoration	Achilles tendon repair with allograft	Right	Gambardella, Gabriel	DPM
11/11/2019	Gonzalez, Rafael	09/04/2019	626	Saint Francis Hospital and Medical Center	00836148	24	Male	Yes	2	5	543	Open Repair of Adult Ankle Fracture	ORIF medial malleolar fracture	Left	Balloch, Rachel	DPM
11/11/2019	Gonzalez, Rafael	09/04/2019	627	Saint Francis Hospital and Medical Center	03833471	35	Male	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	Achilles tenotomy	Right	Balloch, Rachel	DPM
11/11/2019	Gonzalez, Rafael	09/09/2019	634	Saint Francis Hospital and Medical Center	10412819	72	Female	No	1	5	546	Management of Bone/Joint Infection (With or Without Bone Graft)	left foot I&D with debridement of medial mal, tenolysis of foot, partial 2nd ray, application of integra bilayer	Left	Butto, Danielle	DPM
11/11/2019	Gonzalez, Rafael	09/18/2019	646	Blue Back Surgery Center	1000284839	57	Male	No	1	5	516	Tendon Augmentation/Supplementation/Restoration	repair of Achilles tendon 2/2 chronic tendinosis	Right	Wagner, Brian	DPM

11/11/2019	Gonzalez, Rafael	09/19/2019	654	Saint Francis Hospital and Medical Center	11401512	21	Male	Yes	2	5	543	Open Repair of Adult Ankle Fracture	ORIF L ankle fracture with syndesmotic fixation	Left	Gambardella, Gabriel	DPM
11/11/2019	Gonzalez, Rafael	09/19/2019	655	Saint Francis Hospital and Medical Center	03534783	55	Female	No	2	5	524	Midfoot, Rearfoot, or Ankle Fusion	talectomy with tibiocalcaneal arthrodesis for charcot reconstruction	Left	Gambardella, Gabriel	DPM
11/11/2019	Gonzalez, Rafael	09/19/2019	655	Saint Francis Hospital and Medical Center	03534783	55	Female	No	2	5	549	Application of multiplanar external fixation midfoot, rearfoot, ankle (does not include mini or mono rails)	application of circular external fixator (wright)	Left	Gambardella, Gabriel	DPM
11/11/2019	Gonzalez, Rafael	09/27/2019	659	Saint Francis Hospital and Medical Center	11375147	63	Female	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastroc recession	Right	Balloch, Rachel	DPM
11/11/2019	Gonzalez, Rafael	09/27/2019	660	Saint Francis Hospital and Medical Center	00751281	73	Male	No	2	5	543	Open Repair of Adult Ankle Fracture	ORIF bimal with syndesmosis fixation	Left	Balloch, Rachel	DPM
11/11/2019	Gonzalez, Rafael	10/09/2019	672	Saint Francis Hospital and Medical Center	00615604	60	Female	Yes	1	5	549	Application of multiplanar external fixation midfoot, rearfoot, ankle (does not include mini or mono rails)	closed reduction of tri-mal fracture with application of delta frame	Left	Butto, Danielle	DPM
11/11/2019	Gonzalez, Rafael	10/09/2019	672	Saint Francis Hospital and Medical Center	00615604	60	Female	Yes	1	5	546	Management of Bone/Joint Infection (With or Without Bone Graft)	debridement of medial malleolus 2/2 OM, arthrotomy of ankle joint 2/2 septic ankle	Left	Butto, Danielle	DPM
11/11/2019	Gonzalez, Rafael	10/14/2019	674	Saint Francis Hospital and Medical Center	03566165	59	Female	No	2	5	516	Tendon Augmentation/Supplementation/Restoration	EGR	Right	Balloch, Rachel	DPM
11/11/2019	Gonzalez, Rafael	10/14/2019	678	Saint Francis Hospital and Medical Center	00615604	60	Female	No	1	5	546	Management of Bone/Joint Infection (With or Without Bone Graft)	left ankle I&D with bone debridement of tib/fib, adjustment of external fixator, insertion of abx beads into medial and lateral malleolus	Left	Butto, Danielle	DPM
11/11/2019	Gonzalez, Rafael	10/17/2019	683	Middlesex Hospital	30655348	53	Female	No	1	5	524	Midfoot, Rearfoot, or Ankle Fusion	NC joint fusion, arthrex plate	Left	Adeleke, Adebola	DPM
11/11/2019	Gonzalez, Rafael	10/24/2019	696	Saint Francis Hospital and Medical Center	00590639	75	Female	Yes	2	5	543	Open Repair of Adult Ankle Fracture	ORIF fibular fx with syndesmotic repair in DM	Right	Gambardella, Gabriel	DPM

11/11/2019	Gonzalez, Rafael	10/25/2019	698	Saint Francis Hospital and Medical Center	11402898	53	Female	No	1	5	516	Tendon Augmentation/Supplementation/Restoration	open gastroc recession	Left	Balloch, Rachel	DPM
11/11/2019	Gonzalez, Rafael	10/29/2019	707	Saint Francis Hospital and Medical Center	00284643	47	Male	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	hokes TAL	Left	Kosofsky, Eric	DPM
12/02/2019	Gonzalez, Rafael	11/15/2019	750	Saint Francis Hospital and Medical Center	03464819	56	Female	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastroc recession	Left	Balloch, Rachel	DPM
12/02/2019	Gonzalez, Rafael	11/15/2019	752	Saint Francis Hospital and Medical Center	00926168	22	Male	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastroc recession	Right	Butto, Danielle	DPM
12/02/2019	Gonzalez, Rafael	11/22/2019	758	Saint Francis Hospital and Medical Center	00821797	51	Male	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastroc recession	Right	Balloch, Rachel	DPM
12/02/2019	Gonzalez, Rafael	11/27/2019	767	Bloomfield Ambulatory Surgery Center	8811	39	Female	No	1	5	516	Tendon Augmentation/Supplementation/Restoration	repair of PT tendon, repair of spring ligament, kidner procedure	Left	Rode, Kurt	DPM
12/02/2019	Gonzalez, Rafael	11/27/2019	767	Bloomfield Ambulatory Surgery Center	8811	39	Female	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	single portal EGR	Left	Rode, Kurt	DPM
12/02/2019	Gonzalez, Rafael	11/27/2019	768	Bloomfield Ambulatory Surgery Center	9375	20	Female	No	1	5	521	Operative Arthroscopy	ankle joint scope, debridement of synovitis	Right	Rode, Kurt	DPM
12/02/2019	Gonzalez, Rafael	11/27/2019	768	Bloomfield Ambulatory Surgery Center	9375	20	Female	No	1	5	515	Delayed Primary or Secondary Repair of Ligamentous Structures	semitendinous allograft used for ATFL CFL repair (modified chrisman snook)	Right	Rode, Kurt	DPM
12/02/2019	Gonzalez, Rafael	12/02/2019	773	Saint Francis Hospital and Medical Center	11414175	36	Female	No	1	5	516	Tendon Augmentation/Supplementation/Restoration	secondary repair of PT tendon (topaz)	Right	Butto, Danielle	DPM
01/17/2020	Gonzalez, Rafael	12/05/2019	787	Middlesex Hospital	137075	60	Male	Yes	1	5	543	Open Repair of Adult Ankle Fracture	ORIF fibular fracture with syndesmotic fixation (synchfix)	Left	Adeleke, Adebola	DPM
01/17/2020	Gonzalez, Rafael	12/05/2019	789	Saint Francis Hospital and Medical Center	00194662	51	Male	No	2	5	524	Midfoot, Rearfoot, or Ankle Fusion	triple arthrodesis with medial column fusion	Left	Gambardella, Gabriel	DPM
01/17/2020	Gonzalez, Rafael	12/05/2019	789	Saint Francis Hospital and Medical Center	00194662	51	Male	No	2	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastroc recession	Left	Gambardella, Gabriel	DPM

01/17/2020	Gonzalez, Rafael	12/05/2019	789	Saint Francis Hospital and Medical Center	00194662	51	Male	No	2	5	549	Application of multiplanar external fixation midfoot, rearfoot, ankle (does not include mini or mono rails)	application of static ring fixator	Left	Gambardella, Gabriel	DPM
01/17/2020	Gonzalez, Rafael	12/05/2019	790	Rockville General Hospital	03877188	79	Female	No	2	5	547	Amputation Proximal to The Tarsometatarsal Joints	partial calcanectomy	Right	Gambardella, Gabriel	DPM
01/17/2020	Gonzalez, Rafael	12/09/2019	794	Saint Francis Hospital and Medical Center	00911631	62	Female	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastroc recession	Left	Balloch, Rachel	DPM
01/17/2020	Gonzalez, Rafael	12/11/2019	800	Middlesex Surgery Center	322224	43	Female	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	EGR	Right	Mucinskas, Adam	DPM
01/17/2020	Gonzalez, Rafael	12/13/2019	813	Saint Francis Hospital and Medical Center	03838726	61	Male	No	1	5	547	Amputation Proximal to The Tarsometatarsal Joints	partial calcanectomy	Left	Gambardella, Gabriel	DPM
01/17/2020	Gonzalez, Rafael	12/13/2019	813	Saint Francis Hospital and Medical Center	03838726	61	Male	No	1	5	549	Application of multiplanar external fixation midfoot, rearfoot, ankle (does not include mini or mono rails)	application of static circular ex fix	Left	Gambardella, Gabriel	DPM
01/17/2020	Gonzalez, Rafael	12/19/2019	822	Saint Francis Hospital and Medical Center	03734430	77	Male	No	1	5	546	Management of Bone/Joint Infection (With or Without Bone Graft)	left fibula bone sent for biopsy, likely OM	Left	Gambardella, Gabriel	DPM
01/17/2020	Gonzalez, Rafael	12/19/2019	823	Saint Francis Hospital and Medical Center	00734453	61	Female	No	2	5	549	Application of multiplanar external fixation midfoot, rearfoot, ankle (does not include mini or mono rails)	application of hexapod frame	Right	Gambardella, Gabriel	DPM
01/17/2020	Gonzalez, Rafael	12/19/2019	823	Saint Francis Hospital and Medical Center	00734453	61	Female	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	Achilles tenotomy/lengthenin g	Left	Gambardella, Gabriel	DPM
01/17/2020	Gonzalez, Rafael	12/19/2019	823	Saint Francis Hospital and Medical Center	00734453	61	Female	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	Achilles tenotomy/lengthenin g	Right	Gambardella, Gabriel	DPM
01/17/2020	Gonzalez, Rafael	12/19/2019	823	Saint Francis Hospital and Medical Center	00734453	61	Female	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	PT tendon tenotomy/lengthenin g	Right	Gambardella, Gabriel	DPM
01/17/2020	Gonzalez, Rafael	01/03/2020	835	Saint Francis Hospital and Medical Center	11377298	61	Male	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	gastroc recession (open) and Z lengthening of PL	Left	Butto, Danielle	DPM
03/03/2020	Gonzalez, Rafael	01/16/2020	849	Saint Francis Hospital and Medical Center	00821596	48	Female	No	1	5	546	Management of Bone/Joint Infection (With or Without Bone Graft)	excision of medial cuneiform secondary to OM and septic joint	Left	Gambardella, Gabriel	DPM

03/03/2020	Gonzalez, Rafael	01/22/2020	864	Saint Francis Hospital and Medical Center	11434264	35	Male	Yes	1	5	531	Repair of Acute Tendon Injury	Achilles tendon rupture repair with V-Y lengthening	Right	Balloch, Rachel	DPM
03/03/2020	Gonzalez, Rafael	01/23/2020	865	Saint Francis Hospital and Medical Center	10019058	56	Female	No	2	5	521	Operative Arthroscopy	STJ scope	Left	Gambardella, Gabriel	DPM
03/03/2020	Gonzalez, Rafael	01/23/2020	865	Saint Francis Hospital and Medical Center	10019058	56	Female	No	2	5	516	Tendon Augmentation/Supplementation/Restoration	peroneal longus tendon repair	Left	Gambardella, Gabriel	DPM
03/03/2020	Gonzalez, Rafael	01/23/2020	866	Saint Francis Hospital and Medical Center	00472776	43	Female	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastrocnemius recession	Right	Gambardella, Gabriel	DPM
03/03/2020	Gonzalez, Rafael	01/23/2020	866	Saint Francis Hospital and Medical Center	00472776	43	Female	No	2	5	524	Midfoot, Rearfoot, or Ankle Fusion	STJ and TN fusion	Right	Gambardella, Gabriel	DPM
03/03/2020	Gonzalez, Rafael	01/30/2020	873	Saint Francis Hospital and Medical Center	00734453	62	Female	No	2	5	524	Midfoot, Rearfoot, or Ankle Fusion	Pantalar fusion. Orthofix IM nail (TTC fusion) TN fusion (screws), CC fusion (staples)	Right	Gambardella, Gabriel	DPM
03/03/2020	Gonzalez, Rafael	01/30/2020	874	Saint Francis Hospital and Medical Center	00297904	71	Female	No	2	5	521	Operative Arthroscopy	ankle scope	Right	Gambardella, Gabriel	DPM
03/03/2020	Gonzalez, Rafael	01/30/2020	874	Saint Francis Hospital and Medical Center	00297904	71	Female	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastroc recession	Right	Gambardella, Gabriel	DPM
03/03/2020	Gonzalez, Rafael	01/30/2020	874	Saint Francis Hospital and Medical Center	00297904	71	Female	No	2	5	524	Midfoot, Rearfoot, or Ankle Fusion	triple arthrodesis (screw for TN, staples for CC, screw for STJ)	Right	Gambardella, Gabriel	DPM
03/03/2020	Gonzalez, Rafael	01/31/2020	878	Rockville General Hospital	10277522	50	Female	Yes	1	5	515	Delayed Primary or Secondary Repair of Ligamentous Structures	repair of ATFL with sonic anchor	Right	Balloch, Rachel	DPM
03/03/2020	Gonzalez, Rafael	01/31/2020	878	Rockville General Hospital	10277522	50	Female	Yes	1	5	543	Open Repair of Adult Ankle Fracture	Open treatment of distal fibular fracture with excision of fracture fragment and sub-chondroplasty	Right	Balloch, Rachel	DPM
03/03/2020	Gonzalez, Rafael	02/05/2020	886	Bloomfield Ambulatory Surgery Center	10123	71	Female	No	1	5	512	Tendon Transfer Involving the Midfoot, Rearfoot, Ankle, or Leg	kidner procedure with stryker sonic anchor for PT tendon	Left	Mucinskas, Adam	DPM

03/03/2020	Gonzalez, Rafael	02/20/2020	898	Saint Francis Hospital and Medical Center	00919346	69	Male	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastroc recession	Left	Gambardella, Gabriel	DPM
03/03/2020	Gonzalez, Rafael	02/20/2020	899	Saint Francis Hospital and Medical Center	00905220	57	Female	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastroc recession	Left	Gambardella, Gabriel	DPM
03/03/2020	Gonzalez, Rafael	02/21/2020	903	Saint Francis Hospital and Medical Center	00102744	60	Male	No	2	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	Hokes TAL	Left	Vander Poel, Laura	DPM
03/03/2020	Gonzalez, Rafael	02/27/2020	906	Middlesex Hospital	948714	41	Male	Yes	1	5	542	Open Repair of Adult Rearfoot Fracture	ORIF tongue type calcaneal fracture	Left	Adeleke, Adebola	DPM
03/03/2020	Gonzalez, Rafael	02/28/2020	910	Saint Francis Hospital and Medical Center	11283299	38	Female	Yes	1	5	543	Open Repair of Adult Ankle Fracture	ORIF tri-malleolar ankle fracture, repair of distal tib-fib syndesmosis injury	Right	Gambardella, Gabriel	DPM
03/20/2020	Gonzalez, Rafael	03/04/2020	914	Saint Francis Hospital and Medical Center	11435046	18	Female	No	2	5	515	Delayed Primary or Secondary Repair of Ligamentous Structures	open repair of lateral ankle ligaments (stabilization)	Left	Litchfield, Andrew	DPM
03/20/2020	Gonzalez, Rafael	03/05/2020	919	Saint Francis Hospital and Medical Center	03235307	64	Female	No	1	5	521	Operative Arthroscopy	ankle scope with debridement of bone and synovial tissue	Right	Gambardella, Gabriel	DPM
03/20/2020	Gonzalez, Rafael	03/05/2020	919	Saint Francis Hospital and Medical Center	03235307	64	Female	No	1	5	524	Midfoot, Rearfoot, or Ankle Fusion	triple arthrodesis with medial column fusion, resection of CN bar	Right	Gambardella, Gabriel	DPM
03/20/2020	Gonzalez, Rafael	03/05/2020	919	Saint Francis Hospital and Medical Center	03235307	64	Female	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	gastroc recession	Right	Gambardella, Gabriel	DPM
03/20/2020	Gonzalez, Rafael	03/05/2020	921	Saint Francis Hospital and Medical Center	03445191	43	Female	Yes	1	5	531	Repair of Acute Tendon Injury	repair of tibialis anterior tendon secondary to rupture	Right	Gambardella, Gabriel	DPM
03/20/2020	Gonzalez, Rafael	03/09/2020	930	Saint Francis Hospital and Medical Center	10288491	53	Female	No	1	5	525	Midfoot, Rearfoot, or Tibial Osteotomy	midfoot wedge osteotomy (cole procedure)	Left	Wagner, Brian	DPM
03/20/2020	Gonzalez, Rafael	03/09/2020	930	Saint Francis Hospital and Medical Center	10288491	53	Female	No	1	5	549	Application of multiplanar external fixation midfoot, rearfoot, ankle (does not include mini or mono rails)	application of ring ex fix	Left	Wagner, Brian	DPM

03/20/2020	Gonzalez, Rafael	03/10/2020	931	Saint Francis Hospital and Medical Center	10270009	35	Male	No	1	5	511	Plastic Surgery Techniques Involving The Midfoot, Rearfoot, or Ankle	Revision of right foot flap (previous free flap from thigh to heel/ankle/lower leg)	Right	Buonocore, Samuel	MD
03/20/2020	Gonzalez, Rafael	03/11/2020	936	Saint Francis Hospital and Medical Center	00737001	43	Male	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastrocnemius recession	Left	Litchfield, Andrew	DPM
03/20/2020	Gonzalez, Rafael	03/19/2020	943	Saint Francis Hospital and Medical Center	00902923	65	Female	No	1	5	512	Tendon Transfer Involving the Midfoot, Rearfoot, Ankle, or Leg	FHL transfer	Right	Gambardella, Gabriel	DPM
03/20/2020	Gonzalez, Rafael	03/19/2020	943	Saint Francis Hospital and Medical Center	00902923	65	Female	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	gastroc recession	Right	Gambardella, Gabriel	DPM
04/20/2020	Gonzalez, Rafael	03/29/2020	944	Saint Francis Hospital and Medical Center	11451309	52	Female	Yes	1	5	543	Open Repair of Adult Ankle Fracture	ORIF medial mal fx	Right	Adeleke, Adebola	DPM
04/20/2020	Gonzalez, Rafael	04/06/2020	947	Saint Francis Hospital and Medical Center	00496996	54	Female	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastroc recession	Left	Butto, Danielle	DPM
04/20/2020	Gonzalez, Rafael	04/06/2020	947	Saint Francis Hospital and Medical Center	00496996	54	Female	No	1	5	512	Tendon Transfer Involving the Midfoot, Rearfoot, Ankle, or Leg	FDL tendon transfer 2/2 PT tendon insufficiency	Left	Butto, Danielle	DPM
04/20/2020	Gonzalez, Rafael	04/06/2020	947	Saint Francis Hospital and Medical Center	00496996	54	Female	No	1	5	525	Midfoot, Rearfoot, or Tibial Osteotomy	Kouts and evans calcaneal osteotomy for flat foot reconstruction	Left	Butto, Danielle	DPM
04/20/2020	Gonzalez, Rafael	04/06/2020	948	Saint Francis Hospital and Medical Center	00504213	47	Male	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	Hokes TAL	Right	Butto, Danielle	DPM
04/20/2020	Gonzalez, Rafael	04/07/2020	949	Saint Francis Hospital and Medical Center	03205126	53	Female	Yes	1	5	543	Open Repair of Adult Ankle Fracture	ORIF lateral mal fracture	Left	Litchfield, Andrew	DPM
04/20/2020	Gonzalez, Rafael	04/07/2020	950	Saint Francis Hospital and Medical Center	00682674	31	Male	Yes	1	5	532	Repair of Acute Ligament Injury	repair of distal tib/fib syndesmosis, ORIF lateral mal fracture	Left	Litchfield, Andrew	DPM
05/21/2020	Gonzalez, Rafael	04/30/2020	956	Saint Francis Hospital and Medical Center	00945424	41	Female	No	1	5	524	Midfoot, Rearfoot, or Ankle Fusion	STJ TNJ fusion	Right	Gambardella, Gabriel	DPM
05/21/2020	Gonzalez, Rafael	04/30/2020	956	Saint Francis Hospital and Medical Center	00945424	41	Female	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastroc recession	Right	Gambardella, Gabriel	DPM

05/21/2020	Gonzalez, Rafael	05/05/2020	957	Saint Francis Hospital and Medical Center	03522674	23	Male	Yes	1	5	543	Open Repair of Adult Ankle Fracture	repair of distal tib-fib syndesmosis injury, ORIF Maisonneuve fibular fracture	Left	Litchfield, Andrew	DPM
05/21/2020	Gonzalez, Rafael	05/13/2020	961	Saint Francis Hospital and Medical Center	00572192	53	Male	No	1	5	533	Microscopic Nerve/Vascular Repair of The Midfoot, Rearfoot, or Ankle	Reconstruction of right foot wound with a free myofascial flap from the right thigh - using an anterior tibial artery to right anterior tibial vein AV loop from an autologous ipsilateral greater saphenous vein graft (performed by vascular surgery at same time)	Right	Buonocore, Samuel	MD
06/08/2020	Gonzalez, Rafael	05/13/2020	962	Saint Francis Hospital and Medical Center	00572192	53	Male	No	1	5	549	Application of multiplanar external fixation midfoot, rearfoot, ankle (does not include mini or mono rails)	application of delta external fixator	Right	Gambardella, Gabriel	DPM
05/21/2020	Gonzalez, Rafael	05/14/2020	963	Saint Francis Hospital and Medical Center	00574837	48	Female	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastroc recession	Right	Gambardella, Gabriel	DPM
05/21/2020	Gonzalez, Rafael	05/18/2020	969	Saint Francis Hospital and Medical Center	11456051	14	Female	No	1	5	521	Operative Arthroscopy	Ankle arthroscopy with debridement	Right	Litchfield, Andrew	DPM
05/21/2020	Gonzalez, Rafael	05/18/2020	969	Saint Francis Hospital and Medical Center	11456051	14	Female	No	1	5	515	Delayed Primary or Secondary Repair of Ligamentous Structures	Open repair of collateral ankle ligaments	Right	Litchfield, Andrew	DPM
05/21/2020	Gonzalez, Rafael	05/18/2020	969	Saint Francis Hospital and Medical Center	11456051	14	Female	No	1	5	515	Delayed Primary or Secondary Repair of Ligamentous Structures	Repair of distal tibiofibular syndesmosis injury with synchfix	Right	Litchfield, Andrew	DPM
05/21/2020	Gonzalez, Rafael	05/18/2020	970	Saint Francis Hospital and Medical Center	11456072	41	Male	No	1	5	528	Ankle Arthrotomy With Removal of Loose Body or Other Osteochondral Debridement	ankle arthroscopy with debridement of synovitis leading to arthrotomy of ankle with removal of bone from the tibia and talus	Left	Litchfield, Andrew	DPM
05/21/2020	Gonzalez, Rafael	05/18/2020	970	Saint Francis Hospital and Medical Center	11456072	41	Male	No	1	5	515	Delayed Primary or Secondary Repair of Ligamentous Structures	repair of deltoid ligament	Left	Litchfield, Andrew	DPM
06/08/2020	Gonzalez, Rafael	05/26/2020	987	Saint Francis Hospital and Medical Center	00493821	43	Male	No	2	5	524	Midfoot, Rearfoot, or Ankle Fusion	STJ fusion	Right	Litchfield, Andrew	DPM

06/08/2020	Gonzalez, Rafael	05/26/2020	987	Saint Francis Hospital and Medical Center	00493821	43	Male	No	2	5	525	Midfoot, Rearfoot, or Tibial Osteotomy	osteotomy of calcaneus secondary to neglected calc fracture	Right	Litchfield, Andrew	DPM
06/08/2020	Gonzalez, Rafael	05/26/2020	987	Saint Francis Hospital and Medical Center	00493821	43	Male	No	2	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	hokes TAL	Right	Litchfield, Andrew	DPM
06/08/2020	Gonzalez, Rafael	06/05/2020	990	Saint Francis Hospital and Medical Center	10325532	79	Female	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastrocnemius recession	Right	Balloch, Rachel	DPM
07/08/2020	Gonzalez, Rafael	06/10/2020	992	Saint Francis Hospital and Medical Center	11458591	42	Female	Yes	1	5	521	Operative Arthroscopy	Arthroscopy of the ankle with debridement, left	Left	Litchfield, Andrew	DPM
07/08/2020	Gonzalez, Rafael	06/10/2020	992	Saint Francis Hospital and Medical Center	11458591	42	Female	Yes	1	5	515	Delayed Primary or Secondary Repair of Ligamentous Structures	repair of lateral collateral ankle ligaments	Left	Litchfield, Andrew	DPM
07/08/2020	Gonzalez, Rafael	06/10/2020	992	Saint Francis Hospital and Medical Center	11458591	42	Female	Yes	1	5	532	Repair of Acute Ligament Injury	Repair of distal tibiofibular syndesmosis, left ankle	Left	Litchfield, Andrew	DPM
07/08/2020	Gonzalez, Rafael	06/10/2020	993	Saint Francis Hospital and Medical Center	10173263	26	Male	Yes	1	5	521	Operative Arthroscopy	Ankle arthroscopy with debridement, right ankle	Right	Litchfield, Andrew	DPM
07/08/2020	Gonzalez, Rafael	06/10/2020	993	Saint Francis Hospital and Medical Center	10173263	26	Male	Yes	1	5	543	Open Repair of Adult Ankle Fracture	Open repair of medial malleolar fracture	Right	Litchfield, Andrew	DPM
07/08/2020	Gonzalez, Rafael	06/10/2020	994	Saint Francis Hospital and Medical Center	11457683	49	Male	No	1	5	521	Operative Arthroscopy	Ankle arthroscopy with debridement, right ankle	Right	Litchfield, Andrew	DPM
07/08/2020	Gonzalez, Rafael	06/10/2020	994	Saint Francis Hospital and Medical Center	11457683	49	Male	No	1	5	515	Delayed Primary or Secondary Repair of Ligamentous Structures	repair of deltoid ligament	Right	Litchfield, Andrew	DPM
07/08/2020	Gonzalez, Rafael	06/10/2020	994	Saint Francis Hospital and Medical Center	11457683	49	Male	No	1	5	515	Delayed Primary or Secondary Repair of Ligamentous Structures	repair of lateral collateral ligaments of the ankle with secondary stabilization	Right	Litchfield, Andrew	DPM
07/08/2020	Gonzalez, Rafael	06/11/2020	996	Saint Francis Hospital and Medical Center	03417023	59	Female	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastrocnemius recession	Left	Gambardella, Gabriel	DPM

07/08/2020	Gonzalez, Rafael	06/11/2020	997	Saint Francis Hospital and Medical Center	03912402	81	Female	No	1	5	512	Tendon Transfer Involving the Midfoot, Rearfoot, Ankle, or Leg	FHL tendon transfer	Left	Gambardella, Gabriel	DPM
07/08/2020	Gonzalez, Rafael	06/11/2020	997	Saint Francis Hospital and Medical Center	03912402	81	Female	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastrocnecmius recession	Left	Gambardella, Gabriel	DPM
07/08/2020	Gonzalez, Rafael	06/11/2020	997	Saint Francis Hospital and Medical Center	03912402	81	Female	No	1	5	516	Tendon Augmentation/Supplementatio n/Restoration	repair of achilles tendon	Left	Gambardella, Gabriel	DPM
07/08/2020	Gonzalez, Rafael	06/12/2020	998	Saint Francis Hospital and Medical Center	03906638	58	Male	Yes	1	5	543	Open Repair of Adult Ankle Fracture	ORIF ankle fracture (lateral malleolar fx)	Right	Butto, Danielle	DPM
07/08/2020	Gonzalez, Rafael	06/12/2020	999	Saint Francis Hospital and Medical Center	03859283	29	Female	No	1	5	543	Open Repair of Adult Ankle Fracture	ORIF ankle fracture (lateral malleolar fx)	Left	Butto, Danielle	DPM
07/08/2020	Gonzalez, Rafael	06/19/2020	1008	Saint Francis Hospital and Medical Center	03137739	37	Female	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastroc recession	Left	Balloch, Rachel	DPM
07/08/2020	Gonzalez, Rafael	06/23/2020	1012	Saint Francis Hospital and Medical Center	00420532	37	Male	Yes	1	5	542	Open Repair of Adult Rearfoot Fracture	ORIF calcaneal fracture, ORIF of bimalleolar ankle fracture	Right	Gambardella, Gabriel	DPM
07/08/2020	Gonzalez, Rafael	06/24/2020	1013	Saint Francis Hospital and Medical Center	11239307	45	Female	No	1	5	515	Delayed Primary or Secondary Repair of Ligamentous Structures	repair of chronic subluxing peroneal tendons by repair of SPR	Right	Litchfield, Andrew	DPM
07/08/2020	Gonzalez, Rafael	06/24/2020	1013	Saint Francis Hospital and Medical Center	11239307	45	Female	No	1	5	516	Tendon Augmentation/Supplementatio n/Restoration	repair of peroneal tendons by tenodesis	Right	Litchfield, Andrew	DPM
07/08/2020	Gonzalez, Rafael	06/24/2020	1014	Saint Francis Hospital and Medical Center	10310496	70	Female	No	1	5	543	Open Repair of Adult Ankle Fracture	ORIF fibular fracture	Right	Litchfield, Andrew	DPM
07/08/2020	Gonzalez, Rafael	06/24/2020	1014	Saint Francis Hospital and Medical Center	10310496	70	Female	No	1	5	516	Tendon Augmentation/Supplementatio n/Restoration	repair of peroneal brevis tendon	Right	Litchfield, Andrew	DPM
07/08/2020	Gonzalez, Rafael	06/24/2020	1015	Saint Francis Hospital and Medical Center	00215043	51	Female	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastroc recession	Left	Litchfield, Andrew	DPM
07/08/2020	Gonzalez, Rafael	06/24/2020	1015	Saint Francis Hospital and Medical Center	00215043	51	Female	No	1	5	524	Midfoot, Rearfoot, or Ankle Fusion	triple arthrodesis (STJ, TNJ, CCJ)	Left	Litchfield, Andrew	DPM
07/08/2020	Gonzalez, Rafael	06/25/2020	1017	Saint Francis Hospital and Medical Center	00705246	54	Female	No	1	5	546	Management of Bone/Joint Infection (With or Without Bone Graft)	partial excision of cuboid and 5th met	Left	Gambardella, Gabriel	DPM

07/08/2020	Gonzalez, Rafael	06/25/2020	1020	Saint Francis Hospital and Medical Center	03328383	71	Male	No	1	5	546	Management of Bone/Joint Infection (With or Without Bone Graft)	partial calcanectomy	Left	Gambardella, Gabriel	DPM
07/08/2020	Gonzalez, Rafael	06/26/2020	1024	Saint Francis Hospital and Medical Center	10616518	14	Female	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastroc recession	Left	Balloch, Rachel	DPM
07/08/2020	Gonzalez, Rafael	06/26/2020	1024	Saint Francis Hospital and Medical Center	10616518	14	Female	No	1	5	525	Midfoot, Rearfoot, or Tibial Osteotomy	kouts and evans calcaneal osteotomies	Left	Balloch, Rachel	DPM
08/03/2020	Gonzalez, Rafael	07/02/2020	1036	Saint Francis Hospital and Medical Center	03328383	71	Male	No	2	5	549	Application of multiplanar external fixation midfoot, rearfoot, ankle (does not include mini or mono rails)	application of circular ex fix	Left	Gambardella, Gabriel	DPM
08/03/2020	Gonzalez, Rafael	07/05/2020	1037	Saint Francis Hospital and Medical Center	00402238	39	Male	Yes	1	5	543	Open Repair of Adult Ankle Fracture	ORIF left ankle fracture with syndesmosis repair	Left	Tschudy, Matthew	DPM
08/03/2020	Gonzalez, Rafael	07/02/2020	1038	Bloomfield Ambulatory Surgery Center	10465	11	Female	No	1	5	526	Coalition Resection	CN bar resection	Left	Rode, Kurt	DPM
08/03/2020	Gonzalez, Rafael	07/08/2020	1043	Saint Francis Hospital and Medical Center	10323160	51	Male	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastroc recession	Left	Litchfield, Andrew	DPM
08/03/2020	Gonzalez, Rafael	07/08/2020	1043	Saint Francis Hospital and Medical Center	10323160	51	Male	No	1	5	525	Midfoot, Rearfoot, or Tibial Osteotomy	kouts calc osteotomy (2 screw fixation)	Left	Litchfield, Andrew	DPM
08/03/2020	Gonzalez, Rafael	07/08/2020	1043	Saint Francis Hospital and Medical Center	10323160	51	Male	No	1	5	525	Midfoot, Rearfoot, or Tibial Osteotomy	evans calc osteotomy	Left	Litchfield, Andrew	DPM
08/03/2020	Gonzalez, Rafael	07/08/2020	1043	Saint Francis Hospital and Medical Center	10323160	51	Male	No	1	5	512	Tendon Transfer Involving the Midfoot, Rearfoot, Ankle, or Leg	transfer of FDL to navicular tuberosity	Left	Litchfield, Andrew	DPM
08/03/2020	Gonzalez, Rafael	07/08/2020	1044	Saint Francis Hospital and Medical Center	11467006	23	Female	No	1	5	521	Operative Arthroscopy	ankle scope with debridement	Right	Litchfield, Andrew	DPM
08/03/2020	Gonzalez, Rafael	07/08/2020	1044	Saint Francis Hospital and Medical Center	11467006	23	Female	No	1	5	515	Delayed Primary or Secondary Repair of Ligamentous Structures	Lateral ankle stabilization via a modified Broström-Split Evans procedure	Right	Litchfield, Andrew	DPM
08/03/2020	Gonzalez, Rafael	07/09/2020	1045	Saint Francis Hospital and Medical Center	11459807	13	Male	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastroc recession	Left	Gambardella, Gabriel	DPM

08/03/2020	Gonzalez, Rafael	07/09/2020	1045	Saint Francis Hospital and Medical Center	11459807	13	Male	No	1	5	525	Midfoot, Rearfoot, or Tibial Osteotomy	kouts calc osteotomy, fixated with plate	Left	Gambardella, Gabriel	DPM
08/03/2020	Gonzalez, Rafael	07/09/2020	1045	Saint Francis Hospital and Medical Center	11459807	13	Male	No	1	5	525	Midfoot, Rearfoot, or Tibial Osteotomy	evans calc wedge osteotomy, fixated with staple	Left	Gambardella, Gabriel	DPM
08/03/2020	Gonzalez, Rafael	07/13/2020	1051	Saint Francis Hospital and Medical Center	03695367	58	Male	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastroc recession	Left	Balloch, Rachel	DPM
08/03/2020	Gonzalez, Rafael	07/13/2020	1053	Saint Francis Hospital and Medical Center	03780733	66	Female	No	1	5	524	Midfoot, Rearfoot, or Ankle Fusion	ankle fusion (3 screw technique with fibular take-down)	Right	Balloch, Rachel	DPM
08/03/2020	Gonzalez, Rafael	07/13/2020	1053	Saint Francis Hospital and Medical Center	03780733	66	Female	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastroc recession	Right	Balloch, Rachel	DPM
08/03/2020	Gonzalez, Rafael	07/23/2020	1057	Saint Francis Hospital and Medical Center	00886679	41	Male	No	1	5	547	Amputation Proximal to The Tarsometatarsal Joints	partial calc 2/2 OM	Left	Gambardella, Gabriel	DPM
08/03/2020	Gonzalez, Rafael	07/23/2020	1060	Saint Francis Hospital and Medical Center	00278511	48	Female	No	1	5	524	Midfoot, Rearfoot, or Ankle Fusion	triple arthrodesis	Right	Gambardella, Gabriel	DPM
08/03/2020	Gonzalez, Rafael	07/23/2020	1060	Saint Francis Hospital and Medical Center	00278511	48	Female	No	1	5	516	Tendon Augmentation/Supplementation/Restoration	Tenosynovectomy/bursectomy of the tibialis anterior tendon, right foot	Right	Gambardella, Gabriel	DPM
08/03/2020	Gonzalez, Rafael	07/29/2020	1062	Saint Francis Hospital and Medical Center	00886679	41	Male	No	1	5	511	Plastic Surgery Techniques Involving The Midfoot, Rearfoot, or Ankle	reverse sural artery flap	Left	Buonocore, Samuel	MD
08/03/2020	Gonzalez, Rafael	07/31/2020	1070	Saint Francis Hospital and Medical Center	03928169	26	Male	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastroc recesssion	Left	Balloch, Rachel	DPM
08/03/2020	Gonzalez, Rafael	07/31/2020	1070	Saint Francis Hospital and Medical Center	03928169	26	Male	No	1	5	525	Midfoot, Rearfoot, or Tibial Osteotomy	kouts calc osteotomy	Left	Balloch, Rachel	DPM
08/03/2020	Gonzalez, Rafael	07/31/2020	1071	Saint Francis Hospital and Medical Center	10780494	30	Female	No	1	5	516	Tendon Augmentation/Supplementation/Restoration	secondary repair of PT tendon	Right	Butto, Danielle	DPM
09/03/2020	Gonzalez, Rafael	08/05/2020	1077	Saint Francis Hospital and Medical Center	10071939	24	Female	No	1	5	521	Operative Arthroscopy	ankle arthroscopy and debridement	Right	Litchfield, Andrew	DPM
09/03/2020	Gonzalez, Rafael	08/05/2020	1077	Saint Francis Hospital and Medical Center	10071939	24	Female	No	1	5	515	Delayed Primary or Secondary Repair of Ligamentous Structures	open repair of lateral ankle ligaments (brostrom gould)	Right	Litchfield, Andrew	DPM

09/03/2020	Gonzalez, Rafael	08/05/2020	1077	Saint Francis Hospital and Medical Center	10071939	24	Female	No	1	5	542	Open Repair of Adult Rearfoot Fracture	ORIF right calcaneus secondary to delayed healing	Right	Litchfield, Andrew	DPM
09/03/2020	Gonzalez, Rafael	08/06/2020	1081	Saint Francis Hospital and Medical Center	11473571	63	Female	No	1	5	516	Tendon Augmentation/Supplementation/Restoration	repair of achilles tendon	Left	Gambardella, Gabriel	DPM
09/03/2020	Gonzalez, Rafael	08/06/2020	1081	Saint Francis Hospital and Medical Center	11473571	63	Female	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastroc recession	Left	Gambardella, Gabriel	DPM
09/03/2020	Gonzalez, Rafael	08/06/2020	1081	Saint Francis Hospital and Medical Center	11473571	63	Female	No	1	5	512	Tendon Transfer Involving the Midfoot, Rearfoot, Ankle, or Leg	transfer of FHL	Left	Gambardella, Gabriel	DPM
09/03/2020	Gonzalez, Rafael	08/06/2020	1084	Saint Francis Hospital and Medical Center	00549562	60	Male	No	1	5	524	Midfoot, Rearfoot, or Ankle Fusion	pantalar fusion	Right	Gambardella, Gabriel	DPM
09/03/2020	Gonzalez, Rafael	08/06/2020	1084	Saint Francis Hospital and Medical Center	00549562	60	Male	No	1	5	549	Application of multiplanar external fixation midfoot, rearfoot, ankle (does not include mini or mono rails)	application of circular ex fix	Right	Gambardella, Gabriel	DPM
09/03/2020	Gonzalez, Rafael	08/12/2020	1085	Saint Francis Hospital and Medical Center	00860818	40	Female	Yes	1	5	541	Open Repair of Adult Midfoot Fracture	ORIF lis franc injury	Left	Butto, Danielle	DPM
09/03/2020	Gonzalez, Rafael	08/14/2020	1087	Saint Francis Hospital and Medical Center	00886679	42	Male	No	1	5	511	Plastic Surgery Techniques Involving The Midfoot, Rearfoot, or Ankle	Debridement of left heel wound with a total of 162 square cm	Left	Buonocore, Samuel	MD
09/03/2020	Gonzalez, Rafael	08/26/2020	1088	Saint Francis Hospital and Medical Center	11478373	63	Female	No	1	5	528	Ankle Arthrotomy With Removal of Loose Body or Other Osteochondral Debridement	ankle scope and debridement & repair of talar OCD	Right	Litchfield, Andrew	DPM
09/03/2020	Gonzalez, Rafael	08/26/2020	1090	Saint Francis Hospital and Medical Center	11392793	22	Male	No	1	5	521	Operative Arthroscopy	R ankle scope and debridement	Right	Litchfield, Andrew	DPM
09/03/2020	Gonzalez, Rafael	08/26/2020	1090	Saint Francis Hospital and Medical Center	11392793	22	Male	No	1	5	515	Delayed Primary or Secondary Repair of Ligamentous Structures	Open secondary repair and stabilization of lateral ankle ligaments using stryker omega knotless suture anchor and 2 sonic anchors	Right	Litchfield, Andrew	DPM
09/03/2020	Gonzalez, Rafael	08/27/2020	1094	Saint Francis Hospital and Medical Center	00795350	50	Female	No	1	5	516	Tendon Augmentation/Supplementation/Restoration	repair of achilles tendon	Left	Gambardella, Gabriel	DPM

09/03/2020	Gonzalez, Rafael	08/27/2020	1094	Saint Francis Hospital and Medical Center	00795350	50	Female	No	1	5	516	Tendon Augmentation/Supplementation/Restoration	tubularization of peroneus brevis	Left	Gambardella, Gabriel	DPM
09/03/2020	Gonzalez, Rafael	08/27/2020	1095	Saint Francis Hospital and Medical Center	03670227	52	Male	Yes	1	5	543	Open Repair of Adult Ankle Fracture	ORIF bi mal ankle fracture with ORIF syndesmosis	Left	Gambardella, Gabriel	DPM
09/03/2020	Gonzalez, Rafael	08/27/2020	1096	Saint Francis Hospital and Medical Center	11470226	60	Female	No	1	5	524	Midfoot, Rearfoot, or Ankle Fusion	triple arthrodesis with medial column fusion	Right	Gambardella, Gabriel	DPM
10/14/2020	Gonzalez, Rafael	09/04/2020	1099	Saint Francis Hospital and Medical Center	11372096	62	Female	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastroc recession	Left	Balloch, Rachel	DPM
10/14/2020	Gonzalez, Rafael	09/04/2020	1099	Saint Francis Hospital and Medical Center	11372096	62	Female	No	1	5	524	Midfoot, Rearfoot, or Ankle Fusion	first NC fusion for flatfoot recon	Left	Balloch, Rachel	DPM
10/14/2020	Gonzalez, Rafael	09/04/2020	1099	Saint Francis Hospital and Medical Center	11372096	62	Female	No	1	5	525	Midfoot, Rearfoot, or Tibial Osteotomy	kouts calc osteotomy	Left	Balloch, Rachel	DPM
10/14/2020	Gonzalez, Rafael	09/04/2020	1099	Saint Francis Hospital and Medical Center	11372096	62	Female	No	1	5	516	Tendon Augmentation/Supplementation/Restoration	secondary repair of PT tendon	Left	Balloch, Rachel	DPM
10/14/2020	Gonzalez, Rafael	09/09/2020	1101	Saint Francis Hospital and Medical Center	11261237	22	Female	No	1	5	525	Midfoot, Rearfoot, or Tibial Osteotomy	dwyer calc osteotomy	Left	Litchfield, Andrew	DPM
10/14/2020	Gonzalez, Rafael	09/09/2020	1101	Saint Francis Hospital and Medical Center	11261237	22	Female	No	1	5	516	Tendon Augmentation/Supplementation/Restoration	secondary repair of lateral collateral ligaments with tendon allograft	Left	Litchfield, Andrew	DPM
10/14/2020	Gonzalez, Rafael	09/10/2020	1103	Saint Francis Hospital and Medical Center	11244125	25	Female	No	1	5	516	Tendon Augmentation/Supplementation/Restoration	excision of accessory peroneal muscle (quartus)	Right	Gambardella, Gabriel	DPM
10/14/2020	Gonzalez, Rafael	09/12/2020	1112	Saint Francis Hospital and Medical Center	10244608	75	Female	Yes	1	5	543	Open Repair of Adult Ankle Fracture	ORIF tri mal ankle fx	Left	Tschudy, Matthew	DPM
10/14/2020	Gonzalez, Rafael	09/14/2020	1113	Saint Francis Hospital and Medical Center	10295771	24	Male	Yes	1	5	543	Open Repair of Adult Ankle Fracture	ORIF trimal ankle fx	Right	Tschudy, Matthew	DPM
10/14/2020	Gonzalez, Rafael	09/15/2020	1114	Saint Francis Hospital and Medical Center	10238992	70	Male	Yes	1	5	543	Open Repair of Adult Ankle Fracture	ORIF displaced fibular fx	Right	Tschudy, Matthew	DPM
10/14/2020	Gonzalez, Rafael	09/17/2020	1117	Saint Francis Hospital and Medical Center	03125528	73	Female	Yes	1	5	543	Open Repair of Adult Ankle Fracture	ORIF bimal ankle fx	Left	Litchfield, Andrew	DPM
10/14/2020	Gonzalez, Rafael	09/17/2020	1118	Saint Francis Hospital and Medical Center	03502221	80	Female	Yes	1	5	543	Open Repair of Adult Ankle Fracture	ORIF distal fib fx with syndesmotic fixation	Right	Litchfield, Andrew	DPM

10/14/2020	Gonzalez, Rafael	09/17/2020	1119	Middlesex Hospital	412369	66	Male	No	1	5	524	Midfoot, Rearfoot, or Ankle Fusion	triple arthrodesis	Left	Adeleke, Adebola	DPM
10/14/2020	Gonzalez, Rafael	09/17/2020	1119	Middlesex Hospital	412369	66	Male	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastroc recession	Left	Adeleke, Adebola	DPM
10/14/2020	Gonzalez, Rafael	09/18/2020	1121	Saint Francis Hospital and Medical Center	00463402	61	Female	No	1	5	524	Midfoot, Rearfoot, or Ankle Fusion	ankle fusion, 3 screws	Right	Balloch, Rachel	DPM
10/14/2020	Gonzalez, Rafael	09/18/2020	1121	Saint Francis Hospital and Medical Center	00463402	61	Female	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastroc recession	Right	Balloch, Rachel	DPM
10/14/2020	Gonzalez, Rafael	09/24/2020	1128	Saint Francis Hospital and Medical Center	00411214	83	Male	No	1	5	546	Management of Bone/Joint Infection (With or Without Bone Graft)	debridement/saucerization of fibula for OM	Right	Gambardella, Gabriel	DPM
10/14/2020	Gonzalez, Rafael	09/24/2020	1129	Saint Francis Hospital and Medical Center	00297530	75	Female	Yes	1	5	521	Operative Arthroscopy	left ankle scope and debridement	Left	Gambardella, Gabriel	DPM
10/14/2020	Gonzalez, Rafael	09/24/2020	1129	Saint Francis Hospital and Medical Center	00297530	75	Female	Yes	1	5	543	Open Repair of Adult Ankle Fracture	ORIF distal fib fx	Left	Gambardella, Gabriel	DPM
10/14/2020	Gonzalez, Rafael	09/24/2020	1129	Saint Francis Hospital and Medical Center	00297530	75	Female	Yes	1	5	524	Midfoot, Rearfoot, or Ankle Fusion	triple arthrodesis	Left	Gambardella, Gabriel	DPM
10/14/2020	Gonzalez, Rafael	10/01/2020	1135	Middlesex Hospital	666570	18	Male	Yes	1	5	543	Open Repair of Adult Ankle Fracture	ORIF fibular shaft fx	Right	Adeleke, Adebola	DPM
10/14/2020	Gonzalez, Rafael	10/07/2020	1140	Saint Francis Hospital and Medical Center	11492318	37	Male	Yes	1	5	543	Open Repair of Adult Ankle Fracture	ORIF ankle fx and syndesmotic fixation	Right	Gambardella, Gabriel	DPM
10/14/2020	Gonzalez, Rafael	10/08/2020	1146	Saint Francis Hospital and Medical Center	03492955	55	Female	No	1	5	512	Tendon Transfer Involving the Midfoot, Rearfoot, Ankle, or Leg	FHL transfer	Right	Gambardella, Gabriel	DPM
10/14/2020	Gonzalez, Rafael	10/08/2020	1146	Saint Francis Hospital and Medical Center	03492955	55	Female	No	1	5	516	Tendon Augmentation/Supplementation/Restoration	repair and debridement of achilles tendon	Right	Gambardella, Gabriel	DPM
10/14/2020	Gonzalez, Rafael	10/08/2020	1146	Saint Francis Hospital and Medical Center	03492955	55	Female	No	2	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastroc recession	Right	Gambardella, Gabriel	DPM
10/14/2020	Gonzalez, Rafael	10/08/2020	1148	Saint Francis Hospital and Medical Center	10774431	57	Female	No	1	5	512	Tendon Transfer Involving the Midfoot, Rearfoot, Ankle, or Leg	FHL transfer	Right	Gambardella, Gabriel	DPM
10/14/2020	Gonzalez, Rafael	10/08/2020	1148	Saint Francis Hospital and Medical Center	10774431	57	Female	No	1	5	516	Tendon Augmentation/Supplementation/Restoration	repair and debridement of achilles tendon	Right	Gambardella, Gabriel	DPM

10/14/2020	Gonzalez, Rafael	10/08/2020	1148	Saint Francis Hospital and Medical Center	10774431	57	Female	No	2	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastrocnemius recession	Right	Gambardella, Gabriel	DPM
10/14/2020	Gonzalez, Rafael	10/12/2020	1152	Middlesex Hospital	137177	73	Female	Yes	1	5	543	Open Repair of Adult Ankle Fracture	ORIF of open/compound bimalleolar ankle fracture with syndesmotic fixation	Left	Adeleke, Adebola	DPM
11/25/2020	Gonzalez, Rafael	10/22/2020	1159	Saint Francis Hospital and Medical Center	00565655	44	Female	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastroc recession	Left	Gambardella, Gabriel	DPM
11/25/2020	Gonzalez, Rafael	10/22/2020	1159	Saint Francis Hospital and Medical Center	00565655	44	Female	No	1	5	516	Tendon Augmentation/Supplementation/Restoration	debridement and repair of achilles tendon	Left	Gambardella, Gabriel	DPM
11/25/2020	Gonzalez, Rafael	10/22/2020	1161	Saint Francis Hospital and Medical Center	00594613	78	Male	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastroc recession	Left	Gambardella, Gabriel	DPM
11/25/2020	Gonzalez, Rafael	10/22/2020	1162	Saint Francis Hospital and Medical Center	03624133	74	Female	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open achilles lengthening	Left	Gambardella, Gabriel	DPM
11/25/2020	Gonzalez, Rafael	10/22/2020	1163	Saint Francis Hospital and Medical Center	03768838	82	Male	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastroc recession	Left	Gambardella, Gabriel	DPM
11/25/2020	Gonzalez, Rafael	10/22/2020	1163	Saint Francis Hospital and Medical Center	03768838	82	Male	No	1	5	516	Tendon Augmentation/Supplementation/Restoration	repair of achilles tendon	Left	Gambardella, Gabriel	DPM
11/25/2020	Gonzalez, Rafael	10/28/2020	1166	Saint Francis Hospital and Medical Center	11208356	52	Male	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastroc recession	Left	Litchfield, Andrew	DPM
11/25/2020	Gonzalez, Rafael	10/28/2020	1169	Saint Francis Hospital and Medical Center	11475263	61	Male	No	1	5	516	Tendon Augmentation/Supplementation/Restoration	debridement and tenodesis of PT tendon to FDL	Left	Litchfield, Andrew	DPM
11/25/2020	Gonzalez, Rafael	10/28/2020	1169	Saint Francis Hospital and Medical Center	11475263	61	Male	No	1	5	512	Tendon Transfer Involving the Midfoot, Rearfoot, Ankle, or Leg	FDL transfer to navicular	Left	Litchfield, Andrew	DPM
11/25/2020	Gonzalez, Rafael	10/28/2020	1169	Saint Francis Hospital and Medical Center	11475263	61	Male	No	1	5	515	Delayed Primary or Secondary Repair of Ligamentous Structures	repair of spring ligament	Left	Litchfield, Andrew	DPM
11/25/2020	Gonzalez, Rafael	10/28/2020	1169	Saint Francis Hospital and Medical Center	11475263	61	Male	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastroc recession	Left	Litchfield, Andrew	DPM

11/25/2020	Gonzalez, Rafael	10/28/2020	1169	Saint Francis Hospital and Medical Center	11475263	61	Male	No	1	5	525	Midfoot, Rearfoot, or Tibial Osteotomy	kouts calc osteotomy	Left	Litchfield, Andrew	DPM
11/25/2020	Gonzalez, Rafael	10/28/2020	1169	Saint Francis Hospital and Medical Center	11475263	61	Male	No	1	5	525	Midfoot, Rearfoot, or Tibial Osteotomy	evans calc osteotomy	Left	Litchfield, Andrew	DPM
11/25/2020	Gonzalez, Rafael	10/29/2020	1171	Middlesex Hospital	930169	70	Female	No	1	5	524	Midfoot, Rearfoot, or Ankle Fusion	TN fusion	Left	Adeleke, Adebola	DPM
11/25/2020	Gonzalez, Rafael	11/04/2020	1173	Saint Francis Hospital and Medical Center	11456051	15	Female	No	1	5	521	Operative Arthroscopy	ankle scope with debridement	Left	Litchfield, Andrew	DPM
11/25/2020	Gonzalez, Rafael	11/04/2020	1173	Saint Francis Hospital and Medical Center	11456051	15	Female	No	1	5	515	Delayed Primary or Secondary Repair of Ligamentous Structures	lateral ankle stabilization	Left	Litchfield, Andrew	DPM
11/25/2020	Gonzalez, Rafael	11/04/2020	1174	Saint Francis Hospital and Medical Center	11499246	19	Male	Yes	1	5	543	Open Repair of Adult Ankle Fracture	ORIF bi mal ankle fx with syndesmotic fixation	Right	Litchfield, Andrew	DPM
11/25/2020	Gonzalez, Rafael	11/04/2020	1175	Saint Francis Hospital and Medical Center	10172428	31	Male	No	1	5	528	Ankle Arthrotomy With Removal of Loose Body or Other Osteochondral Debridement	Open excision and repair of osteochondral lesion with talar osteochondral allograft, utilizing medial mal takedown	Left	Litchfield, Andrew	DPM
11/25/2020	Gonzalez, Rafael	11/05/2020	1177	Saint Francis Hospital and Medical Center	11497105	45	Female	No	1	5	516	Tendon Augmentation/Supplementation/Restoration	repair of PB tendon	Right	Gambardella, Gabriel	DPM
11/25/2020	Gonzalez, Rafael	11/05/2020	1179	Saint Francis Hospital and Medical Center	00874188	32	Female	No	1	5	521	Operative Arthroscopy	ankle scope and debridement	Right	Gambardella, Gabriel	DPM
11/25/2020	Gonzalez, Rafael	11/05/2020	1179	Saint Francis Hospital and Medical Center	00874188	32	Female	No	1	5	516	Tendon Augmentation/Supplementation/Restoration	repair of PB and tenolysis of PL	Right	Gambardella, Gabriel	DPM
11/25/2020	Gonzalez, Rafael	11/05/2020	1180	Saint Francis Hospital and Medical Center	03412257	57	Female	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastroc recession	Right	Gambardella, Gabriel	DPM
11/25/2020	Gonzalez, Rafael	11/11/2020	1186	Saint Francis Hospital and Medical Center	11258490	41	Female	Yes	1	5	543	Open Repair of Adult Ankle Fracture	ORIF trimal with syndesmotic fixation	Right	Balloch, Rachel	DPM
11/25/2020	Gonzalez, Rafael	11/11/2020	1187	Saint Francis Hospital and Medical Center	11501367	24	Male	Yes	1	5	543	Open Repair of Adult Ankle Fracture	ORIF fib fx	Right	Balloch, Rachel	DPM
11/25/2020	Gonzalez, Rafael	11/16/2020	1188	Saint Francis Hospital and Medical Center	03496314	64	Male	No	1	5	516	Tendon Augmentation/Supplementation/Restoration	debridement and repair of achilles tendon	Right	Litchfield, Andrew	DPM

11/25/2020	Gonzalez, Rafael	11/16/2020	1190	Saint Francis Hospital and Medical Center	00555634	57	Male	Yes	1	5	543	Open Repair of Adult Ankle Fracture	ORIF bi mal ankle fx	Right	Litchfield, Andrew	DPM
11/25/2020	Gonzalez, Rafael	11/16/2020	1191	Saint Francis Hospital and Medical Center	00839292	70	Female	Yes	1	5	543	Open Repair of Adult Ankle Fracture	ORIF bi mal ankle fx	Left	Litchfield, Andrew	DPM
12/28/2020	Gonzalez, Rafael	11/19/2020	1193	Saint Francis Hospital and Medical Center	00653711	88	Female	No	2	5	546	Management of Bone/Joint Infection (With or Without Bone Graft)	partial calcanectomy 2/2 OM	Left	Gambardella, Gabriel	DPM
12/28/2020	Gonzalez, Rafael	11/19/2020	1200	Saint Francis Hospital and Medical Center	11378213	50	Female	No	1	5	521	Operative Arthroscopy	ankle scope and debridement with microfracture	Right	Gambardella, Gabriel	DPM
12/28/2020	Gonzalez, Rafael	11/19/2020	1200	Saint Francis Hospital and Medical Center	11378213	50	Female	No	1	5	515	Delayed Primary or Secondary Repair of Ligamentous Structures	brostrom gould procedure	Right	Gambardella, Gabriel	DPM
12/28/2020	Gonzalez, Rafael	11/19/2020	1200	Saint Francis Hospital and Medical Center	11378213	50	Female	No	1	5	516	Tendon Augmentation/Supplementation/Restoration	repair of peroneal tendons	Right	Gambardella, Gabriel	DPM
12/28/2020	Gonzalez, Rafael	11/19/2020	1201	Saint Francis Hospital and Medical Center	03434364	61	Female	No	1	5	521	Operative Arthroscopy	ankle scope with debridement and microfracture	Right	Gambardella, Gabriel	DPM
12/28/2020	Gonzalez, Rafael	11/19/2020	1201	Saint Francis Hospital and Medical Center	03434364	61	Female	No	1	5	524	Midfoot, Rearfoot, or Ankle Fusion	triple arthrodesis	Right	Gambardella, Gabriel	DPM
12/28/2020	Gonzalez, Rafael	11/19/2020	1201	Saint Francis Hospital and Medical Center	03434364	61	Female	No	1	5	515	Delayed Primary or Secondary Repair of Ligamentous Structures	repair of ATFL	Right	Gambardella, Gabriel	DPM
12/28/2020	Gonzalez, Rafael	11/19/2020	1203	Saint Francis Hospital and Medical Center	03700142	54	Male	Yes	1	5	543	Open Repair of Adult Ankle Fracture	ORIF distal fib fracture and syndesmosis fixation	Left	Gambardella, Gabriel	DPM
12/28/2020	Gonzalez, Rafael	11/20/2020	1208	Saint Francis Hospital and Medical Center	03485984	23	Female	No	1	5	523	Subtalar Arthroeresis	MBA implant	Left	Balloch, Rachel	DPM
12/28/2020	Gonzalez, Rafael	11/20/2020	1208	Saint Francis Hospital and Medical Center	03485984	23	Female	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastroc recession	Left	Balloch, Rachel	DPM
12/28/2020	Gonzalez, Rafael	11/25/2020	1213	Saint Francis Hospital and Medical Center	11417883	19	Female	No	1	5	521	Operative Arthroscopy	right ankle scope and debridement	Right	Litchfield, Andrew	DPM
12/28/2020	Gonzalez, Rafael	11/25/2020	1213	Saint Francis Hospital and Medical Center	11417883	19	Female	No	1	5	515	Delayed Primary or Secondary Repair of Ligamentous Structures	brostrom gould procedure	Right	Litchfield, Andrew	DPM

12/28/2020	Gonzalez, Rafael	11/25/2020	1213	Saint Francis Hospital and Medical Center	11417883	19	Female	No	1	5	516	Tendon Augmentation/Supplementation/Restoration	repair of peroneal tendons	Right	Litchfield, Andrew	DPM
12/28/2020	Gonzalez, Rafael	11/25/2020	1214	Saint Francis Hospital and Medical Center	00614860	57	Female	No	1	5	516	Tendon Augmentation/Supplementation/Restoration	excision of os peroneum & repair of peroneus longus	Left	Litchfield, Andrew	DPM
12/28/2020	Gonzalez, Rafael	12/03/2020	1217	Saint Francis Hospital and Medical Center	11494324	21	Female	No	1	5	521	Operative Arthroscopy	ankle scope and debridement	Right	Pascarella, Raffaella	DPM
12/28/2020	Gonzalez, Rafael	12/03/2020	1217	Saint Francis Hospital and Medical Center	11494324	21	Female	No	1	5	515	Delayed Primary or Secondary Repair of Ligamentous Structures	lateral ankle stabilization	Right	Pascarella, Raffaella	DPM
12/28/2020	Gonzalez, Rafael	12/03/2020	1217	Saint Francis Hospital and Medical Center	11494324	21	Female	No	1	5	516	Tendon Augmentation/Supplementation/Restoration	repair of peroneus brevis	Right	Pascarella, Raffaella	DPM
01/27/2021	Gonzalez, Rafael	12/10/2020	1230	Saint Francis Hospital and Medical Center	00378724	56	Female	No	1	5	524	Midfoot, Rearfoot, or Ankle Fusion	STJ & TNJ AD	Left	Gambardella, Gabriel	DPM
01/27/2021	Gonzalez, Rafael	12/10/2020	1231	Saint Francis Hospital and Medical Center	00384151	41	Female	No	1	5	524	Midfoot, Rearfoot, or Ankle Fusion	STJ and TNJ fusion	Right	Gambardella, Gabriel	DPM
01/27/2021	Gonzalez, Rafael	12/16/2020	1237	Saint Francis Hospital and Medical Center	00363708	68	Female	Yes	1	5	531	Repair of Acute Tendon Injury	repair of ruptured achilles tendon	Right	Pascarella, Raffaella	DPM
01/27/2021	Gonzalez, Rafael	12/16/2020	1237	Saint Francis Hospital and Medical Center	00363708	68	Female	Yes	1	5	512	Tendon Transfer Involving the Midfoot, Rearfoot, Ankle, or Leg	FHL transfer	Right	Pascarella, Raffaella	DPM
01/27/2021	Gonzalez, Rafael	12/16/2020	1237	Saint Francis Hospital and Medical Center	00363708	68	Female	Yes	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	V to Y gastroc recession	Right	Pascarella, Raffaella	DPM
01/27/2021	Gonzalez, Rafael	12/17/2020	1239	Middlesex Hospital	949024	70	Female	No	1	5	524	Midfoot, Rearfoot, or Ankle Fusion	ankle arthrodesis via anterior approach	Right	Adeleke, Adebola	DPM
01/27/2021	Gonzalez, Rafael	12/20/2020	1242	Saint Francis Hospital and Medical Center	11513896	47	Male	Yes	1	5	543	Open Repair of Adult Ankle Fracture	ORIF distal fib fx	Left	Gambardella, Gabriel	DPM
01/27/2021	Gonzalez, Rafael	12/21/2020	1243	Saint Francis Hospital and Medical Center	10064382	58	Male	No	1	5	516	Tendon Augmentation/Supplementation/Restoration	Debridement and repair of peroneus brevis tendon with tenodesis	Right	Litchfield, Andrew	DPM
01/27/2021	Gonzalez, Rafael	12/21/2020	1244	Saint Francis Hospital and Medical Center	00293811	78	Female	No	1	5	521	Operative Arthroscopy	Right ankle arthroscopy with debridement and microfracture of osteochondral lesion of the talus	Right	Litchfield, Andrew	DPM

01/27/2021	Gonzalez, Rafael	12/21/2020	1244	Saint Francis Hospital and Medical Center	00293811	78	Female	No	1	5	515	Delayed Primary or Secondary Repair of Ligamentous Structures	secondary repair of lateral collateral ankle ligaments	Right	Litchfield, Andrew	DPM
01/27/2021	Gonzalez, Rafael	12/28/2020	1246	Saint Francis Hospital and Medical Center	00865507	74	Female	No	1	5	524	Midfoot, Rearfoot, or Ankle Fusion	STJ fusion	Left	Tschudy, Matthew	DPM
01/27/2021	Gonzalez, Rafael	12/30/2020	1248	Saint Francis Hospital and Medical Center	03506721	91	Male	Yes	1	5	543	Open Repair of Adult Ankle Fracture	ORIF bi mal ankle fracture with syndesmotic fixation	Left	Litchfield, Andrew	DPM
01/27/2021	Gonzalez, Rafael	12/30/2020	1249	Saint Francis Hospital and Medical Center	00107617	61	Male	No	1	5	521	Operative Arthroscopy	left ankle scope and debridement, repair of OCD with biocartilage	Left	Litchfield, Andrew	DPM
01/27/2021	Gonzalez, Rafael	12/30/2020	1249	Saint Francis Hospital and Medical Center	00107617	61	Male	No	1	5	515	Delayed Primary or Secondary Repair of Ligamentous Structures	secondary repair of deltoid ligament	Left	Litchfield, Andrew	DPM
01/27/2021	Gonzalez, Rafael	12/30/2020	1250	Saint Francis Hospital and Medical Center	00990421	64	Male	No	1	5	524	Midfoot, Rearfoot, or Ankle Fusion	STJ TNJ fusion	Left	Litchfield, Andrew	DPM
01/27/2021	Gonzalez, Rafael	12/30/2020	1250	Saint Francis Hospital and Medical Center	00990421	64	Male	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	left open gastroc recession	Left	Litchfield, Andrew	DPM
01/27/2021	Gonzalez, Rafael	01/06/2021	1252	Saint Francis Hospital and Medical Center	10321723	61	Female	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastroc recession	Right	Balloch, Rachel	DPM
01/27/2021	Gonzalez, Rafael	01/06/2021	1252	Saint Francis Hospital and Medical Center	10321723	61	Female	No	1	5	525	Midfoot, Rearfoot, or Tibial Osteotomy	kouts calc osteotomy	Right	Balloch, Rachel	DPM
01/27/2021	Gonzalez, Rafael	01/06/2021	1252	Saint Francis Hospital and Medical Center	10321723	61	Female	No	1	5	516	Tendon Augmentation/Supplementatio n/Restoration	PT tendon repair	Right	Balloch, Rachel	DPM
01/27/2021	Gonzalez, Rafael	01/06/2021	1253	Saint Francis Hospital and Medical Center	00987654	43	Female	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastroc recession	Right	Balloch, Rachel	DPM
01/27/2021	Gonzalez, Rafael	01/06/2021	1253	Saint Francis Hospital and Medical Center	00987654	43	Female	No	1	5	525	Midfoot, Rearfoot, or Tibial Osteotomy	kouts calc osteotomy	Right	Balloch, Rachel	DPM
01/27/2021	Gonzalez, Rafael	01/06/2021	1253	Saint Francis Hospital and Medical Center	00987654	43	Female	No	1	5	512	Tendon Transfer Involving the Midfoot, Rearfoot, Ankle, or Leg	transfer of FDL tendon	Right	Balloch, Rachel	DPM
01/27/2021	Gonzalez, Rafael	01/07/2021	1256	Saint Francis Hospital and Medical Center	00650092	73	Female	No	1	5	524	Midfoot, Rearfoot, or Ankle Fusion	ankle fusion (anterior approach, anterolateral plate) & NC fusion	Left	Gambardella, Gabriel	DPM

01/27/2021	Gonzalez, Rafael	01/07/2021	1259	Saint Francis Hospital and Medical Center	10773932	91	Male	No	1	5	524	Midfoot, Rearfoot, or Ankle Fusion	Ankle and STJ fusion	Right	Gambardella, Gabriel	DPM
01/27/2021	Gonzalez, Rafael	01/07/2021	1259	Saint Francis Hospital and Medical Center	10773932	91	Male	No	1	5	549	Application of multiplanar external fixation midfoot, rearfoot, ankle (does not include mini or mono rails)	application of circular ex fix	Right	Gambardella, Gabriel	DPM
01/27/2021	Gonzalez, Rafael	01/14/2021	1263	Middlesex Hospital	1040748	39	Female	No	1	5	521	Operative Arthroscopy	R ankle scope and debridement	Right	Adeleke, Adebola	DPM
01/27/2021	Gonzalez, Rafael	01/14/2021	1263	Middlesex Hospital	1040748	39	Female	No	1	5	515	Delayed Primary or Secondary Repair of Ligamentous Structures	syndesmotic repair with screw fixation	Right	Adeleke, Adebola	DPM
01/27/2021	Gonzalez, Rafael	01/14/2021	1263	Middlesex Hospital	1040748	39	Female	No	1	5	515	Delayed Primary or Secondary Repair of Ligamentous Structures	lateral ankle stabilization.. brostrom and internal brace	Right	Adeleke, Adebola	DPM
01/27/2021	Gonzalez, Rafael	01/11/2021	1265	Saint Francis Hospital and Medical Center	00294170	66	Female	No	1	5	521	Operative Arthroscopy	ankle scope with debridement, arthrotomy	Right	Litchfield, Andrew	DPM
02/26/2021	Gonzalez, Rafael	01/21/2021	1270	Saint Francis Hospital and Medical Center	03705629	62	Female	No	1	5	524	Midfoot, Rearfoot, or Ankle Fusion	pantalar fusion with orthofix IM nail, CCj with staples, TNj with screws/staples	Left	Gambardella, Gabriel	DPM
02/26/2021	Gonzalez, Rafael	01/21/2021	1270	Saint Francis Hospital and Medical Center	03705629	62	Female	No	1	5	549	Application of multiplanar external fixation midfoot, rearfoot, ankle (does not include mini or mono rails)	application of circular ex fix	Left	Gambardella, Gabriel	DPM
02/26/2021	Gonzalez, Rafael	01/25/2021	1275	Saint Francis Hospital and Medical Center	00597906	55	Female	Yes	1	5	543	Open Repair of Adult Ankle Fracture	fib fx ORIF	Left	Tschudy, Matthew	DPM
02/26/2021	Gonzalez, Rafael	01/27/2021	1276	Saint Francis Hospital and Medical Center	00559192	73	Male	Yes	2	5	531	Repair of Acute Tendon Injury	open achilles rupture repair	Right	Litchfield, Andrew	DPM
02/26/2021	Gonzalez, Rafael	01/28/2021	1277	Middlesex Hospital	429108	28	Male	Yes	1	5	543	Open Repair of Adult Ankle Fracture	ORIF distal fib fx and syndesmotic fixation	Right	Adeleke, Adebola	DPM
02/26/2021	Gonzalez, Rafael	02/03/2021	1280	Saint Francis Hospital and Medical Center	00599089	56	Female	No	1	5	521	Operative Arthroscopy	left ankle scope and debridement	Left	Litchfield, Andrew	DPM
02/26/2021	Gonzalez, Rafael	02/03/2021	1280	Saint Francis Hospital and Medical Center	00599089	56	Female	No	1	5	515	Delayed Primary or Secondary Repair of Ligamentous Structures	open repair of lateral ankle ligaments	Left	Litchfield, Andrew	DPM
02/26/2021	Gonzalez, Rafael	02/03/2021	1280	Saint Francis Hospital and Medical Center	00599089	56	Female	No	1	5	515	Delayed Primary or Secondary Repair of Ligamentous Structures	open direct repair of distal tibiofibular syndesmosis	Left	Litchfield, Andrew	DPM

02/26/2021	Gonzalez, Rafael	02/03/2021	1281	Saint Francis Hospital and Medical Center	03343220	44	Male	No	1	5	512	Tendon Transfer Involving the Midfoot, Rearfoot, Ankle, or Leg	FHL tendon transfer	Left	Litchfield, Andrew	DPM
03/30/2021	Gonzalez, Rafael	02/16/2021	1286	Saint Francis Hospital and Medical Center	03485484	26	Female	Yes	1	5	543	Open Repair of Adult Ankle Fracture	ORIF bimal equivalent ankle fracture, repair of deltoid ligament, repair of talar OCD	Left	Litchfield, Andrew	DPM
03/30/2021	Gonzalez, Rafael	02/16/2021	1287	Saint Francis Hospital and Medical Center	11533746	29	Male	Yes	1	5	543	Open Repair of Adult Ankle Fracture	Open reduction internal fixation of a fibular shaft fracture, right lower extremity Repair of distal tibiofibular syndesmosis with suture button, right ankle	Right	Litchfield, Andrew	DPM
03/30/2021	Gonzalez, Rafael	02/18/2021	1289	Saint Francis Hospital and Medical Center	03610051	54	Female	No	1	5	512	Tendon Transfer Involving the Midfoot, Rearfoot, Ankle, or Leg	FHL tendon transfer	Right	Gambardella, Gabriel	DPM
03/30/2021	Gonzalez, Rafael	02/18/2021	1290	Saint Francis Hospital and Medical Center	03610051	54	Female	No	1	5	512	Tendon Transfer Involving the Midfoot, Rearfoot, Ankle, or Leg	FHL tendon transfer	Right	Gambardella, Gabriel	DPM
03/30/2021	Gonzalez, Rafael	02/18/2021	1294	Saint Francis Hospital and Medical Center	00980876	62	Female	No	1	5	521	Operative Arthroscopy	ankle scope with debridement	Right	Gambardella, Gabriel	DPM
03/30/2021	Gonzalez, Rafael	02/26/2021	1295	Saint Francis Hospital and Medical Center	10169757	41	Female	Yes	1	5	543	Open Repair of Adult Ankle Fracture	ORIF distal fib fx	Right	Litchfield, Andrew	DPM
03/30/2021	Gonzalez, Rafael	02/26/2021	1296	Saint Francis Hospital and Medical Center	00625639	58	Male	Yes	1	5	543	Open Repair of Adult Ankle Fracture	ORIF tri mal ankle fx with syndesmotic fixation	Right	Gambardella, Gabriel	DPM
03/30/2021	Gonzalez, Rafael	03/02/2021	1297	Saint Francis Hospital and Medical Center	00909426	54	Female	No	1	5	524	Midfoot, Rearfoot, or Ankle Fusion	triple arthrodesis	Left	Tschudy, Matthew	DPM
03/30/2021	Gonzalez, Rafael	03/02/2021	1297	Saint Francis Hospital and Medical Center	00909426	54	Female	No	1	5	516	Tendon Augmentation/Supplementation/Restoration	PB tendon repair and tenodesis	Left	Tschudy, Matthew	DPM
03/30/2021	Gonzalez, Rafael	03/04/2021	1300	Saint Francis Hospital and Medical Center	10119727	50	Male	No	1	5	546	Management of Bone/Joint Infection (With or Without Bone Graft)	partial calc 2/2 OM	Right	Gambardella, Gabriel	DPM
03/30/2021	Gonzalez, Rafael	03/04/2021	1302	Saint Francis Hospital and Medical Center	11459807	14	Male	No	1	5	525	Midfoot, Rearfoot, or Tibial Osteotomy	evans and kouts	Right	Gambardella, Gabriel	DPM

03/30/2021	Gonzalez, Rafael	03/04/2021	1302	Saint Francis Hospital and Medical Center	11459807	14	Male	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastroc recession	Right	Gambardella, Gabriel	DPM
03/30/2021	Gonzalez, Rafael	03/04/2021	1302	Saint Francis Hospital and Medical Center	11459807	14	Male	No	1	5	516	Tendon Augmentation/Supplementation/Restoration	kidner	Right	Gambardella, Gabriel	DPM
03/30/2021	Gonzalez, Rafael	03/04/2021	1304	Saint Francis Hospital and Medical Center	11461211	37	Female	No	1	5	521	Operative Arthroscopy	ankle scope and debridement	Left	Gambardella, Gabriel	DPM
03/30/2021	Gonzalez, Rafael	03/04/2021	1304	Saint Francis Hospital and Medical Center	11461211	37	Female	No	1	5	516	Tendon Augmentation/Supplementation/Restoration	debridement and repair of PB tendon	Left	Gambardella, Gabriel	DPM
03/30/2021	Gonzalez, Rafael	03/04/2021	1304	Saint Francis Hospital and Medical Center	11461211	37	Female	No	1	5	515	Delayed Primary or Secondary Repair of Ligamentous Structures	lateral ankle stabilization	Left	Gambardella, Gabriel	DPM
03/30/2021	Gonzalez, Rafael	03/04/2021	1305	Saint Francis Hospital and Medical Center	11269239	31	Female	Yes	1	5	541	Open Repair of Adult Midfoot Fracture	lis franc injury, AD of 2nd TMTJ, excision of navicular fx	Right	Gambardella, Gabriel	DPM
03/30/2021	Gonzalez, Rafael	03/06/2021	1306	Saint Francis Hospital and Medical Center	03606084	69	Female	No	1	5	524	Midfoot, Rearfoot, or Ankle Fusion	ankle fusion, anterior approach	Right	Balloch, Rachel	DPM
03/30/2021	Gonzalez, Rafael	03/10/2021	1309	Saint Francis Hospital and Medical Center	00860818	41	Female	Yes	1	5	541	Open Repair of Adult Midfoot Fracture	lis franc injury, fusion of 1st and 2nd TMTJ and intercuneiform AD	Left	Bruce, Amy	DPM
03/30/2021	Gonzalez, Rafael	03/11/2021	1311	Middlesex Hospital	9026602	65	Male	No	1	5	524	Midfoot, Rearfoot, or Ankle Fusion	revision STJ fusion	Left	Adeleke, Adebola	DPM
03/30/2021	Gonzalez, Rafael	03/11/2021	1312	Middlesex Hospital	378751	49	Male	Yes	1	5	542	Open Repair of Adult Rearfoot Fracture	ORIF intra-articular displaced comminuted calc fracture	Right	Adeleke, Adebola	DPM
03/30/2021	Gonzalez, Rafael	03/18/2021	1319	Saint Francis Hospital and Medical Center	03283991	32	Male	Yes	1	5	531	Repair of Acute Tendon Injury	open achilles tendon rupture repair	Right	Gambardella, Gabriel	DPM
03/30/2021	Gonzalez, Rafael	03/18/2021	1321	Saint Francis Hospital and Medical Center	03359575	71	Male	Yes	1	5	543	Open Repair of Adult Ankle Fracture	ORIF distal fib fx	Right	Gambardella, Gabriel	DPM
04/29/2021	Gonzalez, Rafael	03/24/2021	1323	Saint Francis Hospital and Medical Center	00714476	48	Female	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastroc recession	Right	Litchfield, Andrew	DPM
04/29/2021	Gonzalez, Rafael	03/31/2021	1328	Saint Francis Hospital and Medical Center	03025404	76	Male	Yes	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastroc recession	Right	Litchfield, Andrew	DPM

04/29/2021	Gonzalez, Rafael	03/31/2021	1328	Saint Francis Hospital and Medical Center	03025404	76	Male	Yes	1	5	524	Midfoot, Rearfoot, or Ankle Fusion	STJ TNJ AD	Right	Litchfield, Andrew	DPM
04/29/2021	Gonzalez, Rafael	03/31/2021	1328	Saint Francis Hospital and Medical Center	03025404	76	Male	Yes	1	5	532	Repair of Acute Ligament Injury	repair of deltoid rupture	Right	Litchfield, Andrew	DPM
04/29/2021	Gonzalez, Rafael	04/11/2021	1331	Saint Francis Hospital and Medical Center	00516672	65	Male	Yes	1	5	543	Open Repair of Adult Ankle Fracture	ORIF tri mal ankle fracture with synchfix repair of syndesmosis	Left	Pascarella, Raffaella	DPM
04/29/2021	Gonzalez, Rafael	04/19/2021	1343	Saint Francis Hospital and Medical Center	10080235	24	Male	No	1	5	536	Open Repair of Dislocation (Proximal to Tarsometatarsal Joints)	Open repair of dislocating peroneal tendons, right ankle	Right	Litchfield, Andrew	DPM
04/29/2021	Gonzalez, Rafael	04/19/2021	1344	Saint Francis Hospital and Medical Center	00885880	70	Male	No	1	5	513	Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	open gastroc recession	Right	Litchfield, Andrew	DPM
06/01/2021	Gonzalez, Rafael	04/28/2021	1348	Saint Francis Hospital and Medical Center	11529024	19	Male	No	1	5	516	Tendon Augmentation/Supplementation/Restoration	repair PT tendon	Left	Butto, Danielle	DPM
06/01/2021	Gonzalez, Rafael	04/28/2021	1348	Saint Francis Hospital and Medical Center	11529024	19	Male	No	1	5	524	Midfoot, Rearfoot, or Ankle Fusion	resection of coalition with STJ AD	Right	Butto, Danielle	DPM
06/01/2021	Gonzalez, Rafael	04/28/2021	1350	Saint Francis Hospital and Medical Center	00302378	47	Female	Yes	1	5	543	Open Repair of Adult Ankle Fracture	ORIF distal fib with syndesmotic screw repair	Left	Balloch, Rachel	DPM
06/01/2021	Gonzalez, Rafael	04/29/2021	1352	Saint Francis Hospital and Medical Center	03834389	49	Male	No	1	5	515	Delayed Primary or Secondary Repair of Ligamentous Structures	anterior talofibular ligament repair with lateral ankle stabilization and internal brace, left ankle	Left	Gambardella, Gabriel	DPM
06/01/2021	Gonzalez, Rafael	04/29/2021	1352	Saint Francis Hospital and Medical Center	03834389	49	Male	No	1	5	521	Operative Arthroscopy	Left ankle arthroscopy with debridement and synovectomy, with osteochondral defect, with excision and microfracture, subchondroplasty of the talus, left ankle	Left	Gambardella, Gabriel	DPM
06/01/2021	Gonzalez, Rafael	04/29/2021	1352	Saint Francis Hospital and Medical Center	03834389	49	Male	No	1	5	516	Tendon Augmentation/Supplementation/Restoration	Debridement, synovectomy, and repair of peroneus brevis tendon, left ankle	Left	Gambardella, Gabriel	DPM

06/01/2021	Gonzalez, Rafael	04/29/2021	1353	Saint Francis Hospital and Medical Center	00835869	28	Female	No	1	5	521	Operative Arthroscopy	Left ankle arthroscopy with extensive debridement and synovectomy, with excision of osteochondral defect, microfracture, and subchondroplasty of the talus	Left	Gambardella, Gabriel	DPM
06/01/2021	Gonzalez, Rafael	04/29/2021	1353	Saint Francis Hospital and Medical Center	00835869	28	Female	No	1	5	515	Delayed Primary or Secondary Repair of Ligamentous Structures	anterior talofibular ligament repair with lateral ankle stabilization and internal brace, left ankle	Left	Gambardella, Gabriel	DPM
06/01/2021	Gonzalez, Rafael	04/29/2021	1355	Saint Francis Hospital and Medical Center	00790464	30	Female	Yes	1	5	543	Open Repair of Adult Ankle Fracture	ORIF distal fib	Left	Gambardella, Gabriel	DPM
06/21/2021	Gonzalez, Rafael	05/05/2021	1357	Saint Francis Hospital and Medical Center	10270679	74	Female	No	1	5	516	Tendon Augmentation/Supplementation/Restoration	Debridement and tenodesis of peroneal tendons, left foot and ankle	Left	Litchfield, Andrew	DPM
06/21/2021	Gonzalez, Rafael	05/26/2021	1360	Saint Francis Hospital and Medical Center	11603268	33	Female	Yes	1	5	543	Open Repair of Adult Ankle Fracture	ORIF distal fib fx and syndesmosis	Left	Litchfield, Andrew	DPM
06/21/2021	Gonzalez, Rafael	05/26/2021	1361	Saint Francis Hospital and Medical Center	11261237	23	Female	No	1	5	521	Operative Arthroscopy	left ankle scope	Left	Litchfield, Andrew	DPM
06/21/2021	Gonzalez, Rafael	05/26/2021	1361	Saint Francis Hospital and Medical Center	11261237	23	Female	No	1	5	515	Delayed Primary or Secondary Repair of Ligamentous Structures	open repair of lateral ankle ligaments	Left	Litchfield, Andrew	DPM
06/21/2021	Gonzalez, Rafael	05/26/2021	1361	Saint Francis Hospital and Medical Center	11261237	23	Female	No	1	5	516	Tendon Augmentation/Supplementation/Restoration	repair of peroneal tendons	Left	Litchfield, Andrew	DPM
06/21/2021	Gonzalez, Rafael	06/02/2021	1362	Saint Francis Hospital and Medical Center	10210420	50	Female	No	1	5	524	Midfoot, Rearfoot, or Ankle Fusion	TN NC (medial column) fusion	Right	Bruce, Amy	DPM
06/21/2021	Gonzalez, Rafael	06/07/2021	1363	Saint Francis Hospital and Medical Center	00952818	64	Female	Yes	1	5	524	Midfoot, Rearfoot, or Ankle Fusion	TTC fusion with nail	Left	Litchfield, Andrew	DPM
06/21/2021	Gonzalez, Rafael	06/09/2021	1365	Saint Francis Hospital and Medical Center	00675799	35	Female	Yes	1	5	531	Repair of Acute Tendon Injury	open repair of achilles rupture	Left	Litchfield, Andrew	DPM
06/21/2021	Gonzalez, Rafael	06/16/2021	1366	Saint Francis Hospital and Medical Center	00860670	60	Female	Yes	1	5	543	Open Repair of Adult Ankle Fracture	open repair of distal fibular fx	Right	Balloch, Rachel	DPM

06/21/2021	Gonzalez, Rafael	06/16/2021	1366	Saint Francis Hospital and Medical Center	00860670	60	Female	Yes	1	5	524	Midfoot, Rearfoot, or Ankle Fusion	STJ fusion for sanders 4 calc fx	Right	Balloch, Rachel	DPM

Yale Podiatric Foot and Ankle Surgery Residency
Resident A
Date Range : 07/01/2020- 6/30/2023

	Assist Level		
Procedure	**1st**	**2nd**	**1st & 2nd**
11 - Partial Ostectomy/Exostectomy	5	1	6
110 - Management of Bone/Joint Infection	5	2	7
111 - Open Management of Digital Fracture/Dislocation	9	0	9
112 - Revision/Repair of Surgical Outcome	10	0	10
12 - Phalangectomy	10	0	10
13 - Arthroplasty (Interphalangeal Joint [IPJ])	143	14	157
16 - Phalangeal Osteotomy	17	1	18
17 - Fusion (IPJ)	42	4	46
18 - Amputation	28	11	39
211 - Bunionectomy (partial ostectomy/Silver procedure), with or without capsulotendon balancing	6	0	6
2110 - Bunionectomy double correction with osteotomy and/or arthrodesis	3	0	3
213 - Bunionectomy with Phalangeal Osteotomy	5	2	5
214 - Bunionectomy with Distal First Metatarsal Osteotomy	28	5	33
215 - Bunionectomy with First Metatarsal Base or Shaft Osteotomy	8	3	11
216 - Bunionectomy with First Metatarsocuneiform Fusion	16	1	17
217 - Metatarsophalangeal Joint (MPJ) Fusion	5	1	6
218 - MPJ Implant	1	0	1
219 - MPJ Arthroplasty	2	0	2
221 - Cheilectomy	10	3	13
222 - Joint Salvage with Phalangeal Osteotomy (Kessel-Bonney, enclavement)	2	0	2
223 - Joint Salvage with Distal Metatarsal Osteotomy	5	0	5
226 - MPJ Fusion	24	6	30
227 - MPJ Implant	10	0	10
228 - MPJ Arthroplasty	3	1	4
231 - Tendon transfer/lengthening procedure	4	0	4
232 - Osteotomy (e.g., Dorsiflexory)	1	1	2
234 - Amputation	40	7	47

236 - Management of Bone/Joint Infection (With or Without Bone Graft)	13	2	15
237 - Open Management of Fracture or MPJ Dislocation	5	0	5
239 - Revision/Repair of Surgical Outcome (e.g., non-union, hallux varus)	7	0	7
31 - Excision of Ossicle/Sesamoid	3	1	4
310 - Excision of soft tissue tumor/mass (without reconstructive surgery)	45	1	46
312 - Plastic Surgery Techniques in Forefoot	59	11	70
316 - External neurolysis/decompression(including tarsal tunnel)	6	0	6
317 - Decompression of compartment syndrome (includes foot or leg)	1	0	1
32 - Excision of Neuroma	8	3	11
33 - Removal of Deep Foreign Body (Excluding Hardware Removal)	4	1	5
34 - Plantar Fasciotomy	10	3	13
35 - Lesser MPJ Capsulotendon Balancing	4	0	4
36 - Tendon Repair, Lengthening, or Transfer Involving the Forefoot)	31	0	31
37 - Open Management of Dislocation (MPJ/Tarsometatarsal)	8	0	8
38 - Incision and drainage/wide debridement of soft tissue infection(includes foot, ankle or leg)	14	10	24
39 - Plantar fasciectomy/plantar fibroma resection	6	1	7
41 - Partial Ostectomy (including the talus and calcaneus) (includes foot, ankle or leg)	27	4	31
410 - Amputation (Lesser Ray, Transmetatarsal Amputation)	52	32	84
411 - Management of Bone/Joint Infection Distal to The Tarsometatarsal Joints (W or w/out Bone Graft)	13	4	17
413 - Open Management of Tarsometatarsal Fracture/Dislocation	5	1	6
414 - Multiple Osteotomy Management of Metatarsus Adductus	1	0	1
415 - Tarsometatarsal Fusion	2	0	2
417 - Revision/Repair of Surgical Outcome in The Forefoot	1	0	1
419 - Detachment/Reattachment of Achilles Tendon with Partial Ostectomy	9	1	10
42 - Lesser MPJ Arthroplasty	3	0	3
43 - Bunionectomy of The Fifth Metatarsal Without Osteotomy	7	1	8
44 - Metatarsal Head Resection (Single or Multiple)	19	3	22
46 - Central Metatarsal Osteotomy	32	6	38
47 - Bunionectomy of The Fifth Metatarsal With Osteotomy	5	0	5
48 - Open Management of Lesser Metatarsal Fracture(s)	9	5	14
49 - Harvesting of bone graft (includes foot, ankle or leg)	14	1	15
511 - Plastic Surgery Techniques Involving The Midfoot, Rearfoot, or Ankle	3	0	3
512 - Tendon Transfer Involving the Midfoot, Rearfoot, Ankle, or Leg	8	1	9
513 - Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	39	2	41

515 - Delayed Primary or Secondary Repair of Ligamentous Structures		3	0	3
516 - Tendon Augmentation/Supplementation/Restoration		9	3	12
517 - Open Synovectomy of The Rearfoot/Ankle		3	0	3
521 - Operative Arthroscopy		0	4	4
521 - Operative Arthroscopy W/out Removal of Loose Body or Other Osteochondral Debridement	***	8	1	9
5211 - Other Elective Rearfoot Reconstructive/Ankle Osseous Surgery not Listed Above		1	1	2
523 - Subtalar Arthroeresis		1	1	2
524 - Midfoot, Rearfoot, or Ankle Fusion		25	13	38
525 - Midfoot, Rearfoot, or Tibial Osteotomy		16	2	18
526 - Coalition Resection		1	0	1
528 - Ankle Arthrotomy With Removal of Loose Body or Other Osteochondral Debridement		3	0	3
528 - Ankle Arthroscopy with Removal of Loose Body or Other Osteochondral Debridement	***	20	1	21
529 - Ankle Implant		2	0	2
531 - Repair of Acute Tendon Injury		10	3	13
532 - Repair of Acute Ligament Injury		8	0	8
536 - Open Repair of Dislocation (Proximal to Tarsometatarsal Joints)		0	1	1
541 - Open Repair of Adult Midfoot Fracture		3	0	3
542 - Open Repair of Adult Rearfoot Fracture		7	4	11
543 - Open Repair of Adult Ankle Fracture		38	10	48
544 - Open Repair of Pediatric Rearfoot/Ankle Fractures or Dislocations		2	0	2
546 - Management of Bone/Joint Infection (With or Without Bone Graft)		25	16	41
547 - Amputation Proximal to The Tarsometatarsal Joints		2	1	3
548 - Other Non-elective Rearfoot Reconstructive/Ankle Osseous Surgery not Listed Above		2	0	2
549 - Application of multiplanar external fixation rearfoot or ankle-no mono rail,no static circular frame		3	6	9
92 - Orthopedic Surgery Surgical Cases (Non Foot and Ankle)		22	0	22
93 - Plastic Surgery Surgical Cases (Non Foot and Ankle)		43	0	43
94 - Vascular Surgery Surgical Cases (Non Foot and Ankle)		6	1	7
Total Procedures		**1178**	**225**	**1403**

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Total Ankle Arthroplasty and Ankle Arthrodesis Use: An American Board of Orthopaedic Surgery Part II Database Study

Christopher N. Carender, MD[1], Natalie A. Glass, PhD[2], Alan G. Shamrock, MD[1], Annunziato Amendola, MD[3], Kyle R. Duchman, MD[4]

[1] Resident, Department of Orthopedics and Rehabilitation, University of Iowa Hospitals and Clinics, Iowa City, IA
[2] Staff Epidemiologist, Department of Orthopedics and Rehabilitation, University of Iowa Hospitals and Clinics, Iowa City, IA
[3] Professor, Department of Orthopedic Surgery, Duke University School of Medicine, Durham, NC
[4] Assistant Professor, Department of Orthopedics and Rehabilitation, University of Iowa Hospitals and Clinics, Iowa City, IA

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ABSTRACT

Total ankle arthroplasty (TAA) use has increased during the past 20 years, whereas ankle arthrodesis (AAD) use has remained constant. The purpose of this study was to examine trends in TAA and AAD use in American Board of Orthopedic Surgery Part II candidates while considering the influence of fellowship training status on treatment of end-stage ankle arthritis. The American Board of Orthopedic Surgery Part II database was queried to identify all candidates who performed ≥1 TAA or AAD from examination years 2009 through 2018. Candidates were categorized by examination year and by self-reported fellowship training status. Descriptive statistical methods were used to report procedure volumes. Trends in use of TAA and AAD were examined by using log-modified regression analyses. From 2009through 2018, there was no significant change in TAA or AAD use among all candidates ($p = .92$, $p = .20$). Candidates reporting a foot and ankle fellowship trended toward increased use of TAA relative to AAD compared with non−foot and ankle fellowship candidates, but this failed to reach statistical significance ($p = .06$). The use of arthroscopic AAD increased over time ($p < .01$) among all candidates. TAA and AAD use did not change over the study period. Volume of TAA and AAD performed by early-career surgeons remains low. The findings in this study should serve as an important reference for orthopedic trainees, early-career surgeons, and orthopedic educators interested in optimizing training curriculum for surgical management of end-stage ankle arthritis.

Current surgical options for end-stage ankle arthritis include ankle arthrodesis (AAD) and total ankle arthroplasty (TAA) (1,2). TAA use within the United States has had a particularly large increase in use in recent years (2−6). Despite the increase in TAA use, AAD use has remained relatively unchanged (1−3,7), with recent studies suggesting that AAD is still performed 2 to 6 times more frequently than TAA (1−3).

Despite changes in use during the past 20 years, annual hospital procedure volume for TAA and AAD remains low, with 50% of hospitals reporting a median of ≤5 cases of each procedure per year (3,4). Additionally, teaching hospitals are estimated to account for only 50% to 60% of TAA volume (4). A recent study examining data on a national level estimated the 50th percentile for TAA surgical volume to be between 0 and 5 cases annually (8). Low procedure volumes may limit the experience of residents, fellows, and early-career surgeons, raising concern for the volume of training experiences for those interested in performing TAA and AAD. This is of particular importance considering that multiple studies suggest a prolonged learning curve associated with TAA as well as poorer patient outcomes and decreased implant survival among low-volume surgeons and hospitals (8−12).

Because of the concerns associated with training volume for procedures aimed at treating end-stage ankle arthritis, a better understanding of current practice patterns for surgeons performing TAA and AAD is needed to guide potential changes in training curricula (13). The purpose of this study was to examine trends in use of TAA and AAD in American Board of Orthopaedic Surgery (ABOS) Part II candidates while considering the influence of fellowship training status on the treatment of end-stage ankle arthritis.

Materials and Methods

This study was reviewed by the institutional review board at our institution and granted exemption from full review. A proposal and request for data were submitted to the ABOS and subsequently approved. The ABOS Part II database was queried for examination years 2009 through 2018 (procedures performed in 2008 to 2017) for all

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Address correspondence to: Christopher N. Carender, Department of Orthopedics and Rehabilitation, University of Iowa Hospitals and Clinics, 200 Hawkins Drive, 01008 JPP, Iowa City, IA 52242.
E-mail address: christopher-carender@uiowa.edu (C.N. Carender).

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candidates who had logged ≥1 of the following procedures identified using Common Procedural Terminology (CPT) codes: ankle arthroplasty, with implant (27702); ankle arthroplasty, revision (27703); ankle arthrodesis, open (27870); and ankle arthrodesis, arthroscopic (29899) (14). CPT code 27700 (noninstrumented arthroplasty) was excluded from this study. Specific details and processes for the collection and curation of data within the ABOS Part II database have been published previously (13–15).

Relevant patient data elements included the age of the patient at the time of surgery and the year the surgery was performed. Candidate procedural data included the total number of all candidates sitting for the ABOS Part II examination and the total number of procedures performed by all candidates for a given examination year. Additional data were collected on candidates who reported ≥1 TAA or AAD; demographic information collected pertaining to candidates included the geographic region of practice (Northeast, Southeast, South, Midwest, Northwest, Southwest) and a self-reported history of all previous fellowship training experiences. Fellowship training experiences were categorized in the following fashion: foot and ankle (F+A), orthopedic trauma, sports medicine, no fellowship training (general), other (pediatrics, spine, tumor, adult reconstruction, hand and upper extremity, shoulder and elbow), and multiple. "high-volume" candidates, defined as performing ≥5 TAAs during the board collection period, were also identified (3,8). This cutoff was chosen given that performing ≥5 TAAs during the collection period would place candidates at the ≥75th percentile for annual TAA volume among orthopedic surgeons in the United States who performed TAA in previous years (3,8). General data collected included the total number of ABOS Part II candidates and total number of cases submitted as part of ABOS Part II each respective examination year from 2009 to 2018.

Statistical Analysis

Descriptive statistics were performed, and the median (minimum–maximum) patient age and procedure volumes, as well as the frequencies and percentages of candidates performing AAD and TAA, were determined and described by year, region, fellowship experience, and procedure type. Linear regression was used to evaluate trends over time with respect to patient age and use of AAD and TAA. Logistic regression was used to evaluate the use of TAA and AAD between regions, use of TAA and AAD between those with and without F+A fellowship experience, and trends in use of open versus arthroscopic procedures over time. Analyses were performed by using SAS statistical software version 9.4 (SAS Institute, Inc., Cary, NC), and a value of $p < .05$ was considered statistically significant.

Results

Candidates

From 2009 through 2018, a total of 7155 candidates submitted cases to the ABOS Part II database. Of these candidates, 498 (7.0%) performed ≥1 AAD, whereas 105 (1.5%) performed ≥1 TAA (Table 1). There were 50 (0.7%) candidates who reported performing both 1 AAD and TAA during their collection period (Table 1). There was no significant change in the number of candidates performing AAD ($p = .39$) or TAA ($p = .78$) during the study period.

Of the candidates who reported performing AAD, 455 (91.4%) were fellowship trained: 336 (60.2%) in F+A (36 of 46 candidates who reported multiple fellowships reported an F+A fellowship training experience); 69 (13.9%) in orthopedic trauma; 24 (5.0%) in sports medicine; 17 (3.4%) in other fellowships, and 10 (2.0%) in multiple fellowships with no F+A fellowship experience (Table 2). Of candidates who performed TAA, 100 (95.2%) were fellowship trained: 76 (72.3%) in F+A (5 of 15 candidates who reported multiple fellowships reported a F + A fellowship); 10 (9.5%) in orthopedic trauma; 1 (1.0%) in sports medicine; 3 (2.9%) in other fellowships, and 10 (9.5%) in multiple fellowships with no F+A experience (Table 2).

There were 11 candidates who met the definition of high-volume TAA candidates identified within the study cohort; this represented 10.5% of all candidates performing TAA. Of these high-volume TAA candidates, 10 (90.9%) of 11 candidates were in the 2012 examination year cohort. High-volume candidates accounted for 34.2% of all TAAs performed over the study period. All high-volume candidates reported at least 1 F+A fellowship experience.

Use of TAA and AAD

During the study period, all candidates sitting for the Part II examination submitted a total of 851,628 cases, including 1185 AADs and 222 TAAs (Table 3). Candidates performing AAD or TAA reported a median of 2.4 (range 1 to 21) AADs and 1.0 (range 1 to 12) TAAs performed, respectively, during the board collection period; the median number of procedures performed per candidate did not change over the study period (AAD, $p = .31$; TAA, $p = .20$). There was no significant change in the use of TAA or AAD among all candidates ($p = .92$, $p = .20$) (Table 3). Combining all candidates performing AAD and TAA into a single cohort, the number of candidates treating end-stage ankle OA surgically did not change significantly over time ($p = .07$). Additionally, the number of surgical procedures performed for end-stage ankle OA was relatively stable and did not change significantly during the study period ($p = .21$). Candidates reporting an F+A fellowship trended toward increased use of TAA relative to AAD versus non–F+A fellowship candidates, but this failed to reach statistical significance ($p = .06$).

During the study period, 1103 (93.1%) AADs were performed via open techniques, whereas 82 (6.9%) were performed arthroscopically (Table 2). The use of arthroscopic AAD increased in more recent years among all candidates ($p < .01$). However, there was no change in the use of open versus arthroscopic AAD among F+A–trained candidates ($p = .33$). Of the TAAs performed, 204 (91.9%) of 222 were primary and 18 (8.1%) were revision (Table 2).

The use of TAA relative to AAD was significantly less in the Northwest compared with all other regions of the United States (Fig. 1). There were no other regional differences in the use of TAA relative to AAD. There was no significant regional variation in performing open versus arthroscopic AAD (Fig. 2).

Table 1
Candidates Performing Ankle Arthrodesis and Total Ankle Arthroplasty by Examination Year, 2009 to 2018 (N = 7155)

Exam Year	Candidates			
	Total No. of Candidates	No. of Candidates Performing AAD (% of All Candidates)	No. of Candidates Performing TAA (% of All Candidates)	No. of Candidates Performing AAD and TAA (% of All Candidates)
2009	663	57 (8.6)	6 (0.9)	5 (0.8)
2010	680	57 (8.4)	2 (0.3)	2 (0.3)
2011	662	34 (5.1)	10 (1.5)	5 (0.8)
2012	722	10 (1.4)	44 (6.1)	8 (1.1)
2013	689	62 (9.0)	2 (0.3)	2 (0.3)
2014	770	49 (6.4)	0 (0)	0 (0)
2015	746	56 (7.5)	0 (0)	0 (0)
2016	729	51 (7.0)	5 (0.7)	3 (0.4)
2017	743	61 (8.2)	8 (1.0)	6 (0.8)
2018	751	61 (8.1)	28 (3.7)	19 (2.5)
Overall	7155	498	105	50

The trends in the number of candidates treating end-stage ankle osteoarthritis are demonstrated by examination year; the number of candidates is relatively stable over time.

Table 2
Candidates Performing Ankle Arthrodesis and Total Ankle Arthroplasty by Fellowship Training Status, 2009 to 2018 (N = 1185)

	Foot and Ankle	Trauma	Sports	General	Other*	Multiple	***Total***
Candidates (AAD)	300	69	24	42	17	46†	498
AAD	843	109	28	64	17	124	1185
Open	773	103	28	58	17	124	1103
Arthroscopic	70	6	0	6	0	0	82
Candidates (TAA)	71	10	1	5	3	15‡	105
TAA	170	14	2	5	5	26	222
Primary	156	13	2	4	5	24	204
Revision	14	1	0	1	0	2	18

Abbreviations: AAD, ankle arthrodesis; TAA, total ankle arthroplasty.
* Pediatrics, spine, tumor, adult reconstruction, hand and upper extremity, shoulder and elbow.
† 36 of 46 candidates reporting multiple fellowship experiences reported at least 1 foot and ankle fellowship experience.
‡ 5 of 15 candidates reporting multiple fellowship experiences reported at least 1 foot and ankle fellowship experience.

Table 3
Use of Ankle Arthrodesis and Total Ankle Arthroplasty, per Candidate, by Examination Year, 2009 to 2018 (N = 1185)

Examination year	No. of Procedures of All Types Performed by All Candidates	AAD			TAA		
		No.	Median (Range)	Mean	No.	Median (Range)	Mean
2009	82,384	122-	1 (1 to 9)	2.1	8	1.5 (1 to 2)	1.5
2010	81,295	115	1 (1 to 9)	2.0	3	1.5 (1 to 2)	1.5
2011	78,761	66	1 (1 to 11)	1.9	12	1 (1 to 2)	1.2
2012	88,889	39	3.5 (1 to 11)	3.9	134	2 (1 to 12)	3
2013	83,817	173	2 (1 to 21)	2.8	2	1 (1)	1
2014	90,525	120	1 (1 to 15)	2.4	0	0 (0)	0
2015	90,046	158	2 (1 to 16)	2.8	0	0 (0)	0
2016	82,639	101	2 (1 to 8)	2.0	7	1 (1 to 2)	1.4
2017	86,648	149	2 (1 to 7)	2.4	12	1 (1 to 4)	1.5
2018	86,624	142	2 (1 to 12)	2.3	44	1 (1 to 5)	1.5
Overall	851,628	1,185	2.4 (1 to 21)	2.5	222	1 (1 to 12)	1.3

Abbreviations: AAD, ankle arthrodesis; TAA, total ankle arthroplasty.
Trends in the use of AADs and TAAs are demonstrated by examination year. Similar to the number of candidates, the number of TAAs and AADs are relatively similar from year to year; examination year 2012 is a relative aberration.

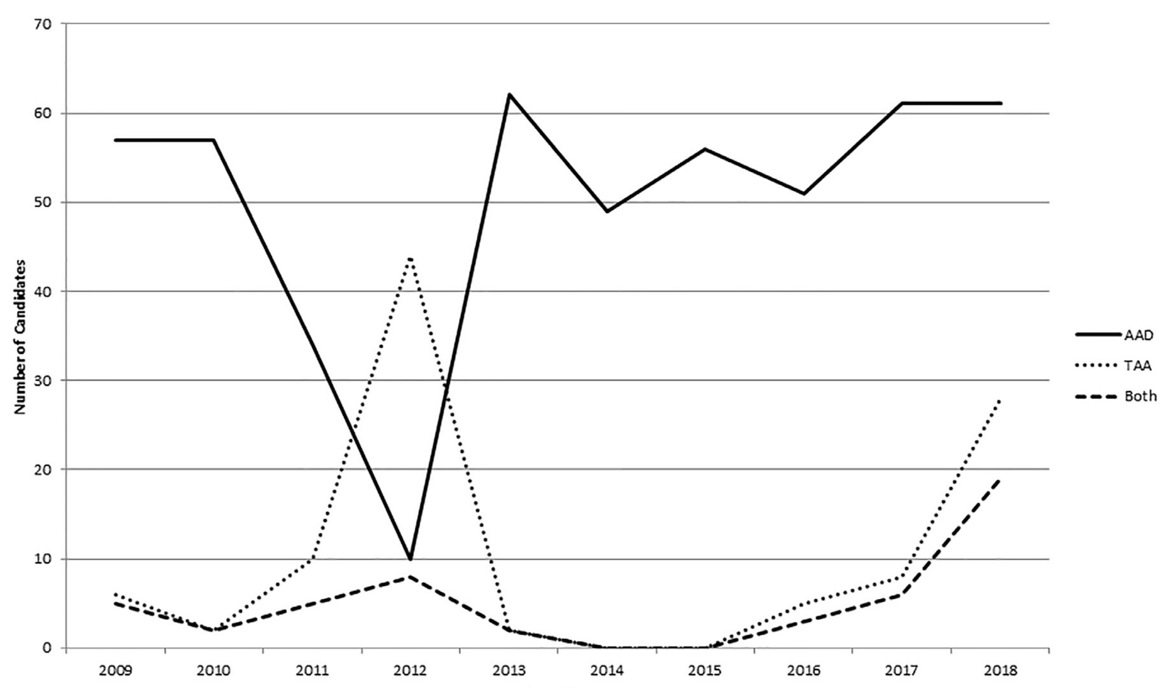

Fig. 1. Candidate volume by examination year, 2009 to 2018. Line graph illustrating trends in the number of candidates performing total ankle arthroplasty, ankle arthrodesis, and both procedures during the study period. Examination year 2012 again appears as an aberration.

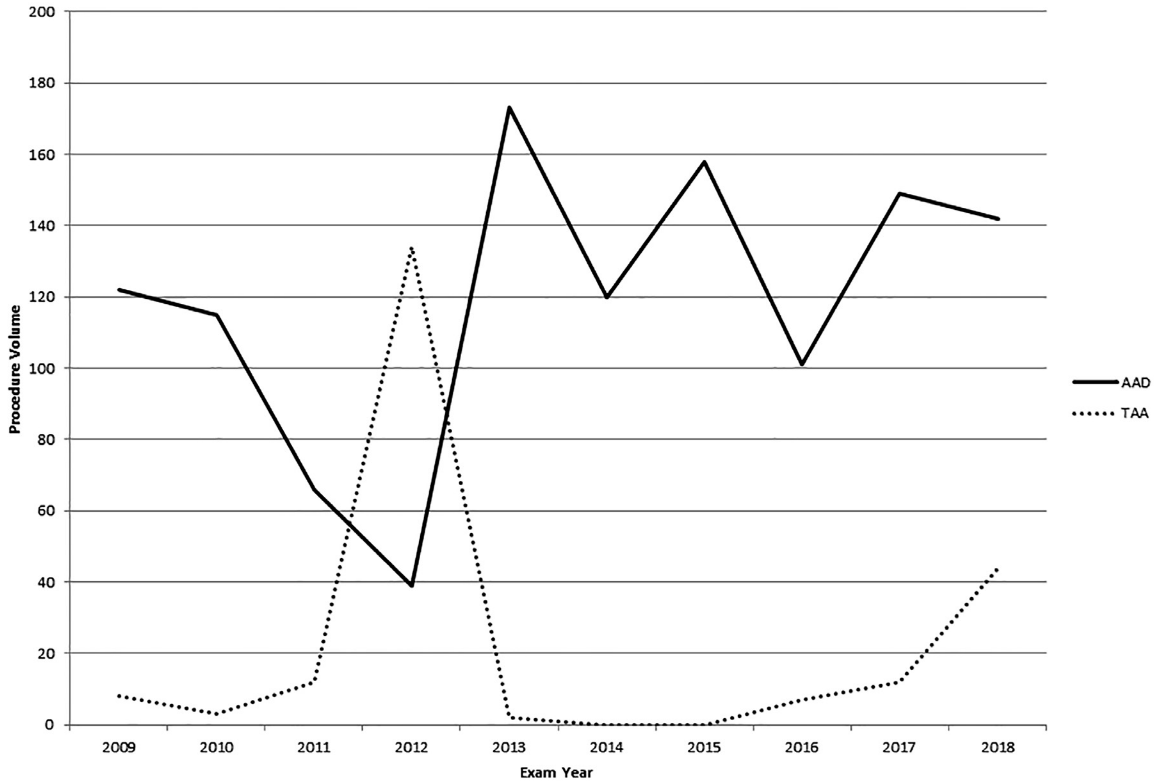

Fig. 2. Procedure volume by examination year, 2009 to 2018. Line graph illustrating trends in total ankle arthroplasty and ankle arthrodesis procedure volume during the study period. Examination year 2012 again appears as an aberration.

For patients undergoing AAD, the median patient age at the time of surgery was 59 years (mean 57.2 years, range 8 to 91 years). The median patient age at the time of surgery for patients undergoing TAA was 57 years (mean 56.3 years, range 21 to 85 years). Patient age at the time of surgery increased during the study period for the AAD cohort ($p = .03$), but it did not change significantly in the TAA cohort ($p = .73$).

Discussion

Recent studies examining TAA and AAD procedure volumes have suggested that for the majority of providers, annual TAA and AAD procedure volume remains low (3,8). The findings in the present study agree with these previous studies, with ABOS Part II candidates performing these procedures reporting a median of 2.4 AAD and 1.0 TAA procedures during their 6-month board collection period. In the present study, 5.4 times more AADs were performed relative to TAA, which is consistent with recent literature (1–3). Additionally, there was no change in the rate of use of TAA and AAD among all candidates over the study period ($p = .92$, $p = .20$). Similarly, when evaluating only candidates with at least 1 F+A fellowship training experience, there was no change in the rate of use of TAA and AAD during the study period ($p = .06$). These findings are important to consider, and although these patterns are limited to a unique cohort of surgeons presumably early in their careers when surgical indications are being critically evaluated, the findings may also reflect the practice patterns at academic training centers that host residency and fellowship programs. Additionally, these findings may highlight the relatively controversial indications for TAA, with early-career surgeons electing to perform more AAD during a period in which their treatment decisions are heavily scrutinized.

Surgical volume is of particularly interest given that low TAA volume may have implications on patient outcomes. Studies by Usuelli et al (11), Lee et al (16), and Henricson et al (17) demonstrated an increased risk for component malposition, perioperative complications, decreased 5-year implant survival rate, and lower postoperative American Orthopedic Foot and Ankle Society (AOFAS) Ankle-Hindfoot Scores during a surgeon's first 25 to 30 TAAs. Extrapolating the procedure volumes reported in the present study, this threshold, or learning curve, may not be reached until well into practice, or not at all. Importantly, the present study does not account for candidate experiences in TAA during residency and fellowship training. Basques et al (8) demonstrated that annual procedure volumes among surgeons performing TAAs are influential for clinical outcomes. Surgeons reporting ≥20 TAAs per year had decreased rates of any adverse event, as well as intraoperative fracture of the medial malleolus (8). In the present study, high-volume TAA candidates were those who reported ≥5 TAAs during their respective 6-month collection period; this corresponds to approximately the 75th percentile of providers in terms of annual TAA volume within the United States (8). Only 11 high-volume candidates were identified and only 1 of 11 reported ≥10 TAAs during the collection period. High-volume candidates represented 10.5% of all candidates performing TAAs in this study while accounting for a disproportionately large volume (34.2%) of overall TAA use. These findings are consistent with those reported by Basques et al (8), who noted that surgeons at or above the 90th percentile for TAA volume performed 33.2% of all TAAs from 2003 to 2009 in the United States. These findings are important to consider, particularly for surgeons currently in-training and early in their careers who have an interest in performing TAAs while limiting complications and optimizing outcomes.

Providers from a multitude of subspecialties performed AAD or TAA during the study period. Regardless, the vast majority of open (80.4%) and arthroscopic (85.4%) AADs and TAAs (77%) were performed by F+A–trained candidates. Open AAD had much higher volume than arthroscopic AAD in this study. However, there was an

Table 4
Use of Ankle Arthrodesis and Total Ankle Arthroplasty by Geographic Region, 2009 to 2018

	Geographic Location						
	Midwest	Northeast	Northwest	Other	South	Southwest	Southeast
AAD, n	211	150	150	4	214	242	214
TAA, n	34	29	10	3	49	43	54
Proportion of AAD to TAA	6.2	5.2	15.0	1.3	4.4	5.6	4.0

Abbreviations: AAD, ankle arthrodesis; TAA, total ankle arthroplasty.
An increased proportion of AADs and TAAs demonstrated in the Northwest region; other regions did not have this phenomenon.

increase in the use of arthroscopic AAD during the study period. These findings are in concordance with other current studies that have suggested an increase in the popularity of arthroscopic AAD in recent years (7,18). Interestingly, all 28 AADs performed by sports medicine−trained candidates were performed open despite the presumed focus on arthroscopic techniques during sports medicine fellowship. Historically, open AAD has been a reliable procedure, consistently achieving fusion and good clinical results (19−21). Recent studies demonstrating increased rates of fusion, shorter hospital stays, and lower complication rates with arthroscopic AAD compared with open AAD that were published during the current study period may be part of the driving force behind the increased popularity of arthroscopic AAD (20,22−24).

Within this cohort, patient age at surgery was nearly identical for patients undergoing TAA and those undergoing AAD at 57 years of age. Recent population-based studies examining TAA and AAD have estimated the average age at the time of surgery for TAA to be approximately 62 years and approximately 55 years for AAD (1,2,7,8,25−27). The findings in the present study suggest that individual patient factors, including activity status and occupation, may have a greater influence on procedure use decision-making in early-career surgeons than patient age alone. These data are not included within the ABOS Part II database.

Overall, there was relatively little geographic variation with respect to the use of AAD compared with TAA, except in the Northwest region (Table 4, Fig. 1). The Northwest region had the highest proportion of use of AADs to TAAs at 15.0. The remainder of the regions ranged in proportions from 1.3 to 6.2. Other studies have estimated the national use of AAD to be roughly 2 to 6 times that of TAA; our data are in agreement with those findings (1−3). There was no geographic variation in the use of open versus arthroscopic AAD (Fig. 2).

Volume of TAAs and AADs performed in examination year 2012 was an outlier from the procedural volume of the other examination years in the study (Table 3). The year 2012 represented a zenith in terms of TAA volume over the study period; more TAAs were reported during this year than in all other examination years in the study combined and accounted for 60.3% of all reported TAAs. This seems to be driven primarily by the volume of 10 high-volume candidates reporting cases during this time. At the same time, 2012 represented a nadir in AAD volume and the number of candidates reporting ≥1 AAD. We were unable to identify any changes in billing or coding practices during or around the time of this examination year that would provide a potential explanation for this discrepancy. Additionally, studies examining TAA volume on a national level demonstrated no significant difference in TAA volume between 2010, 2011, and 2012 (3,4). As such, we believe that these aberrations may be difficult to explain outside of the coincidence of multiple high-volume candidates applying in the same examination year. Eliminating examination year 2012 from the analysis, there remained no significant change in the use of TAA or AAD among all candidates ($p = .19$, $p = .31$, respectively), and no significant change in the number of candidates performing TAA or AAD ($p = .24$, $p = .42$) during the study period.

There are several limitations to this study. First, this study is a retrospective cohort study of prospectively collected data. As with any database study, there is an inherent risk of inaccuracy in the coding or reporting of procedures. Additionally, fellowship status is reported by candidates without methods to verify the accuracy of this reporting. We have no data examining pre-practice experience of candidates from residency and/or fellowship training experiences, which may affect comfort level and technical acumen when performing a given procedure. There is intrinsic variability within any medical practice and within the same practice over time. Such variability may be amplified by the relatively short reporting period for candidates (6 months) and may not consistently represent the case volume of select practices. Our results represent findings from a unique subset of surgeons during a unique time period in their career. Careers and practice patterns evolve, and the findings presented in the current study are not representative of all surgeons currently in practice. Further, surgical indications are not represented in the ABOS Database. Presumably, the board collection period is a time period when candidates may be most selective with their indications. The low volume of TAAs performed by candidates may be a sign of the continued controversy surrounding TAA surgical indications that may limit their use in this highly scrutinized time period. Patient demographics (outside of age), including activity level and occupation, were not available for the present study; they cannot be used to infer decision-making in regard to candidate selection of using TAA versus AAD.

In conclusion, the use of TAA and AAD did not change over the study period, and the number of these procedures performed by early-career surgeons remains low. The majority of both procedures are performed by F+A−trained surgeons with relatively low practice volumes. A small subset of high-volume surgeons account for approximately one-third of all TAAs performed by this cohort. In the present study, there was a trend toward increased TAA use relative to AAD use in F+A−trained surgeons, but this did not reach statistical significance. We observed an increase in the use of arthroscopic AAD during the study period. Early-career surgeons should anticipate performing more AADs relative to TAA; additionally, the findings in this study may highlight the relative controversies surrounding TAA indications. The findings in this study should serve as an important reference for orthopedic trainees, early-career surgeons, and orthopedic educators interested in optimizing educational opportunities for the treatment of end-stage ankle arthritis.

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CLINICAL RESEARCH

Does Medicaid Insurance Confer Adequate Access to Adult Orthopaedic Care in the Era of the Patient Protection and Affordable Care Act?

Joseph T. Labrum IV BA, Taylor Paziuk BS, Theresa C. Rihn BS, JD, Alan S. Hilibrand MD, Alexander R. Vaccaro MD, PhD, MBA, Mitchell G. Maltenfort PhD, Jeffrey A. Rihn MD

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Abstract

Background A current appraisal of access to orthopaedic care for the adult patient receiving Medicaid is important, since Medicaid expansion was written into law by the Patient Protection and Affordable Care Act (PPACA).

Questions/Purposes (1) Do orthopaedic practices provide varying access to orthopaedic care for simulated patients with Medicaid insurance versus private insurance in a blinded survey? (2) What are the surveyed state-by-state Medicaid acceptance rates for adult orthopaedic practices in the current era of Medicaid expansion set forth by the PPACA? (3) Do surveyed rates of access to orthopaedic care in the adult patient population vary across practice setting (private vs academic) or vary with different Medicaid physician reimbursement rates? (4) Are there differences in the surveyed Medicaid acceptance rates for adult orthopaedic practices in states that have expanded Medicaid coverage versus states that have foregone expansion?

Methods Simulated Patient Survey: We performed a telephone survey study of orthopaedic offices in four states with Medicaid expansion. In the survey, the caller assumed a fictitious identity as a 38-year-old male who experienced an ankle fracture 1 day before calling, and attempted to secure an appointment within 2 weeks. During initial contact, the fictitious patient reported Medicaid insurance status. One month later, the fictitious patient contacted the same orthopaedic practice and reported private insurance coverage status. National Orthopaedic Survey: Private and academic orthopaedic practices operating in each state in the United States were called and asked to complete a survey assessing their practice model of Medicaid insurance acceptance. State reimbursement rates for three different Current Procedural Terminology (CPT®) codes were collected from state Medicaid agencies. Results Simulated Patient Survey: Offices were less likely to accept Medicaid than commercial insurance (30 of 64 [47%] versus 62 of 64 [97%]; odds ratio [OR], 0.0145; 95% CI, 0.00088–0.23639; $p < 0.001$), and patients with Medicaid were less likely to be offered an appointment within 2 weeks (23 of 64 [36%] versus 59 of 64 [89%]; OR, 0.0154; 95% CI, 0.00094– 0.251; $p < 0.001$). The Medicaid acceptance rates observed across states sampled in the simulated patient survey were 67% (Pennsylvania), 21% (New Jersey), 58% (Delaware), and 50% (Maryland) ($p = 0.04$). National Orthopaedic Survey: Adult patients with Medicaid insurance had limited access to care in 109

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Each author certifies that his or her institution approved or waived approval for the human protocol for this investigation and that all investigations were conducted in conformity with ethical principles of research.
This work was performed at Thomas Jefferson University, Philadelphia, PA, USA.

J. T. Labrum IV, T. Paziuk
Sidney Kimmel Medical College, Thomas Jefferson University, Philadelphia, PA, USA

T. C. Rihn
Jefferson College of Biomedical Sciences, Thomas Jefferson University, Philadelphia, PA, USA

A. S. Hilibrand, A. R. Vaccaro, M. G. Maltenfort, J. A. Rihn (✉)
The Rothman Institute, Thomas Jefferson University Hospital, 925 Chestnut St., 5th Floor, Philadelphia, PA 19107, USA
e-mail: jrihno16@yahoo.com

of 342 (32%) orthopaedic practices: 37% of private and 13% of academic practices ($p < 0.001$). Practices that accepted Medicaid received higher reimbursement for each CPT® code relative to those that did not and acceptance of Medicaid became increasingly more likely as reimbursement rates increased (99243: OR, 1.03, 95% CI, 1.02–1.04 per dollar, $p < 0.001$; 99213: OR, 1.05; 95% CI, 1.03–1.07 per dollar, $p < 0.001$; 28876: OR, 1.01, 95% CI, 1.00–1.01 per dollar, $p < 0.001$). For a given reimbursement rate, private practices were less likely to take an adult patient with Medicaid relative to an academic practice (99243: OR, 0.11, 95% CI, 0.04–0.33, $p < 0.001$; 99213: OR, 0.11, 95% CI, 0.04–0.32, $p < 0.001$; 27786: OR, 0.12, 95% CI, 0.04–0.35, $p < 0.001$). No difference was observed when comparing Medicaid acceptance rates for all practice types between states that have expanded their Medicaid program versus those that have not (OR, 1.02; 95% CI 0.62–1.70; $p = 0.934$).

Conclusions In this two-part survey study, we found that a simulated patient with commercial insurance was more likely to have their insurance accepted and to gain timely access to orthopaedic care than a patient with Medicaid. Academic practice setting and increased Medicaid reimbursement rates were associated with increased access to care for the patient with Medicaid. Inequality in access to orthopaedic care based on health insurance status likely exists for the adult patient with Medicaid. Furthermore, Medicaid expansion has likely realized minimal gains in access to care for the adult orthopaedic patient. Further research is needed in delineating the patient-payer selection criteria used by orthopaedic practices to aid policymakers in reforming the Medicaid program and comprehensibly addressing this access to care disparity.

Level of Evidence Level II, prognostic study.

Introduction

The Patient Protection and Affordable Care Act (PPACA, also known as Obamacare), passed in 2009, expanded Medicaid eligibility to individuals with incomes up to 138% of the federal poverty level. Since 2012, state Medicaid and Children's Health Insurance Program (CHIP) enrollment in these programs has increased more than 25% nationally as of 2015 [2, 12]. A central tenet of the PPACA was the belief that increased Medicaid eligibility would result in improved access to healthcare and improved outcomes for the uninsured and underinsured [12]. Before passage of the PPACA, several studies found that adult patients with Medicaid experience poorer continuity of care, delayed diagnoses, and worse outcomes than their counterparts with private insurance [3, 9, 19].

Although these studies show poor access and inferior outcomes for patients with Medicaid before the PPACA, there are little data regarding whether the expansion of coverage to previously uninsured groups has resulted in improved access or care. Because a majority of the almost 12 million new patients who went from no insurance to insured received their coverage through Medicaid (92%), we sought to determine whether orthopaedic patients would face fewer impediments to care [5]. The primary objectives of this two-part study are to (1) assess access to care for the adult patients with Medicaid with an acute ankle fracture in states with Medicaid expansion, (2) assess state-by-state differences in Medicaid acceptance rates, (3) assess the effect of physician reimbursement rate and orthopaedic practice construct on access to orthopaedic care for the patient with Medicaid, and (4) determine the effect of Medicaid expansion under the PPACA on access to orthopaedic care for the patient with Medicaid.

We therefore asked: (1) Do blinded, surveyed orthopaedic practices provide varying access to orthopaedic care for simulated patients with Medicaid insurance versus private insurance? (2) What are the surveyed state-by-state Medicaid acceptance rates for adult orthopaedic practices in the current era of Medicaid expansion set forth by the PPACA? (3) Do surveyed rates of access to orthopaedic care in the adult patient population vary across practice setting (private vs academic) or vary with different Medicaid physician reimbursement rates? (4) Are there differences in the surveyed Medicaid acceptance rates for adult orthopaedic practices in states that have expanded Medicaid coverage versus states that have foregone expansion?

Methods

Study Design and Setting

Participant-blinded Simulated Patient Survey

Orthopaedic offices were identified from an online search via Yellow pages™ (YP.com; http://www.yellowpages.com) for "Orthopedic surgeon" within 100 miles in Pennsylvania (Philadelphia), New Jersey (Trenton), Delaware (Newark), and Maryland (Baltimore) in the creation of a multistate survey sample population. Repeat listings were excluded and any practice that was self-described on the listing as nonsurgical was excluded. The design of this study component was based on the 2014 study by Pierce et al. [14].

National Orthopaedic Practice Survey

A study design similar to that published by Skaggs et al. [16] was used in this current nationwide telephone survey

study. The orthopaedic practice list for each state was generated via a Google search delegated: "Orthopaedic Surgery + State". After generating a practice list with a target of 10 private and four academic institutions for each state, a random number was assigned to each practice. These numbers were subsequently used to select the practices that would be contacted to represent each state in ascending order. Study design followed the construct used by Skaggs et al. [16]: Seven practices, two academic and five private, were selected from each state. If a practice on the original list could not be contacted, the practice that was next on the preliminary list was substituted. If a state did not meet the two academic practice requirement, another private practice was added such that the total state representation was seven.

Description of Experiment, Treatment or Surgery

Participant-blinded Simulated Patient Survey

Orthopaedic offices in Pennsylvania, New Jersey, Delaware, and Maryland were contacted twice via telephone to secure an appointment within 2 weeks of contact. The calls were placed 1 month apart. The caller assumed a fictitious identity as a 38-year-old male who experienced an ankle fracture 1 day before calling. The caller attempted to obtain an appointment within 2 weeks using the following script: "Hi, I was seen in the emergency room after I fell yesterday and I was told that I have a fractured ankle. I was told that I needed to be seen by an orthopaedic surgeon within 2 weeks because the fracture likely requires surgery. Can I get an appointment with an orthopaedic surgeon as soon as possible?" During the first stage of calls with the orthopaedic care provider, the caller reported having state-issued Medicaid correlating with the state and region in which the orthopaedic care provider practiced. Four weeks after the initial contact, the same orthopaedic offices were contacted and were subjected to the same interaction with the same caller. The sole difference with the second interaction was that the fictitious patient reported having Blue Cross Blue Shield Preferred Provider Organization coverage. In all instances of more detailed preappointment screenings, the caller stated that there were no legal issues surrounding the injury (disability and/or workers' compensation), claimed to have possession of ankle radiographs, reported current splinting of the injured ankle, and reported no chronic health issues.

National Orthopaedic Practice Survey

Orthopaedic practices operating in each state were contacted via telephone between February and April 2016 and surveyed regarding patient scheduling. The caller identified himself and disclosed that he was calling regarding a three-question anonymous survey assessing patient access to care. The caller surveyed the practice using the following script algorithm: "Does your practice see adult patients with Medicaid insurance?" If the answer was "no," the caller asked if the responder knew why and then ended the call. If the answer was "yes," the caller asked "Does your office have any restriction on the number of adult patients with Medicaid that you see?" If the answer was "no," the call was ended. If the answer was "yes," the caller asked if the responder knew why and then ended the call. If the initial person who answered the phone was incapable of answering the questions posed, the office manager was requested, at which time the question sequence restarted from the beginning.

Variables, Outcome Measures, Data Sources, and Bias

Participant-blinded Simulated Patient Survey

All interactions with orthopaedic care providers were analyzed for the following outcomes: successful contact or failure to contact, acceptance or rejection of insurance coverage, appointment given within 2 weeks of call or appointment not given within 2 weeks of call, and the reason for lack of appointment or the earliest time at which an appointment could be made after the 2-week window. All calls to orthopaedic practices were made by the same caller and all data were recorded immediately after call completion. In any interactions in which the offices provided a tentative appointment on the condition that the patient present a Medicaid or private insurance identification number, emergency room records, or a primary care physician referral on arrival to the appointment or before appointment arrival, the researchers deemed this a successful appointment scheduling.

National Orthopaedic Practice Survey

All survey responses provided by participating orthopaedic practices were recorded. The relationship between practice type, Medicaid reimbursement, and Medicaid acceptance was examined. All calls to orthopaedic practice providers were made by the same caller and all data were recorded immediately after call completion. This survey study, based on work by Skaggs et al. [16], used three different Current Procedural Terminology (CPT®, American Medical Association, Chicago, IL, USA) codes as a representation of a physician's patient population; this included a new patient visit, a followup patient visit, and an

Table 1. Summary of CPT® code reimbursement rate data

State	Medicaid reimbursement rate		
	CPT® 99243	CPT® 99213	CPT® 27786
AL	$86.00	$42.00	$212.00
AK**	$201.65	$119.96	$507.67
AZ**	$98.31	$51.25	$277.34
AR**	$101.20	$36.30	$209.02
CA**	$59.50	$24.00	$173.92
CO**	$87.80*	$73.32	$105.21
CT**	$88.26	$25.74	$153.96
DE**	$123.90*	$72.59	$323.90
FL	$139.05	$79.34	$171.70
GA	$100.50	$40.70	$252.20
HI**	$90.55	$36.31	$157.64
ID	$108.35*	$68.20	$264.33
IL**	$51.30	$28.35	$152.60
IN**	$82.55	$51.99	$224.24
IA**	$90.55	$36.31	$157.64
KS	$92.80*	$53.87*	$233.24*
KY**	$90.43	$42.63	$154.88
LA**	$92.30*	$60.51	$349.65
ME	$77.77*	$40.51	$172.52
MD**	$115.89	$67.54	$282.06
MA**	$73.29	$76.38	$309.22
MI**	$68.34	$40.61	$178.49
MN**	$94.92	$56.39	$222.70
MS	$104.97*	$43.52	$184.87
MO	$74.49	$36.38	$225.56
MT**	$122.41*	$75.85	$337.84
NE**	$88.44	$45.07	$162.87
NV**	$116.40	$67.81	$201.08
NH**	$72.80	$65.98	$225.80
NJ**	$64.70	$23.50	$72.00
NM**	$118.48	$50.52	$278.55
NY**	$76.33	$37.41	$174.50
NC	$99.91	$54.26	$212.65
ND**	$88.48	$106.39	$465.78
OH**	$53.41	$43.61	$163.66
OK	$113.72*	$58.86	$255.27
OR**	$87.05*	$55.53	$222.58
PA**	$59.94*	$40.00	$118.50
RI**	$37.00	$20.64	$67.20
SC	$91.48	$45.37	$193.15
SD	$97.79	$42.48	$270.54
TN	XX	XX	XX
TX	$80.23	$33.27	$239.77
UT	$91.33	$52.74	$231.48
VT**	$123.56	$58.14	$255.23
VA	$84.39	$49.04	$277.24
WA**	$73.51	$39.13	$190.04
WV**	$85.05	$49.88	$216.83
WI	$122.32*	$71.45*	$310.56*
WY	$126.74	$67.36	$277.93

*Values obtained from Kaiser Foundation Medicaid-to-Medicare Fee Index; ** states that have expanded Medicaid; XX value unobtainable owing to statewide variation in CPT® code reimbursement via Medicaid; CPT® = current procedural terminology.

acute care patient visit. The reimbursement rates for CPT® codes 99213 (established followup outpatient visit - level 3 of 5), 99243 (new outpatient consultation - level 3 of 5), and 27786 (closed treatment of distal fibular fracture – lateral malleolus – without manipulation – surgical care only) were determined at the time of the telephone survey via state Medicaid agency fee schedules for comparison to the responses attained via the telephone survey (Table 1). If the state Medicaid fee schedule did not provide the required information, the Kaiser Foundation Medicare-to-Medicaid Fee Index was used to determine the associated CPT® code Medicaid reimbursement rates from known Medicare reimbursement rates [6, 10, 17, 20].

Accounting for all Patients/ Study Subjects

Participant-blinded Simulated Patient Survey

In total, 82 offices, including 21 in Pennsylvania, 21 in New Jersey, 17 in Delaware, and 23 in Maryland, were contacted for orthopaedic appointments. Of the 82 offices called, 18 were excluded from the study; one practice was specialized (TKA), three were nonsurgical (one in personal injury, two in physical therapy), two offices had closed, one practice did not return phone calls, and 11 (three in Pennsylvania, one in New Jersey, three in Maryland, and four in Delaware) did not answer calls or had disconnected phone lines. Sixty-four orthopaedic offices across Pennsylvania (15), New Jersey (19), Delaware (12), and Maryland (18) were included in the study (Table 2).

National Orthopaedic Practice Survey

Three hundred forty-two orthopaedic practices, seven from each state (two academic and five private), were included in the national survey study. Only three practices could be contacted in South Dakota and only six could be contacted in Connecticut, Delaware, Hawaii, and Vermont.

Table 2. Results of the regional simulated patient survey for Medicaid acceptance and appointment scheduling

Orthopaedic practice inclusion	PA	NJ	DE	MD	Total	%
Total offices sampled	21	21	17	23	82	–
Offices meeting study inclusion criteria	15	19	12	18	64	100
Offices accepting Medicaid	10	4	7	9	30	47
Offices providing Medicaid appointment within 2 weeks	6	4	6	7	23	36
Offices accepting private insurance	15	18	12	17	62	97
Offices providing private appointment within 2 weeks	13	18	11	15	57	89

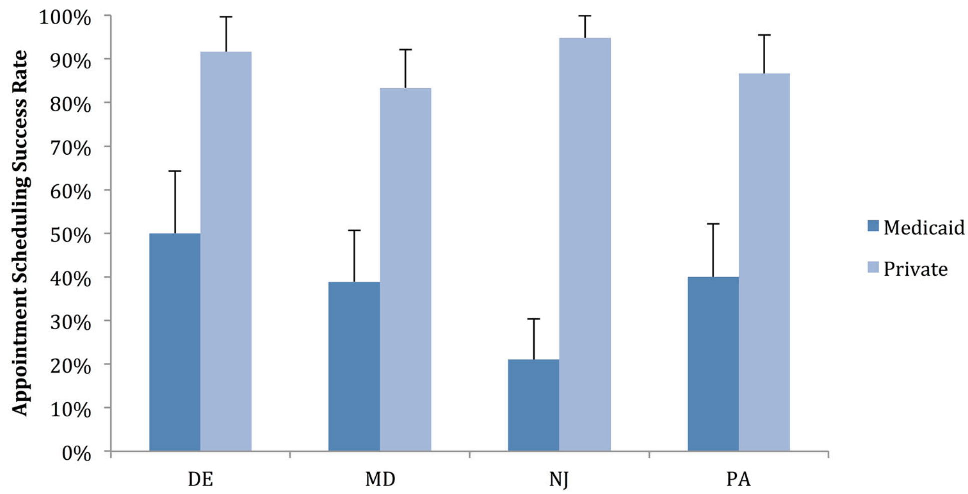

Fig. 1 The observed orthopaedic practice appointment scheduling rates for the simulated patient survey, with the responses broken down by caller insurance status, are shown. Successful scheduling was defined as an appointment within 2 weeks from the time of call.

Statistical Analysis, Study Size

Participant-blinded Simulated Patient Survey

The paired categorical data generated via Medicaid and private insurance calls were statistically analyzed for asymmetry using McNemar's test, which is a chi-square test based on disjoint responses, that is, instances in which a practice provides different access to orthopaedic appointments depending on the form of insurance reported; the cases in which the practice accepts or rejects both forms are not informative [1]. A chi-square test was used to detect potential differences in Medicaid insurance acceptance rates across states sampled in the study. An alpha level of .05 was adopted to define statistically significant findings and subsequent rejection of the null hypothesis. Study size was based on a study by Pierce et al. [14].

National Orthopaedic Practice Survey

Univariate logistic regression was used to estimate how practice type (academic versus private) and Medicaid rate in the state affected the probability of the practice to accept patients with Medicaid insurance. Because the reimbursement rates for the three CPT® codes were correlated, they were each evaluated as predictors in separate regression models. All analyses were performed using the 'rms' package for the R statistical language (R Foundation for Statistical Computing, Vienna, Austria).

Results

(1) Do orthopaedic practices provide varying access to care based on health insurance?

Simulated Patient Survey

Offices were less likely to accept Medicaid than commercial insurance (30 of 64 [47%] versus 62 of 64 [97%]; odds ratio [OR], 0.01449; 95% CI, 0.00088–0.23639; $p < 0.001$), and patients with Medicaid were less likely to be offered an appointment within 2 weeks (23 of 64 [36%] versus 59 of 64 [89%]; OR, 0.0154; 95% CI, 0.00094–0.251; $p < 0.001$) (Fig. 1). The Medicaid acceptance rates observed across states sampled in the simulated patient survey were 67% (Pennsylvania), 21% (New Jersey), 58% (Delaware), and 50% (Maryland) ($p = 0.04$) (Fig. 2).

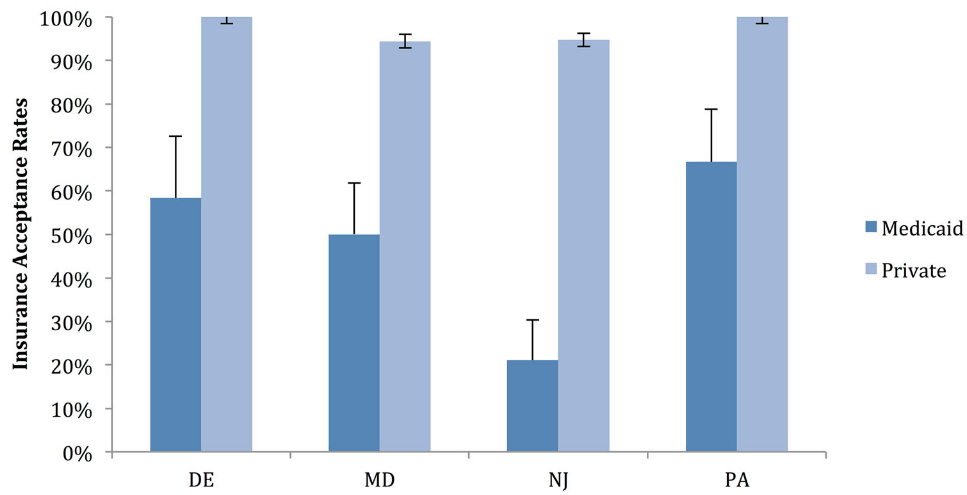

Fig. 2 Insurance acceptance rates for the Medicaid and commercial-insured simulated patient with orthopaedic practice responses broken down by state are shown.

Table 3. Summary of access to healthcare data

Practices	Number	Accept	Limit	Full access
Total	342	260	27	233
Private	271	194	23	171
Academic	71	66	4	62
p Value		< 0.001	0.29	< 0.001

National Survey

Of the 342 orthopaedic practices (ie, 271 private practices, 71 academic practices) contacted for this study, 260 (76%) accepted adult patients with Medicaid, but only 233 do so without restriction (68%) (Table 3).

(2) What are the observed state Medicaid acceptance rates under Medicaid expansion?

Simulated Patient Survey

The Medicaid acceptance rates observed across states sampled in this survey were 66.6% in Pennsylvania (10/15), 21% in New Jersey (four of 19), 58.3% in Delaware (seven of 12), and 50% in Maryland (nine of 18) ($p = 0.04$). However, the sample size of four states used in a chi-square analysis was insufficient to elicit these specific pairwise differences (Table 4).

National Survey

The Medicaid acceptance rates, by State, that were observed in this national survey varied from two of seven to seven of seven (Table 5). For the practices that limited or did not accept adult patients with Medicaid, the individual answering the phone most commonly did not know the reason why this policy was in place (78/109). The other common reasons for not accepting or limiting access of adult patients with Medicaid included emergency room patients only (three of 109), required referral (four of 109), managed care organization preference (eight of 109), case-by-case basis (eight of 109), physician preference in practice (six of 109), and children covered by Medicaid only (two of 109) (Table 6).

(3) Are Medicaid acceptance rates associated with reimbursement or practice type?

National Survey

The acceptance of Medicaid becomes increasingly more likely as the associated CPT® code reimbursement rates increase. Access to orthopaedic care in the adult orthopaedic patient population also varied in accordance with orthopaedic practice setting. The OR for CPT® reimbursement rate and the acceptance of Medicaid is 1.03 (95% CI, 1.02–1.04) per dollar for 99243, 1.05 (95% CI, 1.03–1.07) per dollar for 99213, and 1.01 (95% CI, 1.00–1.01) per dollar for 28876

Table 4. Simulated patient insurance acceptance rates

Insurance status	State	Insurance denied	Insurance accepted	Acceptance rate	Standard error	p Value
Medicaid	DE	5	7	58%	14%	p = 0.04*
Medicaid	MD	9	9	50%	12%	
Medicaid	NJ	15	4	21%	9%	
Medicaid	PA	5	10	67%	12%	
Private	DE	0	12	100%	0%†	p = 0.68
Private	MD	1	17	94%	5%	
Private	NJ	1	18	95%	5%	
Private	PA	0	15	100%	0%†	

*N = 4 was insufficient to show specific pairwise differences despite $p < 0.05$ seen across states dealing with caller with Medicaid; †could not be calculated for 100% of entries (zero is a consequence of the formula).

($p < 0.001$) (99213 = established followup outpatient visit - level 3 of 5; 99243 = new outpatient consultation - level 3 of 5; and 27786 = closed treatment of distal fibular fracture – lateral malleolus – without manipulation – surgical care only) (Table 7). Moreover, the OR for private versus academic practice setting and the acceptance of Medicaid is 0.11 (95% CI, 0.04–0.33, $p < 0.001$) for CPT® code 99243, 0.11 (95% CI, 0.04–0.32, $p < 0.001$) for CPT® code 99213, and 0.12 (95% CI, 0.04–0.35, $p < 0.001$) for CPT® code 27786. Consequently, for a given reimbursement rate, private practices were less likely to take an adult patient with Medicaid insurance relative to an academic practice (Table 7).

Of the 260 institutions that accepted adult patients with Medicaid, 194 were considered private practice and 66 were considered academic practice. Thus, 72% (194/271) of private practices and 93% (66/71) of academic practices accepted adult patients with Medicaid (194 of 271 [72%] versus 66 of 71 [93%]; OR, 0.19; 95% CI, 0.07–0.49; $p < 0.001$) (Table 3). Regarding the private practices that accepted adult patients with Medicaid, 12% (23/194) imposed restrictions on the number of patients they see, leaving 63% of private orthopaedic practices using a full-access Medicaid model. Of the academic practices that accept adult patients with Medicaid, 6% (four of 66) imposed restrictions on the number of patients they see, leaving 87% of academic orthopaedic practices using a full-access Medicaid model. The difference between the number of private and academic practices that use this full-access model was noted (171 of 27 [64%] versus 62 of 71 [87%]; OR, 0.25; 95% CI, 0.12–0.52; $p < 0.001$) (Table 3).

(4) Do patients in Medicaid-expansion States have better access to orthopaedic care?

National Survey

When we compared states that expanded Medicaid after the PPACA with those that did not, there was no difference in access to care for adult orthopaedic patients. This was true for all practice types (OR, 1.02; 95% CI, 0.62–1.70; p = 0.934), for academic practices alone (OR, 1.22; 95% CI, 0.19–7.82; p = 0.84), and for private practices alone (OR, 1.02; 95% CI, 0.59–1.76; p = 0.94) (Table 8). Thus, there was no difference, with the numbers available, in access to care for adult patients with Medicaid insurance based on whether their associated state had adopted PPACA Medicaid expansion.

Discussion

Adult patients with Medicaid insurance typically have faced substantial hurdles in obtaining timely care [3, 4, 7–9, 11, 13–16, 19]. Much of the impetus for the 2009 passage of the PPACA was an effort to address this [12]. However, there are little data regarding whether the expansion of coverage to previously uninsured groups has resulted in improved access or care. Since a majority of the almost 12 million newly insured have received their coverage through Medicaid, we sought to determine whether the new orthopaedic patients with Medicaid insurance would face fewer impediments to care. We found that inequality in access to orthopaedic care based on health insurance status likely exists in the adult patient population seeking care for an acute ankle fracture in state marketplaces with expanded Medicaid. Results from the national telephone survey study likely indicate that there is no difference in access to care for patients with Medicaid across states that have adopted Medicaid expansion versus states that have foregone Medicaid expansion. Additionally, we found that lower Medicaid reimbursement rates and the private practice setting (as opposed to academic practice) are associated with limited access to orthopaedic care in the adult population with Medicaid.

The researchers could not be blinded to the insurance status of the fictitious patient and/or the responses of the contacted practice. There is potential bias introduced by the

Table 5. Summary of state-by-state Medicaid acceptance from the national survey study

State	Medicaid acceptance rate (practice type)		
	Private	Academic	Total
AL	4/5	2/2	6/7
AK**	6/6	1/1	7/7
AZ**	5/6	1/1	6/7
AR**	5/6	1/1	6/7
CA**	1/5	1/2	2/7
CO**	3/6	1/1	4/7
CT**	1/4	2/2	3/6
DE**	5/6	xx	5/6
FL	2/5	2/2	4/7
GA	2/5	2/2	4/7
HI**	3/5	1/1	4/6
ID	7/7	xx	7/7
IL**	3/5	2/2	5/7
IN**	5/6	1/1	6/7
IA**	5/6	1/1	6/7
KS	3/6	1/1	4/7
KY**	5/6	1/1	6/7
LA**	0/5	2/2	2/7
ME	7/7	xx	7/7
MD**	4/5	2/2	6/7
MA**	5/5	2/2	7/7
MI**	4/5	2/2	6/7
MN**	5/5	2/2	7/7
MS	4/6	1/1	5/7
MO	0/5	2/2	2/7
MT**	7/7	xx	7/7
NE**	5/5	2/2	7/7
NV**	2/6	1/1	3/7
NH**	5/6	1/1	6/7
NJ**	1/5	2/2	3/7
NM**	6/6	1/1	7/7
NY**	1/5	2/2	3/7
NC	5/5	2/2	7/7
ND**	7/7	xx	7/7
OH**	2/5	2/2	4/7
OK	5/6	1/1	6/7
OR**	5/5	2/2	7/7
PA**	3/5	1/2	4/7
RI**	1/5	1/2	2/7
SC	3/5	2/2	5/7
SD	2/2	1/1	3/3
TN	4/5	1/2	5/7
TX	1/5	1/2	2/7
UT	5/6	1/1	6/7
VT**	5/5	1/1	6/6
VA	4/5	2/2	6/7
WA**	5/6	1/1	6/7
WV**	4/5	2/2	6/7
WI	4/5	2/2	6/7
WY	7/7	xx	7/7

*Values obtained from Kaiser Foundation Medicaid-to-Medicare Fee Index; **states that have expanded Medicaid; xx = unobtainable owing to statewide variation in CPT® code reimbursement via Medicaid.

Table 6. Reasons for limited or no access to care

Reason	Number
Total number of practices that limit or do not accept Medicaid	109
Unknown reason why the practice limits/does not accept Medicaid	78
Emergency room patients	3
Physician preference	6
Referral required	4
Patients with a specific Managed Care Organization only	8
Case-by-case basis	8
Only accepts children with Medicaid	2

fictitious caller, which may artificially reduce the rate of appointment scheduling; practices might be more likely to appoint the same person if they were referred from a hospital where the practice is affiliated and provides call coverage, or if a referral came from an associated or known practice. The simulated patient survey construct was used to minimize potential researcher bias with the use of a script and identical presentation of information in preappointment screenings. The use of a fictitious patient in the simulated patient survey eliminated the potential for the office contacted to be aware of its participation in a research study, eliminating bias via the observer effect and allowing a more-accurate assessment of access to care. The sample size used in the simulated patient survey and national survey studies may be inadequate to show differences that truly exist, allowing the possibility of a Type II error. Calls were made consecutively and spaced over 4 weeks, which could have resulted in sampling bias owing to an unforeseen confounder. This was preferred over call randomization, as it was presumed that calls made to the same practice during a shorter interval may have introduced bias. The national survey study was limited by an inability to fully access participating practices' policy on Medicaid insurance acceptance. In many cases, the person

Table 7. Private vs academic practice and Medicaid reimbursement for access to care

CPT® code	Private vs academic practice			Medicaid reimbursement rate		
	Odds ratio	95% CI	p Value	Odds ratio	95% CI	p Value
99243	0.11	(0.04–0.33)	< 0.001	1.03	1.02–1.04	< 0.001
99213	0.11	(0.04–0.32)	< 0.001	1.05	1.03–1.07	< 0.001
27786	0.12	(−0.04 to 0.35)	< 0.001	1.01	1.00–1.01	< 0.001

Table 8. Medicaid acceptance in PPACA expansion states versus nonexpansion states

Practice setting	Expansion states Medicaid acceptance	Nonexpansion states Medicaid acceptance	Odds ratio	95% CI	p Value
Total	167/220 (76%)	93/122 (76%)	1.02	0.62–1.70	0.936
Private	125/175 (71%)	69/96 (72%)	1.22	0.19–7.82	0.838
Academic	42/45 (93%)	24/26 (92%)	1.02	0.59–1.76	0.942

PPACA = Patient Protection and Affordable Care Act.

completing the survey could not and/or would not provide explanations of the practices' Medicaid acceptance policies.

The results of our study corroborate those of previous studies, which consistently show that patients with Medicaid face increased challenges during the course of orthopaedic care; patients with Medicaid must travel farther to obtain orthopaedic care, wait a longer time before accessing care, are delayed in receiving the diagnosis of an acute orthopaedic injury, experience disruption in continuity of ambulatory care, and experience worse outcomes after surgery compared with patients with different health insurance [3, 9, 11, 19]. Pierce et al. [14] observed that the pediatric patients with Medicaid seeking outpatient care for an ACL tear before Medicaid expansion were 57 times less likely to receive an appointment within 2 weeks compared with a child with private insurance.

The results of the simulated patient survey study suggest that this inequality may be present to varying degrees on a state-by-state basis, as differences were observed in Medicaid acceptance rates among states surveyed. This was supported by our findings in the national survey, where access to orthopaedic care increased with increasing Medicaid reimbursement rates as well as the academic practice setting on a nationwide scale. Before the PPACA, Skaggs et al. [16] observed a state-by-state variation in access to care for pediatric orthopaedic patients, reporting that state-based access to care improved as state-determined physician reimbursement rates for treatment of a nondisplaced radius and ulna fracture without manipulation increased. Kim et al. [11] had similar findings, observing increased success in appointment scheduling for patients with Medicaid in states with a direct relationship between increased Medicaid reimbursement rates.

Our study and several others [11, 13, 16] showed that limited access to orthopaedic care for the Medicaid population is associated with low physician reimbursement rates. While individuals responding to phone surveys in both studies rarely cited low Medicaid reimbursement as a reason to limit care, this correlation suggests that financial remuneration does play a role in access to orthopaedic care. Prevention of discrepancies in access to care attributable to reimbursement disparities between the Medicaid and private insurance populations is in part why the equal access provision of the Medicaid Act was implemented in the Social Security Act [18]. This requires physician reimbursement rates to be "sufficient to enlist enough providers so that services under the plan are available to recipients at least to the extent that those services are available to the general population" [18]. Despite this provision, the reimbursement rate disparity between private insurance and Medicaid continues to be substantial, as does the disparity between Medicaid and Medicare rates [10]. Additionally, for a given reimbursement rate, private practices were less likely to take an adult patient with Medicaid insurance relative to an academic practice.

Our national study found no difference in access to orthopaedic care between states that have adopted Medicaid expansion and those that have not. Lack of a prior study on access to orthopaedic care in Pennsylvania, New Jersey, Delaware, and Maryland before Medicaid expansion prevents us from quantifying the effects that Medicaid expansion has had on access to orthopaedic care in these states. The effects of Medicaid expansion on access to orthopaedic care are not fully understood. Patterson et al. [13] found that access to orthopaedic care was decreased in areas with high population density and areas in close proximity to an academic orthopaedic center. They posited

that areas with high population density have a larger orthopaedic patient base, which may allow practices to operate with increasingly stringent patient-payer selection criteria while practices in less populous areas may lack this capability. Additionally, practices in areas of lower population density may feel uncomfortable informing patients of the need to travel long distances to seek care at an academic center [13]. However, Kim et al. [11] reported that patients with Medicaid pursuing orthopaedic appointments for primary TKA witnessed successful appointment scheduling rates of 22.8% in states foregoing Medicaid expansion and 37.7% in states with expanded Medicaid ($p = 0.011$). Importantly, Kim et al. [11] also reported that patients with Medicaid seeking orthopaedic care in states with expanded Medicaid programs experienced longer waiting times for appointments obtained ($p = 0.001$).

Patients with Medicaid insurance face a greater barrier to accessing a timely standard of care relative to patients with commercial health insurance. Unfortunately, this trend appears to have continued despite Medicaid expansion, likely indicating that increases in Medicaid coverage availability are not sufficient to increase access to orthopaedic care for the underinsured. Current expansions in Medicaid have likely realized minimal gains for the underinsured as policy has focused only on increasing the patient pool qualified for coverage. As more and more adults obtain coverage through Medicaid expansion and "compete" for a limited number of appointments, it may become more difficult for these patients to obtain an orthopaedic appointment. Policy aimed to improve access to care for orthopaedic patients with Medicaid must encourage greater Medicaid participation by orthopaedic surgeons. Although further research is needed to clearly delineate physician-patient-payer selection criteria, Medicaid reimbursement rates may need to be increased to incentivize the care of these patients and alleviate the pervasive inequality they experience in accessing orthopaedic treatment.

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Clinical Research

Volume and Variability of Foot and Ankle Case Exposure During Orthopaedic Residency: 2014-2019

Davis A. Hartnett, BS, Christopher J. Lama, BS, Edgar Garcia-Lopez, MD, Alan H. Daniels, MD, and David R. Richardson, MD

Abstract: Background: *Exposure to a comprehensive breadth and volume of surgical cases is a fundamental component of orthopaedic education, though standardization of case exposures across residency programs is limited to a small amount of required case minimums. Significant variability in exposure to subspecialty cases, such as foot and ankle surgeries, can create distinctly different residency experiences.* Methods: *Accreditation Council for Graduate Medical Education (ACGME) surgical case logs from 2014 to 2019 for leg/ankle and foot/toes were examined following the 2013 implementation of case minimums. Average surgical case volume across subcategories and the average volume of different residency percentiles were analyzed to assess variability.* Results: *The mean total volume of case exposure for graduating orthopaedic residents has increased significantly since 2014 for both leg/ankle cases (28.6%) and foot/toes (27.8%), though totals were still down compared with when ACGME reporting began in 2007. Arthrodesis exposures have increased significantly for leg/ankle (69.2%) and foot/toes (93.8%) cases since 2014, and ankle arthroscopy has increased 20.7%. Disparities in total cases between 10th and 90th percentile programs have shown a nonsignificant decrease over time, with significant differences between leg/ankle arthrodesis (8-fold), leg/ankle arthroscopy (13-fold), and foot/toe arthrodesis (3.5-fold) in 2019.* Conclusion: *The mean volume of foot and ankle case exposures among graduating residents has continued to rise since the implementation of case minimums in 2013 but disparities in volume are present, most notably concerning arthrodesis and arthroscopy. Recognition and future attention toward addressing this variability can be meaningful in promoting a more comprehensive, standardized orthopaedics education.*

Level of Evidence: *Level III: Retrospective comparative study.*

Keywords: ACGME; case volume; resident training; education

Introduction

Exposure to orthopaedic procedures is a fundamental component of a residency in orthopaedic surgery, and sufficient case volume remains a critical aspect of a resident education. This volume is particularly relevant in

> "Whether foot and ankle case volume has increased overall since the implementation of case minimums, though significant disparities across residency programs would still exist for relevant procedural categories such as arthrodesis and arthroscopy."

DOI: 10.1177/19386400221106889. From University Warren Alpert School of Medicine, Providence, Rhode Island (DAH, CJL, EG-L, AHD), and Department of Orthopaedic Surgery & Biomedical Engineering, University of Tennessee-Campbell Clinic, Memphis, Tennessee (DRR) . Address correspondence to: Davis A. Hartnett, BS, Brown University Warren Alpert School of Medicine, 222 Richmond St, Providence, RI 02903; e-mail: davis_hartnett@brown.edu.

subspecialties to which residents may have less exposure, such as foot and ankle surgery. Guidelines established by the Accreditation Council for Graduate Medical Education (ACGME) require a minimum of 15 ankle fracture fixations and 5 foot/ankle arthrodesis procedures during residency, with other foot and ankle procedure volumes unspecified.[1]

Foot and ankle surgery is a rapidly evolving field with an increasing focus on arthroscopy for management of numerous pathologies, due to largely expanding indications and considerable evidence displaying the efficacy of various arthroscopic techniques.[2,3] The increasing performance of ankle arthroscopy has outpaced shoulder, knee, and elbow arthroscopy, with an associated 27.6% increase in ankle arthroscopy case volume among residents between 2007 and 2013, though there is limited literature on case volume since this time.[4] Arthrodesis of the ankle, midfoot, and hindfoot procedures remains important in foot and ankle surgery warranting a minimum case volume established by the ACGME in 2013. The overall incidence of these procedures remains notably low, with the 50th percentile for ankle arthrodesis surgical volume at hospitals found to be less than 5 cases annually.[5] Despite the case minimum, a 2020 survey by Kohring et al[6] found that only 47.5% of graduating residents felt comfortable performing foot and ankle arthrodesis independently, and a 2019 survey found that 35% of responding orthopaedic residents felt they lacked adequate exposure to foot and ankle surgery with only 6% intending to pursue a foot and ankle fellowship.[7] No studies in the literature have examined resident exposure to ankle fracture fixation, a fundamental orthopaedic procedure, or total ankle replacement cases, which have increased in prominence significantly since 2007.

The ACGME annually releases resident surgical case log data for orthopaedic surgery training programs in the United States. A previous study by DeFroda et al[8] examined trends in foot and ankle ACGME case logs between 2009 and 2013, identifying a nonsignificant increase in case volume in that time but a significant degree of variability between the 10th and 90th percentiles for total resident case exposure, including a 15-fold difference in ankle arthroscopy. No studies have examined ACGME case volume data with a focus on foot and ankle surgery after 2013.

The purpose of this study is to examine ACGME logs for foot and ankle case volume during orthopaedic surgery residency between 2014 and 2019, with focus on trends and variability in program volume over time. We hypothesized that foot and ankle case volume has overall increased since the implementation of case minimums, though significant disparities across residency programs would still exist for relevant procedural categories such as arthrodesis and arthroscopy.

Methods

Publicly available ACGME surgical case logs detailing the national averages of orthopaedic procedures logged by graduating orthopaedic surgery residents in the United States from 2014 to 2019 were examined, with focus on the leg/ankle and foot/toes classifications. Data from 2007 to 2013 were also examined for reference. The ACGME orthopaedic surgery case log reports utilize Current Procedural Terminology (CPT) case categories for procedures, and categorize both leg/ankle and foot/toe procedures into "Incision," "Excision," "Intro/Removal," "Repair/Revise/Reconstruction," "Fracture/Dislocation," "Manipulation," "Arthrodesis," "Amputation," "Arthroscopy," "Other Procedure," and "Total." Resident case volume percentiles were examined and the number of procedures from the 10th and 90th resident percentiles were compared in each category. Subsequently, the difference in the number of procedures performed between the 10th and the 90th resident percentile was examined to determine if the gap in training between the 10th and the 90th percentile groups fluctuated over time.

Statistical Analysis

Student *t* test was performed to assess the statistical significance of the trends in 2007, 2014, and 2019 and to examine the differences in procedures logged by the bottom and top 10th percentiles of graduating residents in each category. Fold difference was computed as the ratio of the difference between the final value and the original value over the initial value, and has been validated in the literature as a means to examine disparities between percentiles.[4,8] Statistical significance was set at a cutoff of $P < .05$. Statistical analysis was performed using Microsoft Excel (Microsoft, Redmond, Washington) and GraphPad Prism (GraphPad Software Inc, San Diego, California).

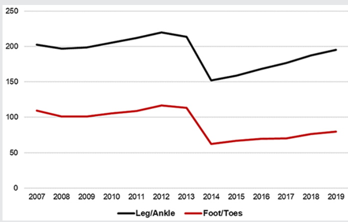
Results

The total number of orthopaedic surgery residency programs in the United States reported by the ACGME ranged from 151 to 154 between 2014 and 2019, with a total of 684 to 725 residents reported. The mean number of total leg/ankle procedures documented by graduating residents in 2014 was 151.9, which increased 28.6% to 195.3% in 2019 (Figure 1). Changes in case volume of leg/ankle procedures were further examined by category. The mean volume of ankle arthroscopy increased by 16.1%, from 12.1 in 2014 to 16.1 in 2019. The volume of "Revision/Repair/Reconstruction" cases increased by 50.7%, from 20.9 in 2014 to 31.5 in 2019. Concerning trauma, "Fracture/Dislocation" cases increased by 27.0% (80.8-102.6) and "Manipulation" cases increased by 39.9% between 2014 and 2019 (17.3-24.2). The volume of "Arthrodesis" cases increased from 2.6 in 2014 to 4.4 in 2019 (69.2%), and the volume of "Amputation" cases increased from 5.8 to 7.0 (20.7%).

The mean number of total foot/toe procedures documented by graduating residents in 2014 was 62.5, with an increase of 27.8% to 79.9% in 2019. Within the foot/toe case categories, a decreased mean volume was observed in 2019 compared with 2014 in "Incisions"

Figure 1.

Average total leg/ankle and foot/toes procedures (2007-2019).



(3.5-3.3, 5.7% decrease) and "Excisions" (9.8-8.8, 10.2% decrease). The volume of "Revision/Repair/Reconstruction" cases increased by 35.5%, from 16.6 in 2014 to 22.5 in 2019. "Fracture/Dislocation" cases increased by 26.3% (16.0-20.2) and "Manipulation" cases increased by 44.4% between 2014 and 2019 (1.8-2.6). The volume of "Arthrodesis" cases increased from 8.0 in 2014 to 15.5 in 2019 (93.5%), the volume of "Amputation" cases increased from 4.9 to 5.7 (16.3%), and foot arthroscopy increased 100% from a mean of 0.1 to 0.2.

The mean reported case volumes of the 10th percentile and 90th percentile residencies differed substantially across all observed years in total cases as well as case categories within both leg/ankle and foot/toe. In leg/ankle "Arthrodesis" (P = .008), "Amputation" (P = .010), and "Arthroscopy" (P = .003) and in foot/toe "Arthrodesis" (P = .008), changes in magnitude over time found between 2014 and 2019 were statistically significant (Table 1). Within leg/ankle procedures between 2014 and 2019, the difference in cases between the 10th and 90th percentiles in "Incision" ranged from 3.8- to 6.0-fold. The difference for "Excision" was 5.0- to 11.0-fold, "Repair/Revision/Reconstruction" was 2.6- to 3.2-fold, "Fracture/Dislocation" was 1.3- to 1.6-fold, and "Manipulation" was 13.0- to 19.0-fold. "Arthrodesis" had a 6.0- to 8.0-fold difference (with 0 cases among the 10th percentile in 2014), "Amputation" had a 12.0- to 14.0-fold difference, and "Arthroscopy" had a 11.0- to 13.0-fold difference. Among foot/toe cases reported between 2014 and 2019, the difference for "Excision" was 4.3- to 7.0-fold, "Repair/Revision/Reconstruction" was 4.8- to 6.0-fold, "Fracture/Dislocation" was 3.3- to 4.0-fold, and "Arthrodesis" was 3.5- to 7.0-fold (Table 1; Figure 2).

Discussion

This study examined resident case volume reported by the ACGME and demonstrated that the mean number of foot and ankle cases logged has steadily increased since 2014, with a particular rise noted in the "Arthrodesis" subcategories for both leg/ankle and foot/toe cases. There remains significant variability in the volume of foot and ankle cases between the 10th and 90th resident percentiles, albeit with a nonsignificant decrease in the variability of foot/toe cases since 2014.

The present study provides an updated and broader context to the investigation by DeFroda et al[8] into foot and ankle case volumes between 2009 and 2013, which reported a nonsignificant increase in resident case volume during this time, similar to the findings of the present study. Of note, the increases seen independently within these 2 studies are diminished or absent when viewed over the complete time frame for which ACGME case log data are available (2007-2019). Since 2007, total leg/ankle cases have decreased by 3.7%, and total foot/toe cases have decreased by 27.0% (Table 2). This is best demonstrated in Figure 1, which shows a notable reduction in case volume occurring between the 2013 and 2014 graduating residents, consistent with research by Pierce et al[9] which found a statistically significant decrease in total resident case volume between 2010 and 2016, observed within every adult subspecialty except pelvis/hip and oncology. The etiology of this decrease was suspected to be multifactorial, including an increase in resident volume (650-705), as well as an increasing number of operations performed in outpatient surgical centers and not in inpatient facilities with residents. The exact reason for the noticeable decrease between 2013 and 2014 is unclear, with a shift in focus toward recently enacted case minimums as a proposed possibility.[10] Among foot and ankle cases, this net decrease in case volume has continued to improve since 2014 as demonstrated by this study, but improving operative exposure remains a crucial issue in foot and ankle surgery.

The efforts by the ACGME to ensure comprehensive exposure to orthopaedic subspecialties as part of a competency-based education include minimum case numbers and broad guidelines regarding the number of months that orthopaedic residents should spend on orthopaedic services. Minimum case numbers were implemented by the ACGME Orthopaedic Surgery Residency Review Committee in 2013 following a review of case log data from 2008 to 2010, with citations for failure to meet these minimums first issued that year.[1] There is limited research in the literature regarding the effectiveness of minimum case numbers in improving resident exposure. Klimstra et al[11] reported that implementation of a case minimum for closed manipulations of forearm and wrist fractures, the only nonoperative procedure with a minimum, was associated with an increase in case counts, most significantly for residents below the 50th percentile. Ankle fracture fixation and ankle/hindfoot/midfoot arthrodesis are the only foot/ankle cases with ACGME minimums (15 and 5, respectively), and have each steadily increased in mean volume since 2014 after the minimum was put into effect (leg/ankle fracture/dislocation: 27.0% increase, leg/ankle arthrodesis: 69.2% increase, foot/toe arthrodesis: 93.8% increase).[1] Orthopaedic residents only performed an average of 4.4 ankle arthrodesis cases in 2019, though they performed a combined average of 19.9 arthrodesis cases when including those of the foot, satisfying the ACGME minimum.

Table 1.

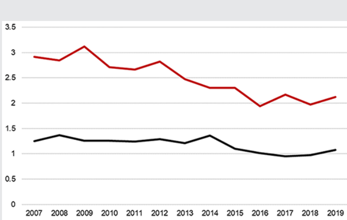
Fold Difference in Leg/Ankle and Foot/Toe Procedures Between 10th and 90th Resident Percentiles.

Log reports classification	2014	2015	2016	2017	2018	2019	*P* value
Leg/ankle							
Incision	5.0	5.0	5.7	3.75	5.3	6.0	.604
Excision	5.5	5.0	5.0	11.0	5.5	11.0	.182
Repair/Revision/Recon	2.9	2.8	2.8	2.6	2.6	3.2	.751
Fracture/Dislocation	1.6	1.4	1.3	1.3	1.3	1.3	.059
Manipulation	19.0	13.0	13.3	14.3	15.7	16.3	.843
Arthrodesis	6.0	6.0	6.0	7.0	8.0	8.0	.008*
Amputation	12.0	12.0	12.0	13.0	13.0	14.0	.010*
Arthroscopy	11.0	11.0	12.0	12.0	13.0	13.0	.003*
Total: leg/ankle	1.4	1.1	1.0	1.0	1.0	1.0	.075
Foot/toe							
Excision	5.3	4.7	4.3	7.0	7.0	4.3	.713
Repair/Revision/Recon	5.4	4.8	4.8	4.8	4.9	6.0	.485
Fracture/Dislocation	3.5	4.0	3.7	3.4	3.3	3.5	.299
Arthrodesis	7.0	5.3	4.5	5.0	4.0	3.5	.011*
Total: foot/toes	2.3	4.3	1.9	2.2	2.0	2.1	.344

*Indicates statistical significance ($P < .05$).

Figure 2.

Fold difference between top and bottom 10th percentiles over time for total leg/ankle and foot/toes procedures between 2007 and 2019.



A 2020 survey by Kohring et al[6] found that only 47.5% of graduating residents felt comfortable performing foot and ankle arthrodesis independently, one of the lowest percentages of confident residents observed across the 18 adult procedures queried, second only to spine decompression/fusion. Of those graduates, the mean number of cases required for independence was 28.1, a volume substantially greater than the required minimum and the mean case volume seen in this study (19.9). For comparison, residents in the 90th percentile completed an average of 36 arthrodesis cases while the 10th percentile performed an average of 7 in 2019. Since 2016, the average number of arthrodesis cases among the lowest 10th percentile has been the ACGME minimum or higher (5.0-7.0), an improvement from previous studies, though residents at this percentile remain dangerously close to not meeting requirements.[8] Although foot and ankle arthrodesis is a very subspecialized procedure, the significant disparity between the 10th and 90th percentiles, as well as the abundance of residents beneath the mean volume posited for independence, suggests a focal target for improving resident competency.

The ACGME does not provide set guidelines regarding time spent by residents rotating within orthopaedic subspecialties. A 2019 study by Sacks et al[12] found that residents spent the second lowest percentage of time on their foot and ankle service (5.9%), with only oncology less so (4.5%). A 2019 survey found that 35% of residents across training years reported that they lacked adequate exposure to foot and ankle surgery cases.[7] This relatively limited exposure to the

Table 2.

Change in Volume of Leg/Ankle and Foot/Toe Cases in 2019 Compared With 2007 and 2014.

Log reports classification	Change in volume in 2019	
	Since 2007, % (*P* value)	Since 2014, % (*P* value)
Leg/ankle		
Incision	–42.3 (.001)	13.7 (.001)
Excision	–27.9 (.001)	–8.8 (.025)
Intro/Removal	0.0 (.999)	0.0 (.999)
Repair/Revision/Recon	–20.9 (.001)	50.7 (.001)
Fracture/Dislocation	2.6 (.217)	27.0 (.001)
Manipulation	79.3 (.001)	39.9 (.001)
Arthrodesis	4.8 (.211)	69.2 (.001)
Amputation	4.5 (.348)	20.7 (.001)
Arthroscopy	12.1 (.029)	16.1 (.005)
Other procedures	–70 (.001)	–29.4 (.002)
Total: leg/ankle	–3.7 (.034)	28.6 (.001)
Foot/toe		
Incision	–45 (.001)	–5.7 (.384)
Excision	–33.8 (.001)	–10.2 (.002)
Intro/Removal	–42.9 (.001)	–33.3 (.001)
Repair/Revision/Recon	–46.3 (.001)	35.5 (.001)
Fracture/Dislocation	–18.9 (.001)	26.3 (.001)
Manipulation	36.8 (.001)	44.4 (.001)
Arthrodesis	26.0 (.001)	93.8 (.001)
Amputation	–12.3 (.021)	16.3 (.007)
Arthroscopy	N/A	100.0 (.009)
Other procedures	–78.6 (.001)	–57.1 (.001)
Total: foot/toes	–27.0 (.001)	27.8 (.001)

subspecialty is a recognized challenge in foot and ankle surgery. A 2003 study by Pinzur et al[13] found that 54.1% of orthopaedic surgery residency programs at the time (80 of 148) had only one foot and ankle faculty member, with 10.1% having no such faculty at all. A 2010 update to this study found a 5.5% increase in programs with at least one dedicated foot and ankle surgeon and a 15.1% increase in programs with dedicated foot and ankle rotations.[14] No such studies have been completed since the implementation of case minimums in 2013, but the present study demonstrates that foot and ankle case volume per resident has steadily increased since this time, suggestive of increased teaching faculty and case availability for trainees.

Likewise, DeFroda et al[8] were unable to compare percentile data for some case subcategories between 2009 and

2013 due to a mean of zero cases being logged by the 10th resident percentile, including ankle arthrodesis and leg/ankle manipulation. The presence of case volume averages greater than zero in these subcategories among lower percentile programs from 2014 to 2019, albeit small values with a substantial difference versus higher percentiles, suggests a possible increase in foot and ankle teaching staff presence at previously underrepresented programs, allowing for resident exposure to previously inaccessible cases. The substantial discrepancy between 10th and 90th percentile programs reinforces the reality that a substantial percentage of foot and ankle teaching cases is being performed at a minority of institutions.[5] Of note, an investigation into resident subspecialization found that residents choosing to pursue a foot/ankle fellowship from academic training programs did not have significantly more exposure to the field than those who were not pursuing a foot/ankle fellowship, in contrast to what was observed of residents pursuing spine surgery, hand surgery, and sports medicine fellowships.[15] Relatively limited case exposure does not appear to affect foot/ankle fellowship decision, though the possibility remains that limited case availability impeded the ability of interested residents to acquire more exposure during training.

Ankle arthroscopy, a fundamental procedure in modern ankle surgery, has seen significant progress and refinement over the past 2 decades, reflected by a steady yet modest increase observed in resident case volume (12.1% increase since 2007, 16.1% since 2014). DeFroda et al[8] reported a statistically significant increase in ankle arthroscopy case volume (23%) between 2009 and 2013, consistent with increased implementation of arthroscopy during this time.[3,4] Ankle arthroscopy (mean of 6.5 cases in 2019) is still logged by residents with less frequency than other common arthroscopic procedures, such as shoulder (mean of 83.8 cases in 2019) and knee arthroscopy (mean of 117.1 cases in 2019), reflective of the overall incidence of these procedures. Sabharwal et al[10] reported a decrease in resident knee and shoulder arthroscopic case volume after minimum case requirements were implemented in 2013, suggesting a redirection of resident focus away from procedures that were well over the ACGME minimum toward those less represented. No such decrease was observed in ankle arthroscopy cases in the present study, and the increased role of arthroscopy in managing midfoot, forefoot, and great toe pathology has resulted in a yearly mean foot/toe arthroscopy case volume greater than zero since 2013.[3] The volume of ankle arthroscopy for residents is low nevertheless, with massive, significant variability across residencies (a 11.0- to 13.0-fold yearly difference between upper and lower percentiles from 2014 to 2019) and the technique can present with a steep learning curve: to feel comfortable performing respective arthroscopy independently, recent orthopaedic residency graduates reported a median of 25 knee cases and 28 shoulder cases required, far more than the mean ankle arthroscopy volume of 6.5 cases in 2019.[6] Opportunity may be limited by the incidence of ankle arthroscopy cases even at active teaching hospitals, particularly when compared with shoulder and knee, though arthroscopy is unique in the potential for simulated experience. Bioskills laboratories can be useful tools for trainees, and recent development of a Diagnostic Ankle Arthroscopy Skills Scoring System similar to that used in knee arthroscopy is evidence of a collective effort to improve this training.[16] Although operative experience is recognized as superior, simulated ankle arthroscopy has a promising future as a meaningful supplement for lower and higher volume residency programs alike.[17]

This study has several potential limitations. Case logs released by the ACGME have been shown to have varying degrees of accuracy, and the published case data may not be fully representative of true case volumes.[18,19] There is also a distinct lack of detail available from the ACGME, with nuances that would be relevant for analysis such as program type, program location, case complexity, faculty presence and experience, and resident involvement unavailable for the present study. The case subcategories are often broad and nonspecific, with the leg/ankle category including lower extremity trauma and multiple subcategories encompassing a range of unique procedures. Despite these unknown variables, there is substantial data for analysis, and the ACGME has implemented strict reporting guidelines for accreditation requirements that help to limit issues with reporting accuracy. Last, case volume is only one component of an orthopaedic surgery education, with other highly relevant aspects of training present beyond the scope of this study.

Conclusions

This investigation demonstrated a gradual increase in foot and ankle case volume since the implementation of minimum case requirements in 2013. Since 2007, there has been a net decrease in foot/toe case volume reported by residents, with no decrease in leg/ankle case volume. Progress continues to be made regarding total resident case quantity, experience with required cases, and exposure to diverse procedures at programs with lower volume, but significant room for improvement remains. Significant disparities between high and low volume programs, predominantly concerning arthrodesis and arthroscopy, are evidence of possible deficiencies in resident education. Increased exposure at low volume programs, either through increased faculty, adjustments in subspecialty rotations, or supplementation through other teaching didactics or simulated modalities, may help bridge this educational gap.

Declaration of Conflicting Interests

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Ethical Approval

Not applicable, because this article does not contain any studies with human or animal subjects.

Informed Consent

Not applicable, because this article does not contain any studies with human or animal subjects.

Trial Registration

Not applicable, because this article does not contain any clinical trials.

ORCID iD

Davis A. Hartnett https://orcid.org/0000-0003-3526-1465 FAS

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Podiatry Residency Resource

Surgical Procedure Summary Report

Golding, Stephanie (PGY-3)	
Category :	Other Osseous Foot Surgery, Digital Surgery, History and Physical Examination, Surgery and Surgical Subspecialties, Other Soft Tissue Foot Surgery, Other Podiatric Procedures, Biomechanics, Reconstructive Rearfoot/Ankle Surgery, Medicine and Medical Subspecialty Experiences, First Ray Surgery
Attending :	Mikheyev, German DPM, Somji, Alyaz MD, Bazata, John DPM, Perez-Izquierdo, Manuel MD, Nazario, Steven md, Siddiqui, Sohail DPM, Varnagy, David , Rutledge, Amanda MD, Adewale, Ademola MD, Choi, Sean md, Conte, Joseph DPM, Talbert, Todd DPM, Funk, Joseph DPM, Childs, Douglas DPM, Buffkin, Kimberly MD, Perez Gomez, Andes DPM, Saranita, Anthony DPM, Martincevic, Matthew DPM, McRorie, Duane DPM, Estrada, Robert DPM, Profetta, Bernadette MD, Denny, Cliff MD, Shane, Amber DPM, Schmidt, Larissa DPM, Moats, David DPM, Reeves, Chris DPM, Alamia, Peter MD, Tomesek, Kevin MD, Lin, Shing-Yu MD, Mohar, Camilo MD, Smith, Michael DPM, O'Grady, Lisa md, Wiernik, Daniel DPM, Grant, Lori DPM, Coutsoumpos, Alex MD, Thurston, Paul DPM, Pascarella, Eugene DPM, Porter, Jason MD, Sayeed, Frazz DPM, Moncman, Tara DO, Sanchez, Luis DPM, Wagner, Curtis DPM, Mason, Tim DPM, Suppiah, Aravinthan MD, Bornstein, Gerald DPM, Woo, Raymond MD, Blum, Jonathen DPM, Wladis, Alan MD, Cavins, Zach DPM, Fussell, Tara DPM, Reeves, Christopher DPM, Hoover, Robert DPM, Weagraffe, Zach MD, Lugo, Katia MD, Tootle, Kevin DPM, Clayton, Jerome MD, Finkelstein, Howard DPM, Cooper, Herbert MD
Institution:	Florida Hospital East Orlando, Florida Hospital Kissimmee, Orlando Regional Medical center, Florida Hospital Orlando, Resident Clinic, Office, Florida Hospital Altamonte, Florida Hospital Winter Garden, Same Day SurgiCenter of Orlando, Sand Lake Hospital, Ambulatory Ankle And Foot Center Florida , Orlando Orthopedics Surgery Center, Orlando Center For Outpatient Surgery, Orlando Surgery Center, Millenia Surgery Center, Orlando Regional Arnold Palmer, South Seminole, Florida Hospital Winter Park, Florida Hospital Celebration Health, Florida Hospital Apopka
Date Range :	07/01/2020-07/01/2023

Procedure	2nd	1st	Total 1st+2nd
11 - Partial Ostectomy/Exostectomy	0	8	8
110 - Management of Bone/Joint Infection	0	14	14
111 - Open Management of Digital Fracture/Dislocation	0	8	8
12 - Phalangectomy	0	3	3

13 - Arthroplasty (Interphalangeal Joint [IPJ])	0	105	105
14 - Implant (IPJ) (silastic implant or spacer)	0	3	3
16 - Phalangeal Osteotomy	0	18	18
17 - Fusion (IPJ)	0	113	113
18 - Amputation	0	74	74
19 - Management of Osseous Tumor/Neoplasm	0	3	3
211 - Bunionectomy (partial ostectomy/Silver procedure), with or without capsulotendon balancing procedure	0	4	4
2110 - Bunionectomy double correction with osteotomy and/or arthrodesis	0	3	3
213 - Bunionectomy with Phalangeal Osteotomy	0	2	2
214 - Bunionectomy with Distal First Metatarsal Osteotomy	0	47	47
215 - Bunionectomy with First Metatarsal Base or Shaft Osteotomy	0	9	9
216 - Bunionectomy with First Metatarsocuneiform Fusion	0	71	71
217 - Metatarsophalangeal Joint (MPJ) Fusion	0	2	2
218 - MPJ Implant	0	1	1
219 - MPJ Arthroplasty	0	2	2
221 - Cheilectomy	0	18	18
226 - MPJ Fusion	0	20	20
227 - MPJ Implant	0	15	15
228 - MPJ Arthroplasty	0	1	1
231 - Tendon transfer/lengthening procedure	0	2	2

2310 - Other First Ray Procedure Not Listed Above	0	2	2
232 - Osteotomy (e.g., Dorsiflexory)	0	1	1
233 - Metatarsocuneiform Fusion (Other Than For Hallux Valgus or Hallux Limitus)	0	1	1
234 - Amputation	0	13	13
236 - Management of Bone/Joint Infection (With or Without Bone Graft)	0	8	8
237 - Open Management of Fracture or MPJ Dislocation	0	2	2
239 - Revision/Repair of Surgical Outcome (e.g., non-union, hallux varus)	0	5	5
31 - Excision of Ossicle/Sesamoid	0	2	2
310 - Excision of soft tissue tumor/mass (without reconstructive surgery: includes foot, ankle or leg)	0	63	63
312 - Plastic Surgery Techniques (Including Skin Graft, Skin Plasty, Flaps, Syndactylization, Desyndactylization, and Debulking Procedures Limited to The Forefoot)	0	68	68
314 - Other Soft Tissue Procedures not Listed Above (Limited to The Foot)	0	1	1
316 - External neurolysis/decompression(including tarsal tunnel)	0	15	15
32 - Excision of Neuroma	0	25	25
33 - Removal of Deep Foreign Body (Excluding Hardware Removal)	0	12	12
34 - Plantar Fasciotomy	0	40	40
35 - Lesser MPJ Capsulotendon Balancing	0	10	10
36 - Tendon Repair, Lengthening, or Transfer Involving the Forefoot (Including Digital Flexor Digitorum Longus Transfer)	0	9	9
37 - Open Management of Dislocation (MPJ/Tarsometatarsal)	0	4	4

38 - Incision and drainage/wide debridement of soft tissue infection(includes foot, ankle or leg)	0	131	131
39 - Plantar fasciectomy/plantar fibroma resection	0	14	14
41 - Partial Ostectomy (including the talus and calcaneus) (includes foot, ankle or leg)	0	37	37
410 - Amputation (Lesser Ray, Transmetatarsal Amputation)	0	59	59
411 - Management of Bone/Joint Infection Distal to The Tarsometatarsal Joints (With or Without Bone Graft)	0	15	15
413 - Open Management of Tarsometatarsal Fracture/Dislocation	0	4	4
414 - Multiple Osteotomy Management of Metatarsus Adductus	0	2	2
415 - Tarsometatarsal Fusion	0	19	19
416 - Corticotomy/Callus Distraction of Lesser Metatarsal	0	2	2
417 - Revision/Repair of Surgical Outcome in The Forefoot	0	7	7
419 - Detachment/Reattachment of Achilles Tendon with Partial Ostectomy	0	22	22
43 - Bunionectomy of The Fifth Metatarsal Without Osteotomy	0	3	3
44 - Metatarsal Head Resection (Single or Multiple)	0	14	14
45 - Lesser MPJ Implant	0	2	2
46 - Central Metatarsal Osteotomy	0	50	50
47 - Bunionectomy of The Fifth Metatarsal With Osteotomy	0	12	12
48 - Open Management of Lesser Metatarsal Fracture(s)	0	34	34
49 - Harvesting of bone graft (includes foot, ankle or leg)	0	13	13
511 - Plastic Surgery Techniques Involving The Midfoot, Rearfoot, or Ankle	0	1	1

512 - Tendon Transfer Involving the Midfoot, Rearfoot, Ankle, or Leg	0	12	12
513 - Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	6	81	87
515 - Delayed Primary or Secondary Repair of Ligamentous Structures	0	43	43
516 - Tendon Augmentation/Supplementation/Restoration	1	61	62
517 - Open Synovectomy of The Rearfoot/Ankle	0	1	1
519 - Other elective rearfoot reconstructive/ankle soft tissue surgery not listed above	0	1	1
521 - Operative Arthroscopy	0	9	9
521 - Operative Arthroscopy Without Removal of Loose Body or Other Osteochondral Debridement	0	22	22
5211 - Other Elective Rearfoot Reconstructive/Ankle Osseous Surgery not Listed Above	0	2	2
523 - Subtalar Arthroeresis	0	7	7
524 - Midfoot, Rearfoot, or Ankle Fusion	1	40	41
525 - Midfoot, Rearfoot, or Tibial Osteotomy	5	41	46
526 - Coalition Resection	0	6	6
527 - Open Management of Talar Dome Lesion (With or Without Osteotomy)	0	6	6
528 - Ankle Arthrotomy With Removal of Loose Body or Other Osteochondral Debridement	0	1	1
528 - Ankle Arthrotomy/Arthroscopy with Removal of Loose Body or Other Osteochondral Debridement	0	2	2
529 - Ankle Implant	1	8	9
531 - Repair of Acute Tendon Injury	0	31	31

532 - Repair of Acute Ligament Injury	0	4	4
534 - Excision of soft tissue tumor/mass of the foot, ankle or leg (with reconstructive surgery)	0	1	1
537 - Other Non-Elective Rearfoot Reconstructive/Ankle Soft Tissue Surgery not Listed Above	0	1	1
541 - Open Repair of Adult Midfoot Fracture	0	4	4
542 - Open Repair of Adult Rearfoot Fracture	0	8	8
543 - Open Repair of Adult Ankle Fracture	2	66	68
544 - Open Repair of Pediatric Rearfoot/Ankle Fractures or Dislocations	0	1	1
545 - Management of Bone Tumor/Neoplasm (With or Without Bone Graft)	0	1	1
546 - Management of Bone/Joint Infection (With or Without Bone Graft)	0	16	16
547 - Amputation Proximal to The Tarsometatarsal Joints	0	10	10
549 - Do not use after 6/30/23 - Application of multiplanar external fixation midfoot, rearfoot, ankle (does not include mini or mono rails)	0	4	4
61 - Do not use after 6/30/23 - Debridement of Superficial Ulcer or Wound	0	1	1
613 - Do not use after 6/30/23 - Other Clinical Experiences	0	1	1
614 - Percutaneous Procedures, (i.e., Coblation, Cryosurgery, Radiofrequency Ablation, Platelet-rich Plasma, Digital Tenotomy)	0	14	14
62 - Excision or Destruction of Skin Lesion (Including Skin Biopsy and Laser Procedures)	0	4	4
63 - Nail Avulsion (partial or complete)	0	13	13
64 - Matrixectomy (Partial or Complete, by Any Means)	0	26	26

65 - Removal of Hardware (Internal or External Fixation)	1	64	65
66 - Repair of Simple Laceration (No Neurovascular, Tendon, or Bone/Joint Involvement); Includes Simple Delayed Wound Closure	0	5	5
67 - Do not use after 6/30/23 - Biological Dressings	0	51	51
71 - Biomechanical Case; Must Include Diagnosis, Evaluation (Biomechanical and Gait Examination), and Treatment.	0	84	84
81 - Comprehensive History and Physical Examination	0	100	100
91 - General Surgery	5	2	7
92 - Orthopedic Surgery	0	8	8
94 - Vascular Surgery	1	5	6
104 - Emergency Medicine	0	1	1
Total Procedures	23	2137	2160

Article

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Effect of Insurance on Rates of Total Ankle Arthroplasty Versus Arthrodesis for Tibiotalar Osteoarthritis

Nathanael Heckmann, MD[1], Alexander Bradley, BS[1], Lakshmanan Sivasundaram, MD[2], Ram Kiran Alluri, MD[1], and Eric W. Tan, MD[1]

Abstract

Background: Several studies have examined the effect of insurance on the management of various orthopedic conditions. The purpose of our study was to assess the effect of insurance and other demographic factors on the operative management of tibiotalar osteoarthritis.

Methods: The National Inpatient Sample (NIS) database was used to identify patients who underwent a total ankle arthroplasty (TAA) or tibiotalar arthrodesis (TTA) for tibiotalar osteoarthritis. Insurance status was identified for each patient, and the proportions of each insurance type were computed for each operative modality. A multivariate analysis was performed to account for confounding variables to isolate the effect of insurance type on operative treatment.

Results: From 2007 to 2012, a total of 10 010 patients (35.6%) were identified who underwent a total ankle replacement (TAR) procedure and 18 094 patients (64.4%) who underwent TTA for tibiotalar osteoarthritis. Patients receiving a TAR were older (65.8 vs 64.2, $P < .001$), more likely to be female (54% vs 51%, $P < .001$), and had fewer comorbidities (4.2 vs 4.5, $P < .001$) than patients who underwent a TTA. After controlling for baseline differences, patients with Medicare (odds ratio [OR] 3.00, $P < .001$), and private insurance (OR 3.19, $P < .001$) were approximately 3 times more likely to undergo TAR than patients with Medicaid.

Conclusions: Patients with tibiotalar osteoarthritis were more likely to receive a TAR procedure if they had Medicare or private insurance compared with patients who had Medicaid. Further research should be done to better understand the drivers of this phenomenon if equitable care is to be achieved.

Level of Evidence: Level II, prognostic study.

Keywords: total ankle arthroplasty, ankle arthrodesis, tibiotalar osteoarthritis

Osteoarthritis of the tibiotalar joint may cause considerable disability, pain, and dysfunction, resulting in socioeconomic losses and substantial medical costs. For patients with end-stage osteoarthritis, initial treatment options include nonsteroidal anti-inflammatory medication, bracing, therapy, joint injections, and activity modification. When conservative measures fail, surgery is often necessary. Tibiotalar arthrodesis (TTA) has traditionally been the treatment of choice, eliminating the symptomatic motion of the affected joint, which thereby reduces pain. However, ankle arthrodesis may result in gait disturbances and stress transfer, resulting in adjacent joint degeneration and the potential need for additional surgery.[2,27,32] With the improvement in implant design and operative techniques, total ankle replacement (TAR) has become an important and effective motion-preserving alternative to TTA.[4,9,23,31]

With the changing paradigm of health care in the United States, access to care has become an issue that has received increased attention, particularly among operative specialties that address degenerative conditions.[5,8,12,16,24] The rising number of newly insured patients and the increasing average age of the US population have only compounded the problem of access to care currently challenging health care providers. With these health care and demographic changes in mind, understanding the influence that insurance coverage has on operative treatment decisions has never been more important. There have been several recent studies examining the effect of insurance coverage on access to care and operative

[1]Department of Orthopaedic Surgery, Keck School of Medicine at USC, Los Angeles, CA, USA
[2]Department of Orthopaedic Surgery, Case Western Reserve University School of Medicine, Cleveland, OH, USA

Corresponding Author:
Eric W. Tan, MD, Department of Orthopaedic Surgery, Keck School of Medicine at USC, 1540 Alcazar St, Los Angeles, CA 90089-9007, USA.
Email: erictan@usc.edu

treatment for various orthopedic conditions, but none, to our knowledge, have examined the effect of insurance on the operative management of tibiotalar osteoarthritis.*

The primary purpose of our study was to examine trends in TAR and TTA utilization to determine whether insurance type influenced the operative treatment a patient received for tibiotalar osteoarthritis. Our secondary purpose was to examine patient, hospital, and demographic factors that may have also accounted for this variability in utilization.

Methods

A retrospective review of the Nationwide Inpatient Sample (NIS) discharge records was conducted from 2007 to 2012 to identify patients who underwent a TAR or TTA. The NIS is the largest inpatient database in the United States, representing approximately 20% of the approximately 37 million annual discharges in the United States. Weighted data from this sample allow researchers to investigate national trends. This database was searched using International Classification of Diseases, 9th edition (ICD-9), procedure coding for individuals who had a primary procedure of TAR (815.6) or ankle arthrodesis (811.1). In addition to having 1 of these 2 procedure codes, all patients included in the study must have had a concomitant diagnosis of tibiotalar osteoarthritis (appendix). Patients who died during their hospital stay were excluded from our analysis. In addition, patients with rheumatoid arthritis, avascular necrosis, and infection were excluded (appendix). To minimize the effect of age as a selection bias, all patients less than 50 years old were excluded from our analysis (Figure 1). This age was selected to maximize the number of patients included in the final analysis while adhering to the commonly accepted age cutoff for TAR.[1,7,25]

Individuals were grouped by the operative intervention they received. Variables assessed included age, gender, race (Caucasian, Black, Hispanic, Asian, Native American), number of chronic medical conditions, total length of stay, primary procedure (TAR, TTA), primary payer (private insurance, Medicare, Medicaid, self-pay), median household income of the patient's ZIP code of residence (1-\$39 003, \$39 000-48 000, \$48 000-\$63 000, \$63 000+), hospital region (Northeast, Midwest, South, West), hospital location and teaching status (urban teaching, urban nonteaching, and rural), hospital bed size (small, medium, large), and hospital ownership (government, private nonprofit, private for-profit). In addition to the total number of chronic conditions, specific comorbidities such as hypertension, congestive heart failure, diabetes mellitus, peripheral vascular disease, and chronic kidney disease were also identified.

All of the aforementioned categorical variables were defined by the Healthcare Cost and Utilization Project (HCUP) prior to distribution of the NIS database. The HCUP provides unweighted data, which is the raw number of records provided in their database. The data are only a sample of discharges; therefore, results from the unweighted data are not generalizable nationwide. To solve this problem, the NIS contains a variable that weights each record by its relative contribution to providing a nationwide estimate. This method of using a weighting variable to produce nationwide estimates has been used in a number of studies using the NIS. Discharge-level weights were used when comparing individual records, while hospital-level weights were used when comparing hospital characteristics in accordance with prior studies using the NIS database.[16,17]

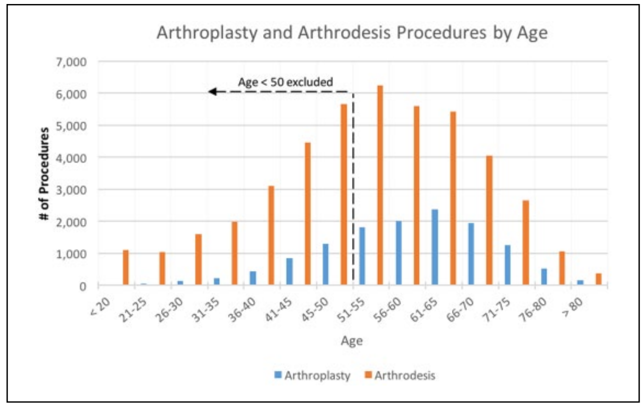

Figure 1. Histogram showing age distribution of tibiotalar arthrodesis and total ankle replacement patients prior to exclusion criteria. Patients were identified using ICD-9 procedure coding for total ankle replacement (815.6) or ankle arthrodesis (811.1).

Statistically significant differences between patients undergoing a TAR versus TTA were determined using a Pearson chi-squared analysis for categorical variables and to compare proportions of procedures performed per year. A Student t test was used to assess differences between continuous variables. Variables that had a P value $\leq .2$ on univariate analysis were added to a regression model. To control for the effects of confounding variables, multinomial logistic regression was used to determine the odds ratios (OR) for each of the aforementioned variables. Statistical significance was set at $P < .05$.

An initial cohort of 57 790 patients were identified during the time period we examined, 44 323 of which received a TTA procedure and 15 467 received a TAR. After exclusion criteria were applied, a total of 28 104 patients were identified who received either a TTA or TAR procedure. Of these, 10 010 patients (35.6%) underwent a TAR procedure and 18 094 patients (64.4%%) underwent TTA. From 2007 to 2012, the number of patients who underwent a TAR procedure increased from 675 procedures per year to 2825 per year, representing a 418.5% increase (Figure 2). Over this same time period, TTA decreased from 3149 procedures per year to 2665 procedures per year, representing a decline of 15.4%. The proportion of patients receiving a TAR for

*References 6, 10, 11, 13-15, 20-22, 26, 28, 29.

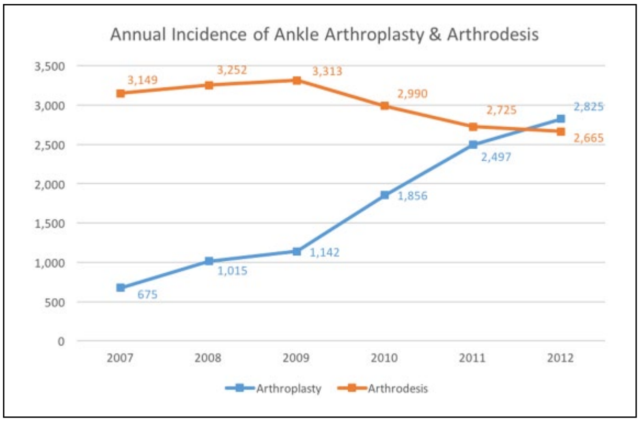

Figure 2. The annual incidence of total ankle replacement and tibiotalar arthrodesis for the treatment of tibiotalar osteoarthritis.

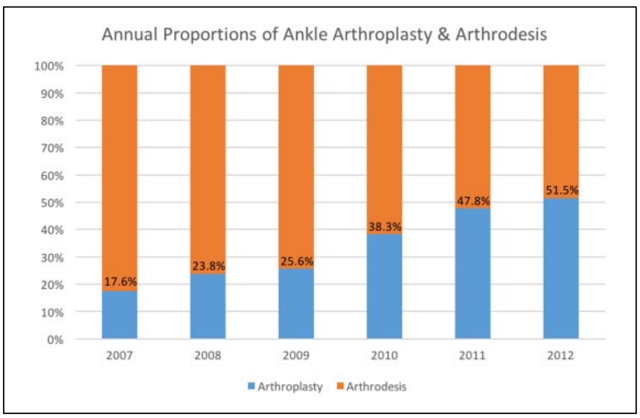

Figure 3. The annual proportion of total ankle replacement procedures as a percentage of all procedures for the treatment of tibiotalar osteoarthritis.

tibiotalar osteoarthritis increased from 17.6% in 2007 to 51.5% in 2012 ($P < .0001$; Figure 3).

The study cohort was 47% female and 88% white. Approximately 50% of patients had Medicare, 3% Medicaid, and 41% private insurance (Table 1). On univariate analysis, several baseline differences were noted between the TTA and TAR groups. Patients receiving a TAR were significantly older than patients receiving a TTA (65.8 ± 8.7 vs 64.2 ± 9.1; $P < .001$). There was also a slightly higher but significant proportion of men in the TTA group compared with the TAR group (54% vs 51%; $P < .001$). A higher proportion of patients in the TTA group were Hispanic or black compared with the TAR group. Patients in the TTA group also had significantly more comorbidities than the TAR group (4.5 ± 2.5 vs 4.2 ± 2.4; $P < .001$) and higher prevalence of congestive heart failure, hypertension, diabetes, obesity, anemia, chronic lung disease, and obesity. A higher proportion of TTA procedures occurred in rural hospitals compared with TAR ($P < .001$). Other patient, hospital, and demographic factors are described in Table 1.

Results

After controlling for patient age, ethnicity, insurance provider, comorbidities, and hospital size and location, patients with Medicare and private insurance were approximately 3 times more likely to undergo a TAR procedure than patients with Medicaid (Medicaid vs Medicare OR 3.00, $P < .001$; private insurance vs Medicaid OR 3.19, $P < .001$; Table 2). When the study period was divided into 2 equal parts (ie, 2007-2009 and 2010-2012), Medicare and private insurance patients remained more than 3 times as likely to receive a TAR compared with patients with Medicaid. There were also no significant differences in the likelihood of receiving TAR between the Medicare and private insurance patients during the entire study period and the 2 study halves.

Patient and hospital factors were also assessed on multivariate analysis to determine other variables that may have independently influenced procedure choice (Table 3). Older, female patients were more likely to undergo a TAR procedure than young (OR 1.02 per year, $P = .001$), male (OR 1.15, $P < .040$) patients. Medium and large hospitals were less likely than small hospitals to perform a TAR (OR 0.81, $P < .034$ and OR 0.85, $P < .049$, respectively), and urban nonteaching and teaching hospitals were more likely to perform a TAR than rural hospitals (OR 2.35, $P < .001$ and OR 1.68, $P < .002$, respectively). Patients with diabetes ($P < .001$), obesity ($P = .009$), and renal failure ($P = .017$) were less likely to have a TAR procedure than patients without these comorbidities.

Discussion

The present study found that patients with Medicare and private insurance were approximately 3 times more likely to receive a TAR than patients with Medicaid for the treatment of tibiotalar arthritis. While many factors likely contribute to this finding, our study found that this discrepancy persisted even after accounting for all identifiable differences between the patient groups. Several explanations may account for this finding. First, patients with Medicaid tend to live in rural areas where access to tertiary centers that perform more TAR procedures may be limited.[14,20] Second, reimbursement varies based on insurance provider, which may incentivize hospitals and surgeons to perform TTA procedures for Medicaid patients, which reimburse less than Medicare and private insurers.[3,30] Finally, socioeconomic and demographic factors, which are known to vary based on insurance type, may play a role in the decision to perform a TAR or TTA.[10,18]

Medicaid patients have several socioeconomic and geographic barriers to orthopedic care.[14,20] A recent study by

Table 1. Patient Demographics & Cohort Characterisitics.

	Total Cohort	Arthroplasty	Arthrodesis	
	N = 28 104	n = 10010	n = 18094	Significance
Age, y, mean ± SD	64.8 ± 9.0	65.8 ± 8.7	64.2 ± 9.1	<.001
Sex, %				<.001
Female	13 130 (47)	4845 (49)	8285 (46)	
Male	13 130 (53)	5134 (51)	9719 (54)	
Ethnicity, %				<.001
White	19538 (88)	7093 (89)	12445 (88)	
Black	831 (4)	212 (3)	619 (4)	
Hispanic	816 (4)	268 (3)	549 (4)	
Asian	259 (1)	39 (0.5)	44 (0.3)	
Other	660 (3)	284 (4)	376 (3)	
Primary health insurance, %				<.001
Medicare	14 103 (50)	5345 (54)	8758 (49)	
Medicaid	937 (3)	130 (1)	808 (4)	
Private	11 405 (41)	4106 (41)	7299 (40)	
Number of comorbidities	4.4 ± 2.5	4.2 ± 2.36	4.5 ± 2.5	<.001
Comorbidities, %				
Congestive heart failure	651 (2)	170 (1.7)	481 (3)	.029
Hypertension	17062 (61)	5810 (58)	11 252 (62)	.001
Diabetes	4498 (16)	1212 (12)	3286 (18)	<.001
Peripheral vascular disease	572 (2)	167 (1.7)	404 (2)	.160
Obesity	4299 (15)	1176 (11)	3123 (17)	<.001
Alcohol abuse	378 (1.3)	79 (0.8)	299 (1.7)	<.001
Depression	3265 (11.6)	1102 (11.0)	2162 (11.9)	.292
Anemia	4586 (8)	562 (4)	4024 (9)	<.001
Chronic lung disease	3883 (14)	1195 (12)	2688 (15)	.003
Hospital type, %				<.001
Rural	1750 (6)	381 (4)	1368 (8)	
Urban nonteaching	10414 (37)	4158 (42)	6255 (35)	
Urban teaching	15656 (57)	5404 (54)	10252 (57)	
Hospital bed size, %				<.001
Small	4722 (17)	1941 (19)	2782 (16)	
Medium	6720 (24)	2338 (24)	4382 (25)	
Large	16377 (59)	5665 (57)	10712 (60)	
Median income, %				<.001
0-25th Percentile	5674 (21)	1763 (18)	3911 (22)	
25-50th Percentile	6953 (25)	2262 (23)	4691 (26)	
50-75th Percentile	7445 (27)	2777 (28)	4668 (26)	
75-100th Percentile	7389 (27)	2999 (30)	4389 (22)	
Total hospital charge	$47,746 ± 37,523	$64,760 ± 41,015	$38,422 ± 31,816	<.001
Length of stay	2.5 ± 2.3	2.3 ± 1.3	2.5 ± 2.7	.001

Patterson et al[20] found that orthopedic practices in North Carolina within urban areas were far less likely to offer Medicaid patients an appointment compared with practices located within a rural area. The authors of this study concluded that Medicaid patients have decreased access to orthopedic care, particularly care from tertiary academic medical centers, which predominantly reside in urban settings. With respect to access to TAR, Kim et al[14] surveyed 240 ankle arthroplasty practices across 8 states and found that Medicaid patients were far less likely to be offered an appointment compared with Medicare and private insurance patients. Furthermore, when patients with Medicaid attained an appointment, they were faced with wait times that were approximately twice as long as those experienced by Medicare and privately insured patients. These studies highlight the continued limitations that Medicaid patients have to orthopedic care, particularly specialized care that is necessary for a technically demanding procedure such as

Table 2. Multivariate Analysis with Odds Ratios Expressed as Odds of Receiving a Total Ankle Replacement.

	OR	95% CI	*P* Value
Entire study period (2007-2012)[a]			
Medicare	3.00	1.78-5.06	<.001
Private insurance	3.19	1.91-5.32	<.001
First half of study period (2007-2009)[a]			
Medicare	3.70	1.36-10.06	.010
Private insurance	3.45	1.28-9.31	.014
Second half of study period (2010-2012)[a]			
Medicare	3.07	1.62-5.80	.001
Private insurance	3.46	1.86-6.42	<.001

[a]Reference: Medicaid.

Table 3. Multivariate Analysis of Noninsurance Factors With Odds Ratios Expressed as Odds of Receiving a Total Ankle Replacement Versus Tibiotalar Arthrodesis.

	OR	95% CI	*P* Value
Age (per 1-year increase in age)	1.02	1.00-1.02	.001
Gender (reference: male)			
Female	1.15	1.00-1.31	<.040
Hospital size (reference: small)			
Medium	0.81	0.67-0.98	.034
Large	0.85	0.72-0.99	.049
Hospital type (reference: rural)			
Urban nonteaching	2.35	1.70-3.24	<.001
Urban teaching	1.68	1.22-2.32	.002
Comorbidities			
Diabetes	0.55	0.46-0.67	<.001
Obesity	0.78	0.64-0.94	.009
Renal failure	0.60	0.39-0.91	.017

TAR. Furthermore, this limitation in access may lead to a delay in treatment, which may increase the likelihood of more severe osteoarthritis and deformity, making these patients less ideal for a TAR procedure.

Operative costs, insurance reimbursement, surgeon financial gains, and hospital profits may also play a role in the surgery offered to a patient with tibiotalar osteoarthritis. A TAR implant alone may cost more than an entire TTA procedure, including pre- and postoperative care.[3] When hospital costs, surgeon fees, and implants are taken into account, a TAR procedure may cost approximately 2 to 3 times more than a TTA procedure.[3,30] Furthermore, surgeon fees for TTA may be higher than TAR in some regions, further incentivizing surgeons to select a TTA procedure, particularly for patients with insurance that may not cover all hospital and implant costs.[19] Our investigation found that hospital charges were significantly ($P < .001$) higher for TAR procedures (approximately $65 000) compared with TTA procedures (approximately $38 000); however, payment data were not readily available through the NIS database, limiting the conclusions we could draw from this finding. We also found a higher proportion of low-income patients received TTA and conversely a higher proportion of high-income patients received TAR. With the available data, it is impossible to estimate the financial impact that insurance plays during the decision-making process when choosing one operative treatment over another, but this influence cannot be overstated and warrants further investigation.

Several studies in the orthopedic literature have demonstrated differences in patient characteristics based on insurance coverage.[10,18] Hinman and Bozac[10] found that hip and knee arthroplasty patients from a single California academic institution varied widely based on their insurance status. Patients with state-administered insurance, for example, were more likely to smoke than Medicare and privately insured patients. Martin et al[18] found that arthroplasty patients in Iowa with Medicaid and state-administered insurance had a higher average body mass index, were more likely to smoke tobacco, and had lower preoperative functional outcome scores compared with Medicare and privately insured patients. Our study found similar differences in baseline patient characteristics based on insurance type. While our study accounted for all identifiable differences between the different surgery groups, the patients comprising the different insurance-based cohorts likely have innumerable and unquantifiable differences not captured by the database that may have played a role in the treatment they received. For example, psychosocial factors such as attitudes about medical treatment and willingness to seek medical care may have played a role in the trends we observed.

The present study corroborates with other studies that have documented a recent increase in TAR procedures in the United States.[23,31] Terrell et al[31] found, using a private insurance database, that the rate of TAR procedures increased by 57% from 2004 to 2009 but did not find a statistically significant change in the rate of TTA procedures over this same period. Pugely et al[23] examined Medicare trends from 1991 to 2010 and found that utilization of TAR increased by 670.8% while TTA utilization decreased by 15.6% over the same years when corrected for population size. In the present study, the number of TAR procedures increased 418.5% while TTA procedures decreased by 15.4% between 2007 and 2012. Our study used the NIS database, which represented a proportional sample of all inpatient admissions. As such, our data likely represented a more accurate nationwide estimate of trends in TAR for ankle osteoarthritis than the 2 aforementioned studies.

This investigation has several limitations. First, it is retrospective in nature and as such is limited by an inherent risk of selection bias. We sought to account for this by excluding patients under the age of 50 years and correcting for differences in baseline characteristics among the various insurance groups in our multivariate analysis; however, it is possible that there are unidentified confounders that were not taken into account in our multivariate model. Second, the NIS database relied on procedure and billing codes and was subject to errors in patient charting. Third, with the data available, we were unable to account for radiographic variables that play a role when deciding on operative treatment for end-stage tibiotalar osteoarthritis (eg, deformity, bone stock, etc).

Conclusion

The present study found an increased utilization of TAR procedures, supporting other studies that have documented an increase in the popularity of this procedure in recent years. However, we found that patients with osteoarthritis of the tibiotalar joint were more likely to get a TAR procedure if they had Medicare or private insurance compared with patients who had Medicaid throughout the time period we examined. Further research should be done to better understand the drivers of this phenomenon if equitable care is to be achieved.

Appendix

Inclusion Criteria

Must have both at least 1 procedure *and* 1 diagnosis code:

Diagnosis Codes. Primary osteoarthritis (OA)
715.17: Localized osteoarthritis, ankle and foot
715.27: Localized osteoarthritis, ankle and foot
715.37: Localized osteoarthritis, NOS, ankle and foot
715.92: Osteoarthrosis, NOS
715.97: Osteoarthrosis, NOS
716.97: Arthropathy, NOS
716.17: Traumatic arthropathy, ankle

Procedure Codes
815.6: Total ankle replacement
811.1: Ankle fusion

Exclusion Criteria

Infection
711.07: Pyogenic arthritis
711.47: Arthropathy associated with other bacterial diseases
711.87: Arthropathy associated with other infectious and parasitic diseases
711.97: Unspecified infective arthritis
730.07: Acute osteomyelitis
730.17: Chronic osteomyelitis
730.27: Unspecified osteomyelitis
730.37: Periostitis
730.87: Other infections involving bone
730.97: Unspecified infection of bone
714.0: Rheumatoid arthritis
733.40: Aseptic necrosis, NOS
733.44: Aseptic necrosis, talus
733.49: Aseptic necrosis, NEC

Outcomes

Wound Complication
998.31: Disruption of internal operation wound
98.32: Disruption of external operation wound
998.59: Other postoperative infection
998.51: Infected postoperative seroma
998.83: Nonhealing surgical wound

Deep Venous Thrombosis/Pulmonary Embolism
415.11: Iatrogenic pulmonary embolism and infarction
415.19: Pulmonary embolism and infarction, other
453.40: Deep venous thrombosis of lower extremity
453.41: DVT of proximal lower extremity
453.42: DVT of distal lower extremity

Amputation
841.0: Lower limb amputation, NOS
841.3: Disarticulation of ankle
841.4: Amputation of ankle through malleoli of tibia and fibula
841.5: Below knee amputation
841.6: Disarticulation of knee
841.7: Above knee amputation

Compartment Syndrome
729.72: Nontraumatic compartment syndrome of lower extremity
958.90: Compartment syndrome, NOS
958.99: Traumatic compartment syndrome

Neurovascular
998.2: Accidental operative laceration
904.7: Injury leg vessels
904.53: Injury posterior tibial artery
904.51: Injury anterior tibial artery

Cardiopulmonary
518.4: Acute lung edema, NOS
518.5: Pulmonary insufficiency
518.51: Acute respiratory failure
518.52: Other pulmonary insufficiency
518.53: Acute respiratory failure following surgery
518.81: Acute respiratory failure
518.82: Other pulmonary insufficiency
997.1: Cardiac complications

Declaration of Conflicting Interests

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American College of Foot and Ankle Surgeons Commentary on Surgeon Type and Outcomes After Inpatient Ankle Arthrodesis and Total Ankle Arthroplasty: Chan et al, *J Bone Joint Surg* 2019;101:127–135

We read with great interest the Chan et al article entitled "Surgeon Type and Outcomes After Inpatient Ankle Arthrodesis and Total Ankle Arthroplasty," published in *The Journal of Bone and Joint Surgery* on January 16, 2019. The article concluded that ankle arthrodesis (AA) and total ankle arthroplasty (TAA) procedures performed by podiatrists were associated with increased length of hospital stay (LOS): TAA by 16.7% and AA by 14.2%, compared with procedures performed by orthopedic foot and ankle surgeons. Additionally, AA performed by podiatrists was associated with a 28.5% increase in the cost of hospitalization ($19,236 compared with $13,433). Although the 30- and 90-day readmission rates for TAA were similar for both podiatrists (1.3% and 2.2%, respectively) and orthopedic foot and ankle surgeons (1.1% and 2.3%), the 30- and 90-day readmission rates for AA differed for podiatrists (1.8% and 2.7%, respectively) and orthopedic foot and ankle surgeons (1.0% and 1.9%). The report also pointed out that podiatrists appeared to treat sicker and more obese patients than did orthopedic foot and ankle surgeons, in regard to AA.

The report highlighted the competitiveness of obtaining orthopedic residency training, which requires among the highest Step 1 and 2 United States Medical Licensing Examination scores of all medical specialties. It also contrasted the 5 years of standard orthopedic residency training after 4 years of medical school with the 3 years of residency training (standard mandated since 2013) after 4 years of podiatric medical school. Although the 5 years of orthopedic residency training is focused on musculoskeletal problems of the entire human body, the overall exposure to foot and ankle surgery is generally inconsistent. Approximately 20% of orthopedic residency training programs have no exposure to the foot and ankle, 30% have 12 weeks, and 10.7% have >20 weeks of dedicated foot ankle training (1). In comparison, the 3 or 4 years of podiatric residency surgical training is focused on foot, ankle, and lower extremity musculoskeletal problems, with 1 year of general medicine and general surgical training. Differences in the training of specialists that provide the same services are not uncommon. For instance, a number of reports document significant differences in case volume, case variety, subspecialty concentrations, and knowledge level between plastics, general surgery, and orthopedic hand services, and also between neurosurgery and orthopedic spine surgery (2–7).

We were struck by the emphasis that Chan et al placed on the associations of LOS and increased hospital costs with provider degree, and we questioned the relative absence of any emphasis on the sicker patients cared for by podiatrists. The association of longer and more costly hospitalization with a higher Charlson Comorbidity Index is well documented in the scientific literature (8–11), and in our opinion, nothing in the Chan et al report scientifically leads the unbiased reviewer to conclude that increased LOS and hospital costs are related to the care provided by podiatrists. Interestingly, and in accordance with the Center for Medicare Services Hospital Readmissions Reduction Program (12), a Medicare value-based purchasing program that aims to reduce costly readmissions, surgeon type did not translate into differences in 30- and 90-day hospital readmissions for AA or TAA.

As health care practitioners, our primary aim is patient-centered outcomes, including patient safety and quality assurance. With the health care environment focus toward value-based care programs and reductions in complications resulting in costly readmission and reoperation, we continue to be active participants in this process.

Board of Directors,
American College of Foot and Ankle Surgeons
8725 West Higgins Rd. Ste 555, Chicago, IL 60631

Email: president@acfas.org
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TOPICS IN TRAINING

Resident Independence Performing Common Orthopaedic Procedures at the End of Training

Perspective of the Graduated Resident

Jessica M. Kohring, MD, John J. Harrast, MS, Alan K. Stotts, MD, Chong Zhang, MS, Morgan M. Millar, PhD, MA, Angela P. Presson, PhD, and Charles L. Saltzman, MD

Investigation performed at the Department of Orthopaedics, University of Utah, Salt Lake City, Utah

Background: The Accreditation Council for Graduate Medical Education (ACGME) has established minimum exposure rates for specific orthopaedic procedures during residency but has not established the achievement of competence at the end of training. The determination of independence performing surgical procedures remains undefined and may depend on the perspective of the observer. The purpose of this study was to understand the perceptions of recently graduated orthopaedic residents on the number of cases needed to achieve independence and on the ability to perform common orthopaedic procedures at the end of training.

Methods: We conducted a web survey of all 727 recently graduated U.S. orthopaedic residents sitting for the 2018 American Board of Orthopaedic Surgery Part I Examination in July 2018. The surveyed participants were asked to assess the ability to independently perform 26 common adult and pediatric orthopaedic procedures as well as to recommend the number of cases to achieve independence at the end of training. We compared these data to the ACGME Minimum Numbers and the average ACGME resident experience data for residents who graduated from 2010 to 2012.

Results: For 14 (78%) of the 18 adult procedures, >80% of respondents reported the ability to perform independently, and for 7 (88%) of the 8 pediatric procedures, >90% reported the ability to perform independently. The resident-recommended number of cases for independence was greater than the ACGME Minimum Numbers for all but 1 adult procedure. For 18 of the 26 adult and pediatric procedures, the mean 2010 to 2012 graduated resident exposure was significantly less than the mean number recommended for independence by 2018 graduates ($p < 0.05$).

Conclusions: Overall, recently graduated residents reported high self-perceived independence in performing the majority of the common adult and pediatric orthopaedic surgical procedures included in this study. In general, recently graduated residents recommended a greater number of case exposures to achieve independence than the ACGME Minimum Numbers.

According to the Accreditation Council for Graduate Medical Education (ACGME), the goal of residency training is for residents to achieve autonomy and independence by the time of graduation. Orthopaedic residents log cases online through the ACGME electronic case log system during residency training to document numbers and types of procedures performed[1,2].

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However, the determinations of "autonomy" and "independence" at the end of training remain undefined and may depend on the perspective of the observer.

The ACGME Minimum Numbers are set by the Residency Review Committee (RRC) to define the minimum exposure during residency training for certain procedures, but they do not establish the achievement of competence. The RRC for Orthopaedic Surgery set Minimum Number requirements for 15 case categories: 13 applying to procedures in adult patients and 2 applying to procedures in pediatric patients. For pediatric cases, the minimum requirements are logging 5 cases of percutaneous treatment of supracondylar humeral fractures and logging at least 200 pediatric cases[3].

In a previous study, we compared the operative experience of residents during training with the operative experience of that same cohort early in practice[4]. We then leveraged those findings to investigate the optimal amount of resident exposure to common orthopaedic procedures, according to early practitioners and program directors, in order to develop consensus regarding the types of procedures residents should be able to independently perform at the end of residency training[5]. This investigation naturally led us to seek an understanding of how recently graduated orthopaedic residents perceived the exposure that they needed during training to achieve independence in performing common orthopaedic surgical procedures by the end of residency.

The purpose of the present study was to assess (1) the self-reported ability of recently graduated orthopaedic residents to perform common procedures and (2) the number of cases that these recently graduated residents believe are necessary to achieve independence at the end of residency training. Additionally, we sought to compare the resident-recommended number of cases for independence with the ACGME Minimum Number case categories and recently reported case log averages during residency training for these procedures.

Materials and Methods

Survey Design and Administration

In previous research, we determined the most commonly performed adult and pediatric orthopaedic procedures by residents from ACGME case log data from 2010 to 2012[4]. We used these data to query early practitioners and program directors regarding which of these 46 procedures they felt trainees should be able to perform independently at the end of residency training, which resulted in 15 adult and 8 pediatric procedures recommended for independence[5]. Those 23 procedures were included in the survey used in the present study. In addition, we included 3 other procedure categories from the ACGME Minimum Numbers: spine decompression/posterior spine fusion, ankle/hindfoot/midfoot arthrodesis, and knee arthroscopy with ACL (anterior cruciate ligament) reconstruction[3].

In July 2018, we queried 727 potential participants who had graduated from U.S. orthopaedic residency programs and who had recently taken the American Board of Orthopaedic Surgery (ABOS) Part I Examination for the first time. The survey was emailed in an electronic format, with 3 reminder emails per week for 4 weeks sent to all potential participants who had not yet completed the survey, after which the survey was closed.

At the beginning of the survey, participants were asked to report the total number of cases they completed during residency and to provide what type of training location they were in for the majority of residency training (i.e., academic tertiary center, community-based program, military program, academic private program, or other). Then, participants were asked to self-assess the ability to perform each of the 26 procedures (18 adult and 8 pediatric) with use of a 3-point scale representing level of independence (i.e., cannot perform, can perform with assistance of an attending, and can perform completely independently); participants were also asked to estimate the number of exposures they believed was necessary to gain independence for each procedure. At the end of the survey, participants were given the option to provide comments regarding orthopaedic residency preparedness.

The study was approved by the ABOS Research Committee and met the criteria for institutional review board exemption.

Data Analysis

Survey responses were summarized as frequency and percentage of total for each of the Likert responses and as mean (standard deviation) and median (interquartile range) for the number of cases estimated by the resident responders needed to achieve independence. For each of the 26 procedures, the number of cases actually performed according to data from 2010 to 2012 resident ACGME case logs and the number of cases recommended to achieve independence collected from the survey were plotted to provide visual comparisons. The mean cases performed and the mean cases recommended to

TABLE I Type of Training Location and Total Number of Cases Performed During Residency for 2018 Graduated Residents

	Summary (N = 404)
Type of training location*† (n = 404)	
Academic private program	38 (9%)
Academic tertiary center	302 (75%)
Community-based program	31 (8%)
Military program	27 (7%)
Other	4 (1%)
Total number of cases	
Mean ± SD	2,123.1 ± 629
Median (IQR)	2,005 (1,644.5 to 2,500)
Range	1,120 to 5,000

*Data are missing for 2 residents. SD = standard deviation, and IQR = interquartile range. †Values are given as the number of residents with the percentage in parentheses.

achieve independence were analyzed with use of t tests because the numbers of cases performed were only available as aggregate summaries. Multiple comparisons were adjusted with use of the Bonferroni method within each set of procedures (18 tests for adult and 8 tests for pediatric procedures). Significance was set at 0.05, and all tests were 2-tailed. Analyses were conducted with use of R (version 3.4.4; the R Project for Statistical Computing).

Results

Of the 727 U.S. orthopaedic residency graduates taking the ABOS Part I Examination for the first time, 404 (56%) responded to the survey. Most respondents trained at academic tertiary centers (75%). The remainder of respondents trained at academic private programs (9%), community-based programs (8%), military programs (7%), and other programs (1%). Respondents reported performing a median of 2,005 cases (range, 1,120 to 5,000) during residency training (Table I).

Data on level of independence and resident-suggested minimum number of cases to achieve independence are summarized for the 18 adult procedures (Table II) and the 8 pediatric procedures (Table III). In 14 (78%) of the 18 adult procedures, >80% of respondents reported the ability to perform independently. In 7 (88%) of the 8 pediatric procedures, >90% of respondents reported the ability to perform independently.

The mean number of cases for independence reported by the recently graduated residents was greater than the ACGME Minimum Numbers for all but 1 procedure, knee arthroscopy with meniscectomy, with respondents reporting a mean of 28.8 cases to achieve independence, slightly lower than the ACGME Mininum Number of 30 cases for this procedure (Tables IV and V). For 9 of the 15 ACGME Minimum Number procedures, the difference between the ACGME and mean resident-suggested minimum number of cases was <12. The discrepancy was greater for the remaining 6 procedures (5 adult and 1 pediatric), which included spine decompression/posterior spine fusion (53.2 for resident-recommended compared with 15 for ACGME), total hip arthroplasty (51.3 compared with 30), total knee arthroplasty (50.1 compared with 30), knee arthroscopy with ACL reconstruction (36.6 compared with 10), ankle/hindfoot/midfoot arthrodesis (28.1 compared with 5), and pediatric percutaneous fixation of supracondylar humeral fracture (23.9 compared with 5).

TABLE II Resident-Reported Level of Independence and Minimum Number of Cases Recommended for Independence by Adult Procedure Type

	Level of Independence*			No. of Cases for Independence	
Type of Procedure	Cannot Perform	Can Perform with Attending Surgeon	Can Perform Independently	Mean (SD)	Median (IQR)
Hardware removal	0 (0%)	1 (0.3%)	397 (99.7%)	18.1 (23.2)	11 (10, 20)
Uniplanar ex-fix placement	0 (0%)	2 (0.5%)	395 (99.5%)	17.0 (18.7)	14 (10, 20)
ORIF bimalleolar ankle fracture	0 (0%)	4 (1%)	398 (99%)	27.0 (18.8)	21 (15, 30)
Irrigation & debridement of open fracture	0 (0%)	5 (1.2%)	395 (98.8%)	21.8 (24.5)	15 (10, 25)
Intramedullary nailing femur fracture	0 (0%)	7 (1.8%)	393 (98.2%)	26.3 (16.5)	21 (15, 30)
Intramedullary nailing tibia shaft fracture	0 (0%)	8 (2%)	391 (98%)	26.0 (16.9)	21 (15, 30)
IMN intertrochanteric/peritrochanteric/subtrochanteric femoral fracture	0 (0%)	8 (2%)	389 (98%)	29.6 (21.5)	25 (16, 35)
Carpal tunnel release	0 (0%)	10 (2.5%)	388 (97.5%)	19.6 (16.2)	15 (10, 21)
Trigger finger release	0 (0%)	11 (2.8%)	388 (97.2%)	15.2 (13.5)	10 (10, 20)
Knee arthroscopy with meniscectomy	0 (0%)	16 (4%)	382 (96%)	28.8 (19.1)	25 (20, 32)
Femoral neck hemiarthroplasty	0 (0%)	33 (8.3%)	366 (91.7%)	32.4 (22.8)	28 (20, 40)
Shoulder arthroscopy with subacromial decompression	1 (0.3%)	40 (10.1%)	357 (89.7%)	32.5 (20.9)	28 (20, 40)
Total knee arthroplasty	0 (0%)	44 (11%)	355 (89%)	50.1 (32.7)	41 (30, 50)
ORIF intra-articular distal radial fracture	0 (0%)	45 (11.3%)	354 (88.7%)	29.1 (19.9)	25 (20, 30)
Total hip replacement	1 (0.3%)	79 (19.9%)	317 (79.8%)	51.3 (32.7)	43 (30, 51)
Knee arthroscopy with ACL reconstruction	10 (2.5%)	163 (41%)	225 (56.5%)	36.6 (21.9)	30 (25, 42)
Ankle/hindfoot/midfoot arthrodesis	9 (2.3%)	200 (50.3%)	189 (47.5%)	28.1 (19.1)	24 (19, 30)
Spine decompression/posterior spine fusion	66 (16.6%)	267 (67.3%)	64 (16.1%)	53.2 (39.4)	40 (30, 53)

*Values are given as the number of responses per category with the percentage of total responses in parentheses. ORIF = open reduction and internal fixation, ex-fix = external fixator, IMN = intramedullary nailing.

TABLE III Resident-Reported Level of Independence and Minimum Number of Cases Recommended for Independence by Pediatric Procedure Type

	Level of Independence*			No. of Cases for Independence	
Procedure	Cannot Perform	Can Perform with Attending Surgeon	Can Perform Independently	Mean (SD)	Median (IQR)
Hardware removal	0 (0%)	2 (0.5%)	395 (99.5%)	16.9 (18.0)	11 (10, 20)
ORIF lateral malleolar fracture	0 (0%)	2 (0.5%)	394 (99.5%)	20.6 (18.8)	15 (10, 23)
I&D of open fracture	0 (0%)	5 (1.3%)	393 (98.7%)	18.5 (18.3)	15 (10, 20)
Knee arthroscopic I&D	0 (0%)	8 (2%)	390 (98%)	16.6 (14.2)	12 (10, 20)
Percutaneous fixation supracondylar humerus fracture	0 (0%)	20 (5%)	378 (95%)	23.9 (21.4)	20 (15, 26)
Percutaneous fixation distal radial fracture	2 (0.5%)	28 (7%)	368 (92.5%)	16.9 (13.6)	15 (10, 20)
ORIF radius and ulnar shaft fractures	0 (0%)	30 (7.6%)	367 (92.4%)	23.1 (18.7)	20 (15, 27)
Closed pinning slipped capital femoral epiphysis	5 (1.3%)	92 (23.2%)	299 (75.5%)	18.8 (18.1)	15 (10, 21)

*Values are given as the number of responses per category with the percentage of total responses in parentheses. ORIF = open reduction and internal fixation, I&D = irrigation and debridement.

TABLE IV Number of Adult Cases Recommended for Independence by 2018 Graduated Resident Respondents Compared with the Number Performed by 2010 to 2012 Graduated Residents and ACGME Minimum Numbers

Procedure	No. of Cases Recommended for Independence*	No. of Procedures Performed†	P Value‡	ACGME§
Spine decompression/posterior spine fusion	53.2 (39.4)	14 (3.7)	<0.001	15
Total hip replacement	51.3 (32.7)	67.3 (8.2)	<0.001	30
Total knee arthroplasty	50.1 (32.7)	97.9 (10)	<0.001	30
Knee arthroscopy with ACL reconstruction	36.6 (21.9)	25.5 (5)	<0.001	10
Shoulder arthroscopy with subacromial decompression	32.5 (20.9)	37.8 (6.2)	<0.001	20#
Femoral neck hemiarthroplasty	32.4 (22.8)	14.4 (3.8)	<0.001	30**
Intramedullary nailing intertrochanteric/peritrochanteric/subtrochanteric femur fracture	29.6 (21.5)	21.2 (4.6)	<0.001	30**
ORIF intra-articular distal radial fracture	29.1 (19.9)	10.2 (3.1)	<0.001	-
Knee arthroscopy with meniscectomy	28.8 (19.1)	35.3 (6.1)	<0.001	30††
Ankle/hindfoot/midfoot arthrodesis	28.1 (19.1)	4.8 (1.4)	<0.001	5
ORIF bimalleolar ankle fracture	27 (18.8)	18.2 (4.2)	<0.001	15‡‡
Intramedullary nailing femur fracture	26.3 (16.5)	20.3 (4.5)	<0.001	25§§
Intramedullary nailing tibia shaft fracture	26 (16.9)	18.8 (4.3)	<0.001	25§§
I&D of open fracture	21.8 (24.5)	31.7 (5.7)	<0.001	-
Carpal tunnel release	19.6 (16.2)	32.8 (5.6)	<0.001	10
Hardware removal	18.1 (23.2)	40.6 (6.4)	<0.001	-
Uniplanar external-fixator placement	17 (18.7)	12.6 (3.6)	<0.001	-
Trigger finger release	15.2 (13.5)	17.4 (4.2)	0.023	-

*Values are given as the mean number of cases recommended with the standard deviation in parentheses. †Values are given as the mean number of cases performed during residency by 2010 to 2012 U.S. residents according to ACGME case log data with the standard deviation in parentheses. ‡T test. Adjusted for multiple comparisons with use of the Bonferroni method. §ACGME Orthopaedic Surgery Minimum Number case categories. #Total minimum number for shoulder arthroscopy. **Total minimum number for hip fractures. ††Total minimum number for knee arthroscopy. ‡‡Total minimum number for ankle fracture fixation. §§Total minimum number for operative treatment of femoral and tibial shaft fractures. ORIF = open reduction and internal fixation. I&D = irrigation and debridement.

TABLE V Number of Pediatric Cases Recommended for Independence by 2018 Graduated Resident Respondents Compared with the Number Performed by 2010 to 2012 Graduated Residents and ACGME Minimum Numbers

Procedure	No. of Cases Recommended for Independence*	No. of Procedures Performed†	P Value‡	ACGME§
Percutaneous fixation supracondylar humerus fracture	23.9 (21.4)	12.1 (3.5)	<0.001	5
ORIF radius and ulnar shaft fractures	23.1 (18.7)	2.5 (1.6)	<0.001	-
ORIF lateral malleolus fracture	20.6 (18.8)	1.6 (1.3)	<0.001	15#
Closed pinning slipped capital femoral epiphysis	18.8 (18.1)	3.2 (1.8)	<0.001	-
I&D of open fracture	18.5 (18.3)	4.3 (2.1)	<0.001	-
Hardware removal	16.9 (18)	14 (3.8)	0.013	-
Percutaneous fixation distal radial fracture	16.9 (13.6)	2.2 (1.6)	<0.001	-
Knee arthroscopic irrigation & debridement	16.6 (14.2)	2.2 (1.5)	<0.001	30**

*Values are given as the mean number of cases recommended with the standard deviation in parentheses. †Values are given as the mean number of cases performed during residency by 2010 to 2012 U.S. residents according to ACGME case log data with the standard deviation in parentheses. ‡T test. Adjusted for multiple comparisons with use of the Bonferroni method. §ACGME Orthopaedic Surgery Minimum Number case categories. #Total minimum number for ankle fracture fixation. **Total minimum number for knee arthroscopy. ORIF = open reduction and internal fixation, I&D = irrigation and debridement.

We also compared the mean resident-reported number of cases to achieve independence with the mean ACGME case log data from 2010 to 2012[4,5] for all adult (Fig. 1 and Table IV) and pediatric (Fig. 2 and Table V) procedures, and found significant differences for all procedures except adult trigger finger release and pediatric hardware removal. For 10 (56%) of the 18 adult procedures, 2010 to 2012 trainees performed significantly fewer than the mean minimum number of cases suggested by the residents who graduated in 2018. For all 8 pediatric procedures, 2010 to 2012 trainees performed significantly fewer than the mean minimum number of cases suggested by the residents who graduated in 2018. We found greater overall discrepancy in the pediatric procedures than in the adult procedures.

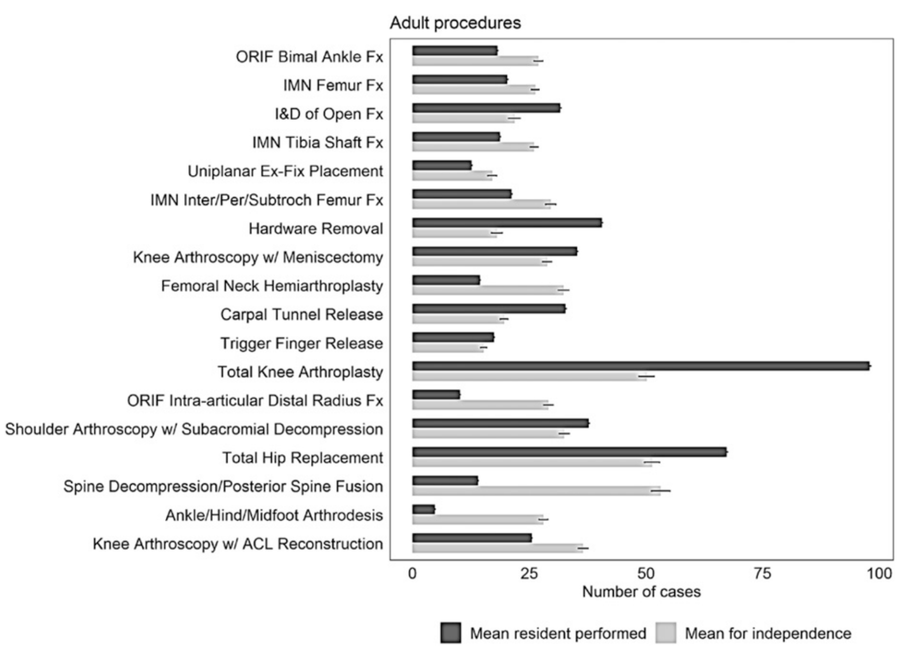

Fig. 1

Graph showing the mean number of adult cases for achievement of independence recommended by the residents who graduated in 2018 compared with the mean number of procedures performed by residents who graduated from 2010 to 2012, with standard error bars. ORIF = open reduction and internal fixation, bimal = bimalleolar, Fx = fracture, IMN = intramedullary nailing, I&D = irrigation and debridement, Ex-Fix = external fixator, and inter/per/subtroch = intertrochanteric/peritrochanteric/subtrochanteric.

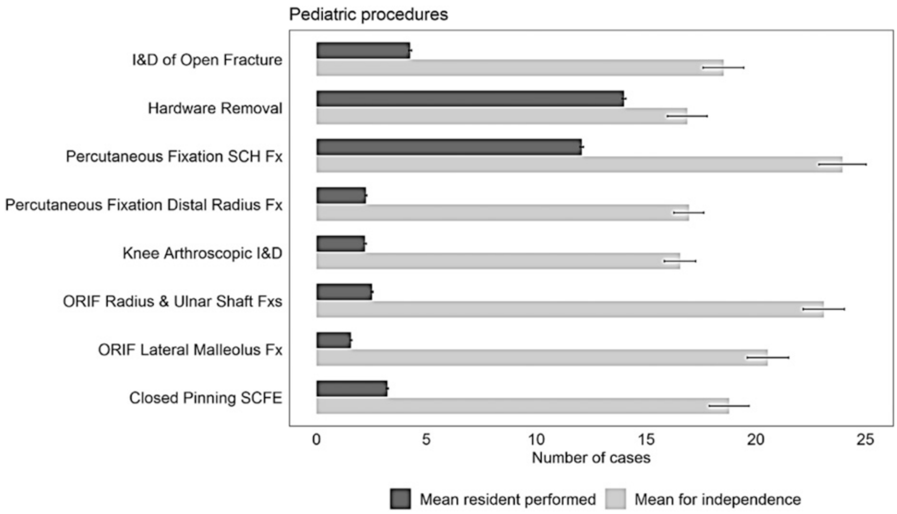

Fig. 2

Graph showing the mean number of pediatric cases for achievement of independence recommended by the residents who graduated in 2018 compared with the mean number of procedures performed by residents who graduated from 2010 to 2012, with standard error bars. I&D = irrigation and debridement, SCH = supracondylar humerus, Fx = fracture, ORIF = open reduction and internal fixation, and SCFE = slipped capital femoral epiphyses.

Discussion

The present study provides new data regarding orthopaedic resident training from the perspective of the recently graduated resident. In a previous investigation, we identified areas of discrepancy between case exposure of residents compared with early practitioners, as well as between the most commonly performed adult and pediatric procedures in residency and in early practice[4]. An additional study determined perceived numbers for achievement of independence in these most commonly performed adult and pediatric procedures by early practitioners and program directors, with overall agreement in case minimums[5]. The present study builds on these findings to gain an understanding of the perceived recommended minimum number of cases during residency to achieve autonomy and personal confidence independently performing 18 common adult and 8 common pediatric procedures, according to recently graduated orthopaedic residents.

Overall, recently graduated residents reported self-perceived independence in performing the majority of the adult and pediatric procedures included in this study. Almost 90% of recently graduated residents reported confidence independently performing 14 of the 18 adult cases and 7 of the 8 pediatric cases. Thee residents recommended a greater number of cases to achieve independence than was reported in the 2010 to 2012 graduate case logs for >50% of the adult procedures and 100% of the pediatric procedures.

In summary, there is a discrepancy between the resident-suggested number of procedures to achieve independence in common orthopaedic procedures and the number of cases that are actually performed during residency training. This finding has several possible explanations. One explanation is that performing different types of procedures facilitates the attainment of skills that may cross over from 1 procedure to another or between adult and pediatric surgery; for example, knee and shoulder arthroscopy, debridement of open fractures, hardware removal, and open reduction and internal fixation of ankle fractures have similar skill requirements in both adult and pediatric patients. Another potential explanation for the high rate of resident-reported independence in performing these procedures may be a general sense of overconfidence in their technical abilities at the end of residency training. This survey queried comfort in performing common orthopaedic procedures independently, and recently graduated residents may have assumed that these cases were straightforward without complicating patient or surgical factors. We recognize that 1 weakness in the survey was that residents were not given clinical context or case-based scenarios when queried on their level of autonomy. The survey also did not ascertain the same assessments of resident abilities from independent observers or instructors, so the autonomy perceived by the residents may not align with objective evaluations of clinical competency. To our knowledge, there is no literature on faculty perceptions of autonomy and competence in assessing trainees on common orthopaedic cases at the end of residency.

In the present study, we found that overall, the residents who graduated in 2018 recommended a greater number of cases to achieve independence compared with the ACGME Minimum Number case categories. This result is not surprising because the ACGME Minimum Numbers serve as a benchmark for exposure, but not as the achievement of autonomy or competency in these specific procedures[1,2]. The results of this study improve our understanding of the perceived number of repetitions that residents believe are necessary to achieve independence in common orthopaedic procedures during training.

Currently, >90% of orthopaedic residents proceed to fellowship training following completing residency[6]. With the emergence of subspecialization in orthopaedics over the past 4 decades, many procedures are performed by subspecialists and there is a strong trend of graduating residents moving toward subspecialty training, leading to the question of whether exposure or achievement of autonomy is most important during training[6,7]. For procedures that are more likely to be performed by subspecialists, such as foot and ankle arthrodesis, spinal decompression and fusion, and treatment of pediatric slipped capital femoral epiphysis and supracondylar humeral fracture, exposure during training may be sufficient for general orthopaedic resident education. After fellowship training, the majority of orthopaedic surgeons are unlikely to perform subspecialty procedures outside of a chosen area of focus, with the exception of general orthopaedic trauma call[6]. The present study highlights the need to restructure the evaluation of residents on the basis of the procedures that they are most likely to see in practice compared with procedures for which exposure is sufficient.

The results of this study and previous related research[4,5] should aid U.S. orthopaedic educational leadership in the consideration of future standards for training programs. The ACGME Review and Recognition Committee procedure category exposure and case minimum number requirements during residency training should be reconsidered in light of the perceptions of program directors, practicing surgeons, and recently graduated residents. The overall goal of orthopaedic surgery curriculum should be to verify that residents achieve autonomy and competence in necessary orthopaedic surgical procedures by the end of residency. Meeting minimum case numbers is not sufficient to determine the achievement of competency and independence performing orthopaedic surgical procedures. Assessment by direct observation and evaluation of technical ability and surgical skill has been advocated[8,9]. Others have advanced the role of simulation training to ensure that residents have adequate practice when surgical case volume does not meet the minimum requirements for skill acquisition[10]. The determination of trainee autonomy and competency remains undefined, and the best methods for determining achievement of independence in surgical procedures require further research, as this is 1 of the major goals of residency training.

The limitations of this study include those inherent to a survey study: relying on self-reported data and the potential for response bias. Recently graduated residents may systematically over- or underestimate the ability to independently perform common procedures. Additionally, there is the potential for recall bias and over- or underestimation of the number of cases recommended for independence. Ideally, we would compare the ACGME case log data for 2018 graduates with the survey responses of those residents to determine reporting accuracy; however, these data were not available, so we used the procedure case averages for resident graduates from 2010 to 2012 as a close surrogate. As a result of the 6 to 8-year lag between these groups of trainees, several factors could confound these findings. Exposure of residents to procedures during training may be changing with the growth of academic faculty size and emphasis on educational opportunities in the operating room during this time period. Another difference relates to the reporting of actual resident case exposure. In 2013, the ACGME Next Accreditation System instituted new resident surgical case logging guidelines. Prior to July 2013, residents logged every individual procedure performed during a case in a single entry, designating 1 procedure as the “primary” procedure. Under the new guidelines, only the “primary” procedure counts toward the total and area-specific procedures. Payne et al. found that in the first 3 years after the implementation of the Next Accreditation System, residents performed an average of 580 fewer total procedures per resident, which is a decrease of >30% from before implementation of the new guidelines[11]. However, other research has found a continual increase in resident case volume from 2007 to 2013, with the surgical case volume gap narrowing between the 10th and 90th percentile of trainees, indicating a more consistent surgical experience among residents[12]. Therefore, the changes in reporting guidelines may not have had a large influence on the perception of graduated residents on the number of cases needed to achieve independence in this study.

In conclusion, recently graduated orthopaedic residents report a high level of perceived ability to independently perform common adult and pediatric procedures. Recently graduated orthopaedic residents recommended a greater number of case repetitions to achieve independence than a recent report on exposure rate during residency training and than the ACGME Minimum Numbers. The results of this study can help to guide curriculum development, surgical skill assessment, and case minimum requirements for orthopaedic surgery residency training. ■

Jessica M. Kohring, MD[1]
John J. Harrast, MS[2]
Alan K. Stotts, MD[1]
Chong Zhang, MS[1]
Morgan M. Millar, PhD, MA[1]
Angela P. Presson, PhD[1]
Charles L. Saltzman, MD[1]

[1]Departments of Orthopaedics (J.M.K., A.K.S., A.P.P., and C.L.S.) and Internal Medicine (C.Z., M.M.M., and A.P.P.), University of Utah, Salt Lake City, Utah

[2]Data Harbor Solutions, Hinsdale, Illinois

Email address for C.L. Saltzman: charles.saltzman@hsc.utah.edu

ORCID iD for J.M. Kohring: 0000-0003-0264-5198
ORCID iD for J.J. Harrast: 0000-0003-3037-2748
ORCID iD for A.K. Stotts: 0000-0003-1863-272X
ORCID iD for C. Zhang: 0000-0002-5014-4331
ORCID iD for M.M. Millar: 0000-0001-5532-6970
ORCID iD for A.P. Presson: 0000-0001-7400-3923
ORCID iD for C.L. Saltzman: 0000-0003-2877-2339

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CLINICAL RESEARCH

Does Medicaid Insurance Confer Adequate Access to Adult Orthopaedic Care in the Era of the Patient Protection and Affordable Care Act?

Joseph T. Labrum IV BA, Taylor Paziuk BS, Theresa C. Rihn BS, JD, Alan S. Hilibrand MD, Alexander R. Vaccaro MD, PhD, MBA, Mitchell G. Maltenfort PhD, Jeffrey A. Rihn MD

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Abstract

Background A current appraisal of access to orthopaedic care for the adult patient receiving Medicaid is important, since Medicaid expansion was written into law by the Patient Protection and Affordable Care Act (PPACA).

Questions/Purposes (1) Do orthopaedic practices provide varying access to orthopaedic care for simulated patients with Medicaid insurance versus private insurance in a blinded survey? (2) What are the surveyed state-by-state Medicaid acceptance rates for adult orthopaedic practices in the current era of Medicaid expansion set forth by the PPACA? (3) Do surveyed rates of access to orthopaedic care in the adult patient population vary across practice setting (private vs academic) or vary with different Medicaid physician reimbursement rates? (4) Are there differences in the surveyed Medicaid acceptance rates for adult orthopaedic practices in states that have expanded Medicaid coverage versus states that have foregone expansion?

Methods Simulated Patient Survey: We performed a telephone survey study of orthopaedic offices in four states with Medicaid expansion. In the survey, the caller assumed a fictitious identity as a 38-year-old male who experienced an ankle fracture 1 day before calling, and attempted to secure an appointment within 2 weeks. During initial contact, the fictitious patient reported Medicaid insurance status. One month later, the fictitious patient contacted the same orthopaedic practice and reported private insurance coverage status. National Orthopaedic Survey: Private and academic orthopaedic practices operating in each state in the United States were called and asked to complete a survey assessing their practice model of Medicaid insurance acceptance. State reimbursement rates for three different Current Procedural Terminology (CPT®) codes were collected from state Medicaid agencies. Results Simulated Patient Survey: Offices were less likely to accept Medicaid than commercial insurance (30 of 64 [47%] versus 62 of 64 [97%]; odds ratio [OR], 0.0145; 95% CI, 0.00088–0.23639; $p < 0.001$), and patients with Medicaid were less likely to be offered an appointment within 2 weeks (23 of 64 [36%] versus 59 of 64 [89%]; OR, 0.0154; 95% CI, 0.00094– 0.251; $p < 0.001$). The Medicaid acceptance rates observed across states sampled in the simulated patient survey were 67% (Pennsylvania), 21% (New Jersey), 58% (Delaware), and 50% (Maryland) ($p = 0.04$). National Orthopaedic Survey: Adult patients with Medicaid insurance had limited access to care in 109

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Each author certifies that his or her institution approved or waived approval for the human protocol for this investigation and that all investigations were conducted in conformity with ethical principles of research.
This work was performed at Thomas Jefferson University, Philadelphia, PA, USA.

J. T. Labrum IV, T. Paziuk
Sidney Kimmel Medical College, Thomas Jefferson University, Philadelphia, PA, USA

T. C. Rihn
Jefferson College of Biomedical Sciences, Thomas Jefferson University, Philadelphia, PA, USA

A. S. Hilibrand, A. R. Vaccaro, M. G. Maltenfort, J. A. Rihn (✉)
The Rothman Institute, Thomas Jefferson University Hospital, 925 Chestnut St., 5th Floor, Philadelphia, PA 19107, USA
e-mail: jrihno16@yahoo.com

of 342 (32%) orthopaedic practices: 37% of private and 13% of academic practices ($p < 0.001$). Practices that accepted Medicaid received higher reimbursement for each CPT® code relative to those that did not and acceptance of Medicaid became increasingly more likely as reimbursement rates increased (99243: OR, 1.03, 95% CI, 1.02–1.04 per dollar, $p < 0.001$; 99213: OR, 1.05; 95% CI, 1.03–1.07 per dollar, $p < 0.001$; 28876: OR, 1.01, 95% CI, 1.00–1.01 per dollar, $p < 0.001$). For a given reimbursement rate, private practices were less likely to take an adult patient with Medicaid relative to an academic practice (99243: OR, 0.11, 95% CI, 0.04–0.33, $p < 0.001$; 99213: OR, 0.11, 95% CI, 0.04–0.32, $p < 0.001$; 27786: OR, 0.12, 95% CI, 0.04–0.35, $p < 0.001$). No difference was observed when comparing Medicaid acceptance rates for all practice types between states that have expanded their Medicaid program versus those that have not (OR, 1.02; 95% CI 0.62–1.70; $p = 0.934$).

Conclusions In this two-part survey study, we found that a simulated patient with commercial insurance was more likely to have their insurance accepted and to gain timely access to orthopaedic care than a patient with Medicaid. Academic practice setting and increased Medicaid reimbursement rates were associated with increased access to care for the patient with Medicaid. Inequality in access to orthopaedic care based on health insurance status likely exists for the adult patient with Medicaid. Furthermore, Medicaid expansion has likely realized minimal gains in access to care for the adult orthopaedic patient. Further research is needed in delineating the patient-payer selection criteria used by orthopaedic practices to aid policymakers in reforming the Medicaid program and comprehensibly addressing this access to care disparity.

Level of Evidence Level II, prognostic study.

Introduction

The Patient Protection and Affordable Care Act (PPACA, also known as Obamacare), passed in 2009, expanded Medicaid eligibility to individuals with incomes up to 138% of the federal poverty level. Since 2012, state Medicaid and Children's Health Insurance Program (CHIP) enrollment in these programs has increased more than 25% nationally as of 2015 [2, 12]. A central tenet of the PPACA was the belief that increased Medicaid eligibility would result in improved access to healthcare and improved outcomes for the uninsured and underinsured [12]. Before passage of the PPACA, several studies found that adult patients with Medicaid experience poorer continuity of care, delayed diagnoses, and worse outcomes than their counterparts with private insurance [3, 9, 19].

Although these studies show poor access and inferior outcomes for patients with Medicaid before the PPACA, there are little data regarding whether the expansion of coverage to previously uninsured groups has resulted in improved access or care. Because a majority of the almost 12 million new patients who went from no insurance to insured received their coverage through Medicaid (92%), we sought to determine whether orthopaedic patients would face fewer impediments to care [5]. The primary objectives of this two-part study are to (1) assess access to care for the adult patients with Medicaid with an acute ankle fracture in states with Medicaid expansion, (2) assess state-by-state differences in Medicaid acceptance rates, (3) assess the effect of physician reimbursement rate and orthopaedic practice construct on access to orthopaedic care for the patient with Medicaid, and (4) determine the effect of Medicaid expansion under the PPACA on access to orthopaedic care for the patient with Medicaid.

We therefore asked: (1) Do blinded, surveyed orthopaedic practices provide varying access to orthopaedic care for simulated patients with Medicaid insurance versus private insurance? (2) What are the surveyed state-by-state Medicaid acceptance rates for adult orthopaedic practices in the current era of Medicaid expansion set forth by the PPACA? (3) Do surveyed rates of access to orthopaedic care in the adult patient population vary across practice setting (private vs academic) or vary with different Medicaid physician reimbursement rates? (4) Are there differences in the surveyed Medicaid acceptance rates for adult orthopaedic practices in states that have expanded Medicaid coverage versus states that have foregone expansion?

Methods

Study Design and Setting

Participant-blinded Simulated Patient Survey

Orthopaedic offices were identified from an online search via Yellow pages™ (YP.com; http://www.yellowpages.com) for "Orthopedic surgeon" within 100 miles in Pennsylvania (Philadelphia), New Jersey (Trenton), Delaware (Newark), and Maryland (Baltimore) in the creation of a multistate survey sample population. Repeat listings were excluded and any practice that was self-described on the listing as nonsurgical was excluded. The design of this study component was based on the 2014 study by Pierce et al. [14].

National Orthopaedic Practice Survey

A study design similar to that published by Skaggs et al. [16] was used in this current nationwide telephone survey

study. The orthopaedic practice list for each state was generated via a Google search delegated: "Orthopaedic Surgery + State". After generating a practice list with a target of 10 private and four academic institutions for each state, a random number was assigned to each practice. These numbers were subsequently used to select the practices that would be contacted to represent each state in ascending order. Study design followed the construct used by Skaggs et al. [16]: Seven practices, two academic and five private, were selected from each state. If a practice on the original list could not be contacted, the practice that was next on the preliminary list was substituted. If a state did not meet the two academic practice requirement, another private practice was added such that the total state representation was seven.

Description of Experiment, Treatment or Surgery

Participant-blinded Simulated Patient Survey

Orthopaedic offices in Pennsylvania, New Jersey, Delaware, and Maryland were contacted twice via telephone to secure an appointment within 2 weeks of contact. The calls were placed 1 month apart. The caller assumed a fictitious identity as a 38-year-old male who experienced an ankle fracture 1 day before calling. The caller attempted to obtain an appointment within 2 weeks using the following script: "Hi, I was seen in the emergency room after I fell yesterday and I was told that I have a fractured ankle. I was told that I needed to be seen by an orthopaedic surgeon within 2 weeks because the fracture likely requires surgery. Can I get an appointment with an orthopaedic surgeon as soon as possible?" During the first stage of calls with the orthopaedic care provider, the caller reported having state-issued Medicaid correlating with the state and region in which the orthopaedic care provider practiced. Four weeks after the initial contact, the same orthopaedic offices were contacted and were subjected to the same interaction with the same caller. The sole difference with the second interaction was that the fictitious patient reported having Blue Cross Blue Shield Preferred Provider Organization coverage. In all instances of more detailed preappointment screenings, the caller stated that there were no legal issues surrounding the injury (disability and/or workers' compensation), claimed to have possession of ankle radiographs, reported current splinting of the injured ankle, and reported no chronic health issues.

National Orthopaedic Practice Survey

Orthopaedic practices operating in each state were contacted via telephone between February and April 2016 and surveyed regarding patient scheduling. The caller identified himself and disclosed that he was calling regarding a three-question anonymous survey assessing patient access to care. The caller surveyed the practice using the following script algorithm: "Does your practice see adult patients with Medicaid insurance?" If the answer was "no," the caller asked if the responder knew why and then ended the call. If the answer was "yes," the caller asked "Does your office have any restriction on the number of adult patients with Medicaid that you see?" If the answer was "no," the call was ended. If the answer was "yes," the caller asked if the responder knew why and then ended the call. If the initial person who answered the phone was incapable of answering the questions posed, the office manager was requested, at which time the question sequence restarted from the beginning.

Variables, Outcome Measures, Data Sources, and Bias

Participant-blinded Simulated Patient Survey

All interactions with orthopaedic care providers were analyzed for the following outcomes: successful contact or failure to contact, acceptance or rejection of insurance coverage, appointment given within 2 weeks of call or appointment not given within 2 weeks of call, and the reason for lack of appointment or the earliest time at which an appointment could be made after the 2-week window. All calls to orthopaedic practices were made by the same caller and all data were recorded immediately after call completion. In any interactions in which the offices provided a tentative appointment on the condition that the patient present a Medicaid or private insurance identification number, emergency room records, or a primary care physician referral on arrival to the appointment or before appointment arrival, the researchers deemed this a successful appointment scheduling.

National Orthopaedic Practice Survey

All survey responses provided by participating orthopaedic practices were recorded. The relationship between practice type, Medicaid reimbursement, and Medicaid acceptance was examined. All calls to orthopaedic practice providers were made by the same caller and all data were recorded immediately after call completion. This survey study, based on work by Skaggs et al. [16], used three different Current Procedural Terminology (CPT®, American Medical Association, Chicago, IL, USA) codes as a representation of a physician's patient population; this included a new patient visit, a followup patient visit, and an

Table 1. Summary of CPT® code reimbursement rate data

State	Medicaid reimbursement rate		
	CPT® 99243	CPT® 99213	CPT® 27786
AL	$86.00	$42.00	$212.00
AK**	$201.65	$119.96	$507.67
AZ**	$98.31	$51.25	$277.34
AR**	$101.20	$36.30	$209.02
CA**	$59.50	$24.00	$173.92
CO**	$87.80*	$73.32	$105.21
CT**	$88.26	$25.74	$153.96
DE**	$123.90*	$72.59	$323.90
FL	$139.05	$79.34	$171.70
GA	$100.50	$40.70	$252.20
HI**	$90.55	$36.31	$157.64
ID	$108.35*	$68.20	$264.33
IL**	$51.30	$28.35	$152.60
IN**	$82.55	$51.99	$224.24
IA**	$90.55	$36.31	$157.64
KS	$92.80*	$53.87*	$233.24*
KY**	$90.43	$42.63	$154.88
LA**	$92.30*	$60.51	$349.65
ME	$77.77*	$40.51	$172.52
MD**	$115.89	$67.54	$282.06
MA**	$73.29	$76.38	$309.22
MI**	$68.34	$40.61	$178.49
MN**	$94.92	$56.39	$222.70
MS	$104.97*	$43.52	$184.87
MO	$74.49	$36.38	$225.56
MT**	$122.41*	$75.85	$337.84
NE**	$88.44	$45.07	$162.87
NV**	$116.40	$67.81	$201.08
NH**	$72.80	$65.98	$225.80
NJ**	$64.70	$23.50	$72.00
NM**	$118.48	$50.52	$278.55
NY**	$76.33	$37.41	$174.50
NC	$99.91	$54.26	$212.65
ND**	$88.48	$106.39	$465.78
OH**	$53.41	$43.61	$163.66
OK	$113.72*	$58.86	$255.27
OR**	$87.05*	$55.53	$222.58
PA**	$59.94*	$40.00	$118.50
RI**	$37.00	$20.64	$67.20
SC	$91.48	$45.37	$193.15
SD	$97.79	$42.48	$270.54
TN	XX	XX	XX
TX	$80.23	$33.27	$239.77
UT	$91.33	$52.74	$231.48
VT**	$123.56	$58.14	$255.23
VA	$84.39	$49.04	$277.24
WA**	$73.51	$39.13	$190.04
WV**	$85.05	$49.88	$216.83
WI	$122.32*	$71.45*	$310.56*
WY	$126.74	$67.36	$277.93

*Values obtained from Kaiser Foundation Medicaid-to-Medicare Fee Index; ** states that have expanded Medicaid; XX value unobtainable owing to statewide variation in CPT® code reimbursement via Medicaid; CPT® = current procedural terminology.

acute care patient visit. The reimbursement rates for CPT® codes 99213 (established followup outpatient visit - level 3 of 5), 99243 (new outpatient consultation - level 3 of 5), and 27786 (closed treatment of distal fibular fracture – lateral malleolus – without manipulation – surgical care only) were determined at the time of the telephone survey via state Medicaid agency fee schedules for comparison to the responses attained via the telephone survey (Table 1). If the state Medicaid fee schedule did not provide the required information, the Kaiser Foundation Medicare-to-Medicaid Fee Index was used to determine the associated CPT® code Medicaid reimbursement rates from known Medicare reimbursement rates [6, 10, 17, 20].

Accounting for all Patients/ Study Subjects

Participant-blinded Simulated Patient Survey

In total, 82 offices, including 21 in Pennsylvania, 21 in New Jersey, 17 in Delaware, and 23 in Maryland, were contacted for orthopaedic appointments. Of the 82 offices called, 18 were excluded from the study; one practice was specialized (TKA), three were nonsurgical (one in personal injury, two in physical therapy), two offices had closed, one practice did not return phone calls, and 11 (three in Pennsylvania, one in New Jersey, three in Maryland, and four in Delaware) did not answer calls or had disconnected phone lines. Sixty-four orthopaedic offices across Pennsylvania (15), New Jersey (19), Delaware (12), and Maryland (18) were included in the study (Table 2).

National Orthopaedic Practice Survey

Three hundred forty-two orthopaedic practices, seven from each state (two academic and five private), were included in the national survey study. Only three practices could be contacted in South Dakota and only six could be contacted in Connecticut, Delaware, Hawaii, and Vermont.

Table 2. Results of the regional simulated patient survey for Medicaid acceptance and appointment scheduling

Orthopaedic practice inclusion	PA	NJ	DE	MD	Total	%
Total offices sampled	21	21	17	23	82	–
Offices meeting study inclusion criteria	15	19	12	18	64	100
Offices accepting Medicaid	10	4	7	9	30	47
Offices providing Medicaid appointment within 2 weeks	6	4	6	7	23	36
Offices accepting private insurance	15	18	12	17	62	97
Offices providing private appointment within 2 weeks	13	18	11	15	57	89

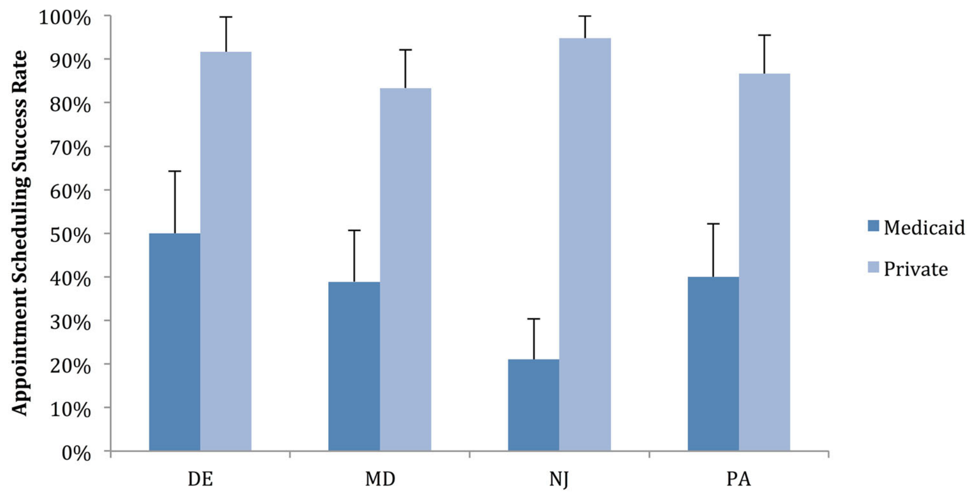

Fig. 1 The observed orthopaedic practice appointment scheduling rates for the simulated patient survey, with the responses broken down by caller insurance status, are shown. Successful scheduling was defined as an appointment within 2 weeks from the time of call.

Statistical Analysis, Study Size

Participant-blinded Simulated Patient Survey

The paired categorical data generated via Medicaid and private insurance calls were statistically analyzed for asymmetry using McNemar's test, which is a chi-square test based on disjoint responses, that is, instances in which a practice provides different access to orthopaedic appointments depending on the form of insurance reported; the cases in which the practice accepts or rejects both forms are not informative [1]. A chi-square test was used to detect potential differences in Medicaid insurance acceptance rates across states sampled in the study. An alpha level of .05 was adopted to define statistically significant findings and subsequent rejection of the null hypothesis. Study size was based on a study by Pierce et al. [14].

National Orthopaedic Practice Survey

Univariate logistic regression was used to estimate how practice type (academic versus private) and Medicaid rate in the state affected the probability of the practice to accept patients with Medicaid insurance. Because the reimbursement rates for the three CPT® codes were correlated, they were each evaluated as predictors in separate regression models. All analyses were performed using the 'rms' package for the R statistical language (R Foundation for Statistical Computing, Vienna, Austria).

Results

(1) Do orthopaedic practices provide varying access to care based on health insurance?

Simulated Patient Survey

Offices were less likely to accept Medicaid than commercial insurance (30 of 64 [47%] versus 62 of 64 [97%]; odds ratio [OR], 0.01449; 95% CI, 0.00088–0.23639; $p < 0.001$), and patients with Medicaid were less likely to be offered an appointment within 2 weeks (23 of 64 [36%] versus 59 of 64 [89%]; OR, 0.0154; 95% CI, 0.00094–0.251; $p < 0.001$) (Fig. 1). The Medicaid acceptance rates observed across states sampled in the simulated patient survey were 67% (Pennsylvania), 21% (New Jersey), 58% (Delaware), and 50% (Maryland) ($p = 0.04$) (Fig. 2).

Fig. 2 Insurance acceptance rates for the Medicaid and commercial-insured simulated patient with orthopaedic practice responses broken down by state are shown.

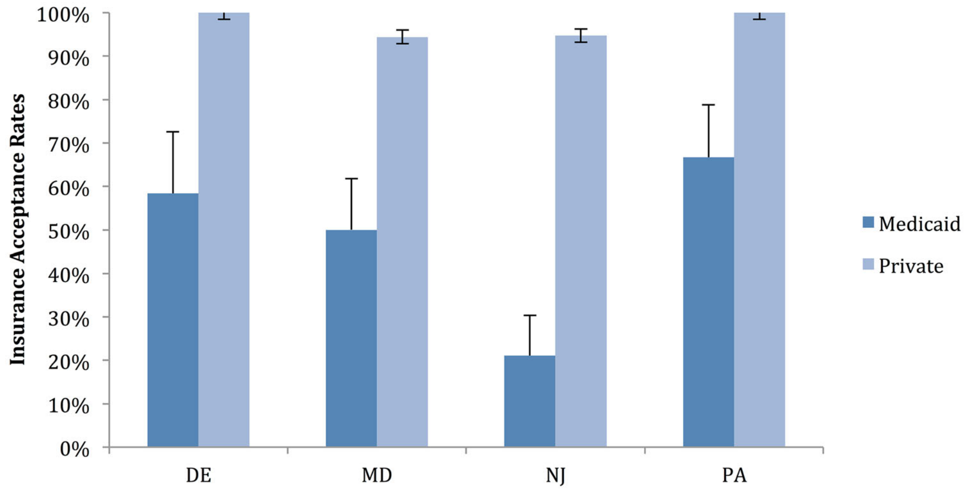

Table 3. Summary of access to healthcare data

Practices	Number	Accept	Limit	Full access
Total	342	260	27	233
Private	271	194	23	171
Academic	71	66	4	62
p Value		< 0.001	0.29	< 0.001

National Survey

Of the 342 orthopaedic practices (ie, 271 private practices, 71 academic practices) contacted for this study, 260 (76%) accepted adult patients with Medicaid, but only 233 do so without restriction (68%) (Table 3).

(2) What are the observed state Medicaid acceptance rates under Medicaid expansion?

Simulated Patient Survey

The Medicaid acceptance rates observed across states sampled in this survey were 66.6% in Pennsylvania (10/15), 21% in New Jersey (four of 19), 58.3% in Delaware (seven of 12), and 50% in Maryland (nine of 18) ($p = 0.04$). However, the sample size of four states used in a chi-square analysis was insufficient to elicit these specific pairwise differences (Table 4).

National Survey

The Medicaid acceptance rates, by State, that were observed in this national survey varied from two of seven to seven of seven (Table 5). For the practices that limited or did not accept adult patients with Medicaid, the individual answering the phone most commonly did not know the reason why this policy was in place (78/109). The other common reasons for not accepting or limiting access of adult patients with Medicaid included emergency room patients only (three of 109), required referral (four of 109), managed care organization preference (eight of 109), case-by-case basis (eight of 109), physician preference in practice (six of 109), and children covered by Medicaid only (two of 109) (Table 6).

(3) Are Medicaid acceptance rates associated with reimbursement or practice type?

National Survey

The acceptance of Medicaid becomes increasingly more likely as the associated CPT® code reimbursement rates increase. Access to orthopaedic care in the adult orthopaedic patient population also varied in accordance with orthopaedic practice setting. The OR for CPT® reimbursement rate and the acceptance of Medicaid is 1.03 (95% CI, 1.02–1.04) per dollar for 99243, 1.05 (95% CI, 1.03–1.07) per dollar for 99213, and 1.01 (95% CI, 1.00–1.01) per dollar for 28876

Table 4. Simulated patient insurance acceptance rates

Insurance status	State	Insurance denied	Insurance accepted	Acceptance rate	Standard error	p Value
Medicaid	DE	5	7	58%	14%	p = 0.04*
Medicaid	MD	9	9	50%	12%	
Medicaid	NJ	15	4	21%	9%	
Medicaid	PA	5	10	67%	12%	
Private	DE	0	12	100%	0%†	p = 0.68
Private	MD	1	17	94%	5%	
Private	NJ	1	18	95%	5%	
Private	PA	0	15	100%	0%†	

*N = 4 was insufficient to show specific pairwise differences despite $p < 0.05$ seen across states dealing with caller with Medicaid; †could not be calculated for 100% of entries (zero is a consequence of the formula).

($p < 0.001$) (99213 = established followup outpatient visit - level 3 of 5; 99243 = new outpatient consultation - level 3 of 5; and 27786 = closed treatment of distal fibular fracture – lateral malleolus – without manipulation – surgical care only) (Table 7). Moreover, the OR for private versus academic practice setting and the acceptance of Medicaid is 0.11 (95% CI, 0.04–0.33, $p < 0.001$) for CPT® code 99243, 0.11 (95% CI, 0.04–0.32, $p < 0.001$) for CPT® code 99213, and 0.12 (95% CI, 0.04–0.35, $p < 0.001$) for CPT® code 27786. Consequently, for a given reimbursement rate, private practices were less likely to take an adult patient with Medicaid insurance relative to an academic practice (Table 7).

Of the 260 institutions that accepted adult patients with Medicaid, 194 were considered private practice and 66 were considered academic practice. Thus, 72% (194/271) of private practices and 93% (66/71) of academic practices accepted adult patients with Medicaid (194 of 271 [72%] versus 66 of 71 [93%]; OR, 0.19; 95% CI, 0.07–0.49; $p < 0.001$) (Table 3). Regarding the private practices that accepted adult patients with Medicaid, 12% (23/194) imposed restrictions on the number of patients they see, leaving 63% of private orthopaedic practices using a full-access Medicaid model. Of the academic practices that accept adult patients with Medicaid, 6% (four of 66) imposed restrictions on the number of patients they see, leaving 87% of academic orthopaedic practices using a full-access Medicaid model. The difference between the number of private and academic practices that use this full-access model was noted (171 of 27 [64%] versus 62 of 71 [87%]; OR, 0.25; 95% CI, 0.12–0.52; $p < 0.001$) (Table 3).

(4) Do patients in Medicaid-expansion States have better access to orthopaedic care?

National Survey

When we compared states that expanded Medicaid after the PPACA with those that did not, there was no difference in access to care for adult orthopaedic patients. This was true for all practice types (OR, 1.02; 95% CI, 0.62–1.70; p = 0.934), for academic practices alone (OR, 1.22; 95% CI, 0.19–7.82; p = 0.84), and for private practices alone (OR, 1.02; 95% CI, 0.59–1.76; p = 0.94) (Table 8). Thus, there was no difference, with the numbers available, in access to care for adult patients with Medicaid insurance based on whether their associated state had adopted PPACA Medicaid expansion.

Discussion

Adult patients with Medicaid insurance typically have faced substantial hurdles in obtaining timely care [3, 4, 7–9, 11, 13–16, 19]. Much of the impetus for the 2009 passage of the PPACA was an effort to address this [12]. However, there are little data regarding whether the expansion of coverage to previously uninsured groups has resulted in improved access or care. Since a majority of the almost 12 million newly insured have received their coverage through Medicaid, we sought to determine whether the new orthopaedic patients with Medicaid insurance would face fewer impediments to care. We found that inequality in access to orthopaedic care based on health insurance status likely exists in the adult patient population seeking care for an acute ankle fracture in state marketplaces with expanded Medicaid. Results from the national telephone survey study likely indicate that there is no difference in access to care for patients with Medicaid across states that have adopted Medicaid expansion versus states that have foregone Medicaid expansion. Additionally, we found that lower Medicaid reimbursement rates and the private practice setting (as opposed to academic practice) are associated with limited access to orthopaedic care in the adult population with Medicaid.

The researchers could not be blinded to the insurance status of the fictitious patient and/or the responses of the contacted practice. There is potential bias introduced by the

Table 5. Summary of state-by-state Medicaid acceptance from the national survey study

State	Medicaid acceptance rate (practice type)		
	Private	Academic	Total
AL	4/5	2/2	6/7
AK**	6/6	1/1	7/7
AZ**	5/6	1/1	6/7
AR**	5/6	1/1	6/7
CA**	1/5	1/2	2/7
CO**	3/6	1/1	4/7
CT**	1/4	2/2	3/6
DE**	5/6	xx	5/6
FL	2/5	2/2	4/7
GA	2/5	2/2	4/7
HI**	3/5	1/1	4/6
ID	7/7	xx	7/7
IL**	3/5	2/2	5/7
IN**	5/6	1/1	6/7
IA**	5/6	1/1	6/7
KS	3/6	1/1	4/7
KY**	5/6	1/1	6/7
LA**	0/5	2/2	2/7
ME	7/7	xx	7/7
MD**	4/5	2/2	6/7
MA**	5/5	2/2	7/7
MI**	4/5	2/2	6/7
MN**	5/5	2/2	7/7
MS	4/6	1/1	5/7
MO	0/5	2/2	2/7
MT**	7/7	xx	7/7
NE**	5/5	2/2	7/7
NV**	2/6	1/1	3/7
NH**	5/6	1/1	6/7
NJ**	1/5	2/2	3/7
NM**	6/6	1/1	7/7
NY**	1/5	2/2	3/7
NC	5/5	2/2	7/7
ND**	7/7	xx	7/7
OH**	2/5	2/2	4/7
OK	5/6	1/1	6/7
OR**	5/5	2/2	7/7
PA**	3/5	1/2	4/7
RI**	1/5	1/2	2/7
SC	3/5	2/2	5/7
SD	2/2	1/1	3/3
TN	4/5	1/2	5/7
TX	1/5	1/2	2/7
UT	5/6	1/1	6/7
VT**	5/5	1/1	6/6
VA	4/5	2/2	6/7
WA**	5/6	1/1	6/7
WV**	4/5	2/2	6/7
WI	4/5	2/2	6/7
WY	7/7	xx	7/7

*Values obtained from Kaiser Foundation Medicaid-to-Medicare Fee Index; **states that have expanded Medicaid; xx = unobtainable owing to statewide variation in CPT® code reimbursement via Medicaid.

Table 6. Reasons for limited or no access to care

Reason	Number
Total number of practices that limit or do not accept Medicaid	109
Unknown reason why the practice limits/does not accept Medicaid	78
Emergency room patients	3
Physician preference	6
Referral required	4
Patients with a specific Managed Care Organization only	8
Case-by-case basis	8
Only accepts children with Medicaid	2

fictitious caller, which may artificially reduce the rate of appointment scheduling; practices might be more likely to appoint the same person if they were referred from a hospital where the practice is affiliated and provides call coverage, or if a referral came from an associated or known practice. The simulated patient survey construct was used to minimize potential researcher bias with the use of a script and identical presentation of information in preappointment screenings. The use of a fictitious patient in the simulated patient survey eliminated the potential for the office contacted to be aware of its participation in a research study, eliminating bias via the observer effect and allowing a more-accurate assessment of access to care. The sample size used in the simulated patient survey and national survey studies may be inadequate to show differences that truly exist, allowing the possibility of a Type II error. Calls were made consecutively and spaced over 4 weeks, which could have resulted in sampling bias owing to an unforeseen confounder. This was preferred over call randomization, as it was presumed that calls made to the same practice during a shorter interval may have introduced bias. The national survey study was limited by an inability to fully access participating practices' policy on Medicaid insurance acceptance. In many cases, the person

Table 7. Private vs academic practice and Medicaid reimbursement for access to care

CPT® code	Private vs academic practice			Medicaid reimbursement rate		
	Odds ratio	95% CI	p Value	Odds ratio	95% CI	p Value
99243	0.11	(0.04–0.33)	< 0.001	1.03	1.02–1.04	< 0.001
99213	0.11	(0.04–0.32)	< 0.001	1.05	1.03–1.07	< 0.001
27786	0.12	(−0.04 to 0.35)	< 0.001	1.01	1.00–1.01	< 0.001

Table 8. Medicaid acceptance in PPACA expansion states versus nonexpansion states

Practice setting	Expansion states Medicaid acceptance	Nonexpansion states Medicaid acceptance	Odds ratio	95% CI	p Value
Total	167/220 (76%)	93/122 (76%)	1.02	0.62–1.70	0.936
Private	125/175 (71%)	69/96 (72%)	1.22	0.19–7.82	0.838
Academic	42/45 (93%)	24/26 (92%)	1.02	0.59–1.76	0.942

PPACA = Patient Protection and Affordable Care Act.

completing the survey could not and/or would not provide explanations of the practices' Medicaid acceptance policies.

The results of our study corroborate those of previous studies, which consistently show that patients with Medicaid face increased challenges during the course of orthopaedic care; patients with Medicaid must travel farther to obtain orthopaedic care, wait a longer time before accessing care, are delayed in receiving the diagnosis of an acute orthopaedic injury, experience disruption in continuity of ambulatory care, and experience worse outcomes after surgery compared with patients with different health insurance [3, 9, 11, 19]. Pierce et al. [14] observed that the pediatric patients with Medicaid seeking outpatient care for an ACL tear before Medicaid expansion were 57 times less likely to receive an appointment within 2 weeks compared with a child with private insurance.

The results of the simulated patient survey study suggest that this inequality may be present to varying degrees on a state-by-state basis, as differences were observed in Medicaid acceptance rates among states surveyed. This was supported by our findings in the national survey, where access to orthopaedic care increased with increasing Medicaid reimbursement rates as well as the academic practice setting on a nationwide scale. Before the PPACA, Skaggs et al. [16] observed a state-by-state variation in access to care for pediatric orthopaedic patients, reporting that state-based access to care improved as state-determined physician reimbursement rates for treatment of a nondisplaced radius and ulna fracture without manipulation increased. Kim et al. [11] had similar findings, observing increased success in appointment scheduling for patients with Medicaid in states with a direct relationship between increased Medicaid reimbursement rates.

Our study and several others [11, 13, 16] showed that limited access to orthopaedic care for the Medicaid population is associated with low physician reimbursement rates. While individuals responding to phone surveys in both studies rarely cited low Medicaid reimbursement as a reason to limit care, this correlation suggests that financial remuneration does play a role in access to orthopaedic care. Prevention of discrepancies in access to care attributable to reimbursement disparities between the Medicaid and private insurance populations is in part why the equal access provision of the Medicaid Act was implemented in the Social Security Act [18]. This requires physician reimbursement rates to be "sufficient to enlist enough providers so that services under the plan are available to recipients at least to the extent that those services are available to the general population" [18]. Despite this provision, the reimbursement rate disparity between private insurance and Medicaid continues to be substantial, as does the disparity between Medicaid and Medicare rates [10]. Additionally, for a given reimbursement rate, private practices were less likely to take an adult patient with Medicaid insurance relative to an academic practice.

Our national study found no difference in access to orthopaedic care between states that have adopted Medicaid expansion and those that have not. Lack of a prior study on access to orthopaedic care in Pennsylvania, New Jersey, Delaware, and Maryland before Medicaid expansion prevents us from quantifying the effects that Medicaid expansion has had on access to orthopaedic care in these states. The effects of Medicaid expansion on access to orthopaedic care are not fully understood. Patterson et al. [13] found that access to orthopaedic care was decreased in areas with high population density and areas in close proximity to an academic orthopaedic center. They posited

that areas with high population density have a larger orthopaedic patient base, which may allow practices to operate with increasingly stringent patient-payer selection criteria while practices in less populous areas may lack this capability. Additionally, practices in areas of lower population density may feel uncomfortable informing patients of the need to travel long distances to seek care at an academic center [13]. However, Kim et al. [11] reported that patients with Medicaid pursuing orthopaedic appointments for primary TKA witnessed successful appointment scheduling rates of 22.8% in states foregoing Medicaid expansion and 37.7% in states with expanded Medicaid ($p = 0.011$). Importantly, Kim et al. [11] also reported that patients with Medicaid seeking orthopaedic care in states with expanded Medicaid programs experienced longer waiting times for appointments obtained ($p = 0.001$).

Patients with Medicaid insurance face a greater barrier to accessing a timely standard of care relative to patients with commercial health insurance. Unfortunately, this trend appears to have continued despite Medicaid expansion, likely indicating that increases in Medicaid coverage availability are not sufficient to increase access to orthopaedic care for the underinsured. Current expansions in Medicaid have likely realized minimal gains for the underinsured as policy has focused only on increasing the patient pool qualified for coverage. As more and more adults obtain coverage through Medicaid expansion and "compete" for a limited number of appointments, it may become more difficult for these patients to obtain an orthopaedic appointment. Policy aimed to improve access to care for orthopaedic patients with Medicaid must encourage greater Medicaid participation by orthopaedic surgeons. Although further research is needed to clearly delineate physician-patient-payer selection criteria, Medicaid reimbursement rates may need to be increased to incentivize the care of these patients and alleviate the pervasive inequality they experience in accessing orthopaedic treatment.

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CLINICAL RESEARCH

Does Medicaid Insurance Confer Adequate Access to Adult Orthopaedic Care in the Era of the Patient Protection and Affordable Care Act?

Joseph T. Labrum IV BA, Taylor Paziuk BS, Theresa C. Rihn BS, JD, Alan S. Hilibrand MD, Alexander R. Vaccaro MD, PhD, MBA, Mitchell G. Maltenfort PhD, Jeffrey A. Rihn MD

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Abstract
Background A current appraisal of access to orthopaedic care for the adult patient receiving Medicaid is important, since Medicaid expansion was written into law by the Patient Protection and Affordable Care Act (PPACA).
Questions/Purposes (1) Do orthopaedic practices provide varying access to orthopaedic care for simulated patients with Medicaid insurance versus private insurance in a blinded survey? (2) What are the surveyed state-by-state Medicaid acceptance rates for adult orthopaedic practices in the current era of Medicaid expansion set forth by the PPACA? (3) Do surveyed rates of access to orthopaedic care in the adult patient population vary across practice setting (private vs academic) or vary with different Medicaid physician reimbursement rates? (4) Are there differences in the surveyed Medicaid acceptance rates for adult orthopaedic practices in states that have expanded Medicaid coverage versus states that have foregone expansion?
Methods Simulated Patient Survey: We performed a telephone survey study of orthopaedic offices in four states with Medicaid expansion. In the survey, the caller assumed a fictitious identity as a 38-year-old male who experienced an ankle fracture 1 day before calling, and attempted to secure an appointment within 2 weeks. During initial contact, the fictitious patient reported Medicaid insurance status. One month later, the fictitious patient contacted the same orthopaedic practice and reported private insurance coverage status. National Orthopaedic Survey: Private and academic orthopaedic practices operating in each state in the United States were called and asked to complete a survey assessing their practice model of Medicaid insurance acceptance. State reimbursement rates for three different Current Procedural Terminology (CPT®) codes were collected from state Medicaid agencies. Results Simulated Patient Survey: Offices were less likely to accept Medicaid than commercial insurance (30 of 64 [47%] versus 62 of 64 [97%]; odds ratio [OR], 0.0145; 95% CI, 0.00088–0.23639; $p < 0.001$), and patients with Medicaid were less likely to be offered an appointment within 2 weeks (23 of 64 [36%] versus 59 of 64 [89%]; OR, 0.0154; 95% CI, 0.00094– 0.251; $p < 0.001$). The Medicaid acceptance rates observed across states sampled in the simulated patient survey were 67% (Pennsylvania), 21% (New Jersey), 58% (Delaware), and 50% (Maryland) ($p = 0.04$). National Orthopaedic Survey: Adult patients with Medicaid insurance had limited access to care in 109

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Each author certifies that his or her institution approved or waived approval for the human protocol for this investigation and that all investigations were conducted in conformity with ethical principles of research.
This work was performed at Thomas Jefferson University, Philadelphia, PA, USA.

J. T. Labrum IV, T. Paziuk
Sidney Kimmel Medical College, Thomas Jefferson University, Philadelphia, PA, USA

T. C. Rihn
Jefferson College of Biomedical Sciences, Thomas Jefferson University, Philadelphia, PA, USA

A. S. Hilibrand, A. R. Vaccaro, M. G. Maltenfort, J. A. Rihn (✉)
The Rothman Institute, Thomas Jefferson University Hospital, 925 Chestnut St., 5th Floor, Philadelphia, PA 19107, USA
e-mail: jrihno16@yahoo.com

of 342 (32%) orthopaedic practices: 37% of private and 13% of academic practices ($p < 0.001$). Practices that accepted Medicaid received higher reimbursement for each CPT® code relative to those that did not and acceptance of Medicaid became increasingly more likely as reimbursement rates increased (99243: OR, 1.03, 95% CI, 1.02–1.04 per dollar, $p < 0.001$; 99213: OR, 1.05; 95% CI, 1.03–1.07 per dollar, $p < 0.001$; 28876: OR, 1.01, 95% CI, 1.00–1.01 per dollar, $p < 0.001$). For a given reimbursement rate, private practices were less likely to take an adult patient with Medicaid relative to an academic practice (99243: OR, 0.11, 95% CI, 0.04–0.33, $p < 0.001$; 99213: OR, 0.11, 95% CI, 0.04–0.32, $p < 0.001$; 27786: OR, 0.12, 95% CI, 0.04–0.35, $p < 0.001$). No difference was observed when comparing Medicaid acceptance rates for all practice types between states that have expanded their Medicaid program versus those that have not (OR, 1.02; 95% CI 0.62–1.70; $p = 0.934$).

Conclusions In this two-part survey study, we found that a simulated patient with commercial insurance was more likely to have their insurance accepted and to gain timely access to orthopaedic care than a patient with Medicaid. Academic practice setting and increased Medicaid reimbursement rates were associated with increased access to care for the patient with Medicaid. Inequality in access to orthopaedic care based on health insurance status likely exists for the adult patient with Medicaid. Furthermore, Medicaid expansion has likely realized minimal gains in access to care for the adult orthopaedic patient. Further research is needed in delineating the patient-payer selection criteria used by orthopaedic practices to aid policymakers in reforming the Medicaid program and comprehensibly addressing this access to care disparity.

Level of Evidence Level II, prognostic study.

Introduction

The Patient Protection and Affordable Care Act (PPACA, also known as Obamacare), passed in 2009, expanded Medicaid eligibility to individuals with incomes up to 138% of the federal poverty level. Since 2012, state Medicaid and Children's Health Insurance Program (CHIP) enrollment in these programs has increased more than 25% nationally as of 2015 [2, 12]. A central tenet of the PPACA was the belief that increased Medicaid eligibility would result in improved access to healthcare and improved outcomes for the uninsured and underinsured [12]. Before passage of the PPACA, several studies found that adult patients with Medicaid experience poorer continuity of care, delayed diagnoses, and worse outcomes than their counterparts with private insurance [3, 9, 19].

Although these studies show poor access and inferior outcomes for patients with Medicaid before the PPACA, there are little data regarding whether the expansion of coverage to previously uninsured groups has resulted in improved access or care. Because a majority of the almost 12 million new patients who went from no insurance to insured received their coverage through Medicaid (92%), we sought to determine whether orthopaedic patients would face fewer impediments to care [5]. The primary objectives of this two-part study are to (1) assess access to care for the adult patients with Medicaid with an acute ankle fracture in states with Medicaid expansion, (2) assess state-by-state differences in Medicaid acceptance rates, (3) assess the effect of physician reimbursement rate and orthopaedic practice construct on access to orthopaedic care for the patient with Medicaid, and (4) determine the effect of Medicaid expansion under the PPACA on access to orthopaedic care for the patient with Medicaid.

We therefore asked: (1) Do blinded, surveyed orthopaedic practices provide varying access to orthopaedic care for simulated patients with Medicaid insurance versus private insurance? (2) What are the surveyed state-by-state Medicaid acceptance rates for adult orthopaedic practices in the current era of Medicaid expansion set forth by the PPACA? (3) Do surveyed rates of access to orthopaedic care in the adult patient population vary across practice setting (private vs academic) or vary with different Medicaid physician reimbursement rates? (4) Are there differences in the surveyed Medicaid acceptance rates for adult orthopaedic practices in states that have expanded Medicaid coverage versus states that have foregone expansion?

Methods

Study Design and Setting

Participant-blinded Simulated Patient Survey

Orthopaedic offices were identified from an online search via Yellow pages™ (YP.com; http://www.yellowpages.com) for "Orthopedic surgeon" within 100 miles in Pennsylvania (Philadelphia), New Jersey (Trenton), Delaware (Newark), and Maryland (Baltimore) in the creation of a multistate survey sample population. Repeat listings were excluded and any practice that was self-described on the listing as nonsurgical was excluded. The design of this study component was based on the 2014 study by Pierce et al. [14].

National Orthopaedic Practice Survey

A study design similar to that published by Skaggs et al. [16] was used in this current nationwide telephone survey

study. The orthopaedic practice list for each state was generated via a Google search delegated: "Orthopaedic Surgery + State". After generating a practice list with a target of 10 private and four academic institutions for each state, a random number was assigned to each practice. These numbers were subsequently used to select the practices that would be contacted to represent each state in ascending order. Study design followed the construct used by Skaggs et al. [16]: Seven practices, two academic and five private, were selected from each state. If a practice on the original list could not be contacted, the practice that was next on the preliminary list was substituted. If a state did not meet the two academic practice requirement, another private practice was added such that the total state representation was seven.

Description of Experiment, Treatment or Surgery

Participant-blinded Simulated Patient Survey

Orthopaedic offices in Pennsylvania, New Jersey, Delaware, and Maryland were contacted twice via telephone to secure an appointment within 2 weeks of contact. The calls were placed 1 month apart. The caller assumed a fictitious identity as a 38-year-old male who experienced an ankle fracture 1 day before calling. The caller attempted to obtain an appointment within 2 weeks using the following script: "Hi, I was seen in the emergency room after I fell yesterday and I was told that I have a fractured ankle. I was told that I needed to be seen by an orthopaedic surgeon within 2 weeks because the fracture likely requires surgery. Can I get an appointment with an orthopaedic surgeon as soon as possible?" During the first stage of calls with the orthopaedic care provider, the caller reported having state-issued Medicaid correlating with the state and region in which the orthopaedic care provider practiced. Four weeks after the initial contact, the same orthopaedic offices were contacted and were subjected to the same interaction with the same caller. The sole difference with the second interaction was that the fictitious patient reported having Blue Cross Blue Shield Preferred Provider Organization coverage. In all instances of more detailed preappointment screenings, the caller stated that there were no legal issues surrounding the injury (disability and/or workers' compensation), claimed to have possession of ankle radiographs, reported current splinting of the injured ankle, and reported no chronic health issues.

National Orthopaedic Practice Survey

Orthopaedic practices operating in each state were contacted via telephone between February and April 2016 and surveyed regarding patient scheduling. The caller identified himself and disclosed that he was calling regarding a three-question anonymous survey assessing patient access to care. The caller surveyed the practice using the following script algorithm: "Does your practice see adult patients with Medicaid insurance?" If the answer was "no," the caller asked if the responder knew why and then ended the call. If the answer was "yes," the caller asked "Does your office have any restriction on the number of adult patients with Medicaid that you see?" If the answer was "no," the call was ended. If the answer was "yes," the caller asked if the responder knew why and then ended the call. If the initial person who answered the phone was incapable of answering the questions posed, the office manager was requested, at which time the question sequence restarted from the beginning.

Variables, Outcome Measures, Data Sources, and Bias

Participant-blinded Simulated Patient Survey

All interactions with orthopaedic care providers were analyzed for the following outcomes: successful contact or failure to contact, acceptance or rejection of insurance coverage, appointment given within 2 weeks of call or appointment not given within 2 weeks of call, and the reason for lack of appointment or the earliest time at which an appointment could be made after the 2-week window. All calls to orthopaedic practices were made by the same caller and all data were recorded immediately after call completion. In any interactions in which the offices provided a tentative appointment on the condition that the patient present a Medicaid or private insurance identification number, emergency room records, or a primary care physician referral on arrival to the appointment or before appointment arrival, the researchers deemed this a successful appointment scheduling.

National Orthopaedic Practice Survey

All survey responses provided by participating orthopaedic practices were recorded. The relationship between practice type, Medicaid reimbursement, and Medicaid acceptance was examined. All calls to orthopaedic practice providers were made by the same caller and all data were recorded immediately after call completion. This survey study, based on work by Skaggs et al. [16], used three different Current Procedural Terminology (CPT®, American Medical Association, Chicago, IL, USA) codes as a representation of a physician's patient population; this included a new patient visit, a followup patient visit, and an

Table 1. Summary of CPT® code reimbursement rate data

State	Medicaid reimbursement rate		
	CPT® 99243	CPT® 99213	CPT® 27786
AL	$86.00	$42.00	$212.00
AK**	$201.65	$119.96	$507.67
AZ**	$98.31	$51.25	$277.34
AR**	$101.20	$36.30	$209.02
CA**	$59.50	$24.00	$173.92
CO**	$87.80*	$73.32	$105.21
CT**	$88.26	$25.74	$153.96
DE**	$123.90*	$72.59	$323.90
FL	$139.05	$79.34	$171.70
GA	$100.50	$40.70	$252.20
HI**	$90.55	$36.31	$157.64
ID	$108.35*	$68.20	$264.33
IL**	$51.30	$28.35	$152.60
IN**	$82.55	$51.99	$224.24
IA**	$90.55	$36.31	$157.64
KS	$92.80*	$53.87*	$233.24*
KY**	$90.43	$42.63	$154.88
LA**	$92.30*	$60.51	$349.65
ME	$77.77*	$40.51	$172.52
MD**	$115.89	$67.54	$282.06
MA**	$73.29	$76.38	$309.22
MI**	$68.34	$40.61	$178.49
MN**	$94.92	$56.39	$222.70
MS	$104.97*	$43.52	$184.87
MO	$74.49	$36.38	$225.56
MT**	$122.41*	$75.85	$337.84
NE**	$88.44	$45.07	$162.87
NV**	$116.40	$67.81	$201.08
NH**	$72.80	$65.98	$225.80
NJ**	$64.70	$23.50	$72.00
NM**	$118.48	$50.52	$278.55
NY**	$76.33	$37.41	$174.50
NC	$99.91	$54.26	$212.65
ND**	$88.48	$106.39	$465.78
OH**	$53.41	$43.61	$163.66
OK	$113.72*	$58.86	$255.27
OR**	$87.05*	$55.53	$222.58
PA**	$59.94*	$40.00	$118.50
RI**	$37.00	$20.64	$67.20
SC	$91.48	$45.37	$193.15
SD	$97.79	$42.48	$270.54
TN	XX	XX	XX
TX	$80.23	$33.27	$239.77
UT	$91.33	$52.74	$231.48
VT**	$123.56	$58.14	$255.23
VA	$84.39	$49.04	$277.24
WA**	$73.51	$39.13	$190.04
WV**	$85.05	$49.88	$216.83
WI	$122.32*	$71.45*	$310.56*
WY	$126.74	$67.36	$277.93

*Values obtained from Kaiser Foundation Medicaid-to-Medicare Fee Index; ** states that have expanded Medicaid; XX value unobtainable owing to statewide variation in CPT® code reimbursement via Medicaid; CPT® = current procedural terminology.

acute care patient visit. The reimbursement rates for CPT® codes 99213 (established followup outpatient visit - level 3 of 5), 99243 (new outpatient consultation - level 3 of 5), and 27786 (closed treatment of distal fibular fracture – lateral malleolus – without manipulation – surgical care only) were determined at the time of the telephone survey via state Medicaid agency fee schedules for comparison to the responses attained via the telephone survey (Table 1). If the state Medicaid fee schedule did not provide the required information, the Kaiser Foundation Medicare-to-Medicaid Fee Index was used to determine the associated CPT® code Medicaid reimbursement rates from known Medicare reimbursement rates [6, 10, 17, 20].

Accounting for all Patients/ Study Subjects

Participant-blinded Simulated Patient Survey

In total, 82 offices, including 21 in Pennsylvania, 21 in New Jersey, 17 in Delaware, and 23 in Maryland, were contacted for orthopaedic appointments. Of the 82 offices called, 18 were excluded from the study; one practice was specialized (TKA), three were nonsurgical (one in personal injury, two in physical therapy), two offices had closed, one practice did not return phone calls, and 11 (three in Pennsylvania, one in New Jersey, three in Maryland, and four in Delaware) did not answer calls or had disconnected phone lines. Sixty-four orthopaedic offices across Pennsylvania (15), New Jersey (19), Delaware (12), and Maryland (18) were included in the study (Table 2).

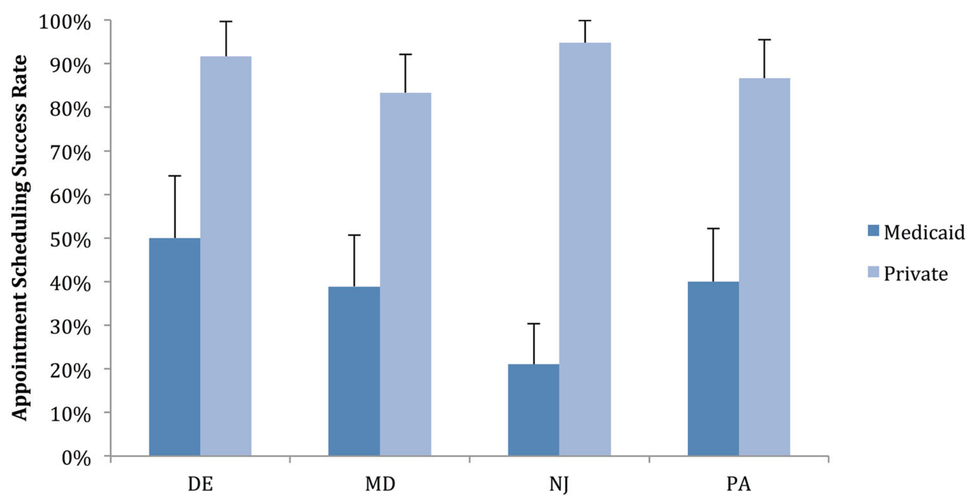
National Orthopaedic Practice Survey

Three hundred forty-two orthopaedic practices, seven from each state (two academic and five private), were included in the national survey study. Only three practices could be contacted in South Dakota and only six could be contacted in Connecticut, Delaware, Hawaii, and Vermont.

Table 2. Results of the regional simulated patient survey for Medicaid acceptance and appointment scheduling

Orthopaedic practice inclusion	PA	NJ	DE	MD	Total	%
Total offices sampled	21	21	17	23	82	–
Offices meeting study inclusion criteria	15	19	12	18	64	100
Offices accepting Medicaid	10	4	7	9	30	47
Offices providing Medicaid appointment within 2 weeks	6	4	6	7	23	36
Offices accepting private insurance	15	18	12	17	62	97
Offices providing private appointment within 2 weeks	13	18	11	15	57	89

Fig. 1 The observed orthopaedic practice appointment scheduling rates for the simulated patient survey, with the responses broken down by caller insurance status, are shown. Successful scheduling was defined as an appointment within 2 weeks from the time of call.



Statistical Analysis, Study Size

Participant-blinded Simulated Patient Survey

The paired categorical data generated via Medicaid and private insurance calls were statistically analyzed for asymmetry using McNemar's test, which is a chi-square test based on disjoint responses, that is, instances in which a practice provides different access to orthopaedic appointments depending on the form of insurance reported; the cases in which the practice accepts or rejects both forms are not informative [1]. A chi-square test was used to detect potential differences in Medicaid insurance acceptance rates across states sampled in the study. An alpha level of .05 was adopted to define statistically significant findings and subsequent rejection of the null hypothesis. Study size was based on a study by Pierce et al. [14].

National Orthopaedic Practice Survey

Univariate logistic regression was used to estimate how practice type (academic versus private) and Medicaid rate in the state affected the probability of the practice to accept patients with Medicaid insurance. Because the reimbursement rates for the three CPT® codes were correlated, they were each evaluated as predictors in separate regression models. All analyses were performed using the 'rms' package for the R statistical language (R Foundation for Statistical Computing, Vienna, Austria).

Results

(1) Do orthopaedic practices provide varying access to care based on health insurance?

Simulated Patient Survey

Offices were less likely to accept Medicaid than commercial insurance (30 of 64 [47%] versus 62 of 64 [97%]; odds ratio [OR], 0.01449; 95% CI, 0.00088–0.23639; $p < 0.001$), and patients with Medicaid were less likely to be offered an appointment within 2 weeks (23 of 64 [36%] versus 59 of 64 [89%]; OR, 0.0154; 95% CI, 0.00094–0.251; $p < 0.001$) (Fig. 1). The Medicaid acceptance rates observed across states sampled in the simulated patient survey were 67% (Pennsylvania), 21% (New Jersey), 58% (Delaware), and 50% (Maryland) ($p = 0.04$) (Fig. 2).

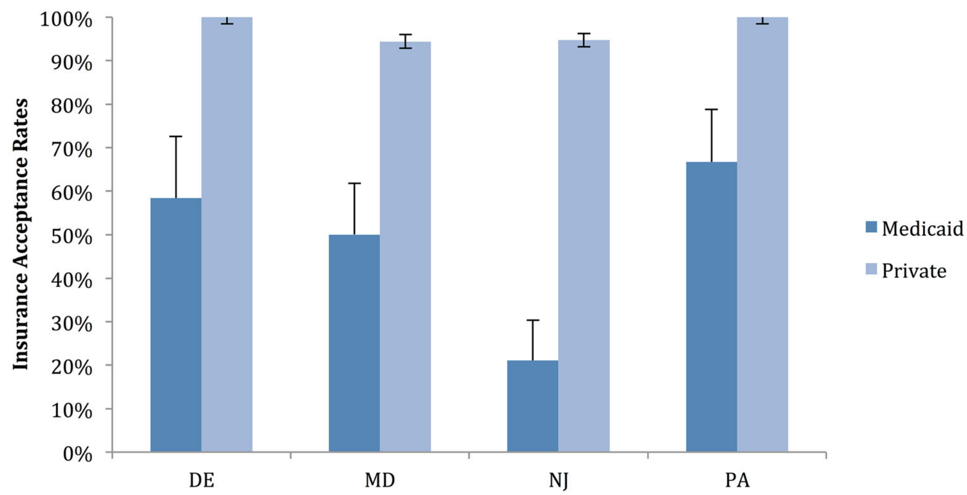


Fig. 2 Insurance acceptance rates for the Medicaid and commercial-insured simulated patient with orthopaedic practice responses broken down by state are shown.

Table 3. Summary of access to healthcare data

Practices	Number	Accept	Limit	Full access
Total	342	260	27	233
Private	271	194	23	171
Academic	71	66	4	62
p Value		< 0.001	0.29	< 0.001

National Survey

Of the 342 orthopaedic practices (ie, 271 private practices, 71 academic practices) contacted for this study, 260 (76%) accepted adult patients with Medicaid, but only 233 do so without restriction (68%) (Table 3).

(2) What are the observed state Medicaid acceptance rates under Medicaid expansion?

Simulated Patient Survey

The Medicaid acceptance rates observed across states sampled in this survey were 66.6% in Pennsylvania (10/15), 21% in New Jersey (four of 19), 58.3% in Delaware (seven of 12), and 50% in Maryland (nine of 18) ($p = 0.04$). However, the sample size of four states used in a chi-square analysis was insufficient to elicit these specific pairwise differences (Table 4).

National Survey

The Medicaid acceptance rates, by State, that were observed in this national survey varied from two of seven to seven of seven (Table 5). For the practices that limited or did not accept adult patients with Medicaid, the individual answering the phone most commonly did not know the reason why this policy was in place (78/109). The other common reasons for not accepting or limiting access of adult patients with Medicaid included emergency room patients only (three of 109), required referral (four of 109), managed care organization preference (eight of 109), case-by-case basis (eight of 109), physician preference in practice (six of 109), and children covered by Medicaid only (two of 109) (Table 6).

(3) Are Medicaid acceptance rates associated with reimbursement or practice type?

National Survey

The acceptance of Medicaid becomes increasingly more likely as the associated CPT® code reimbursement rates increase. Access to orthopaedic care in the adult orthopaedic patient population also varied in accordance with orthopaedic practice setting. The OR for CPT® reimbursement rate and the acceptance of Medicaid is 1.03 (95% CI, 1.02–1.04) per dollar for 99243, 1.05 (95% CI, 1.03–1.07) per dollar for 99213, and 1.01 (95% CI, 1.00–1.01) per dollar for 28876

Table 4. Simulated patient insurance acceptance rates

Insurance status	State	Insurance denied	Insurance accepted	Acceptance rate	Standard error	p Value
Medicaid	DE	5	7	58%	14%	p = 0.04*
Medicaid	MD	9	9	50%	12%	
Medicaid	NJ	15	4	21%	9%	
Medicaid	PA	5	10	67%	12%	
Private	DE	0	12	100%	0%†	p = 0.68
Private	MD	1	17	94%	5%	
Private	NJ	1	18	95%	5%	
Private	PA	0	15	100%	0%†	

*N = 4 was insufficient to show specific pairwise differences despite $p < 0.05$ seen across states dealing with caller with Medicaid; †could not be calculated for 100% of entries (zero is a consequence of the formula).

($p < 0.001$) (99213 = established followup outpatient visit - level 3 of 5; 99243 = new outpatient consultation - level 3 of 5; and 27786 = closed treatment of distal fibular fracture – lateral malleolus – without manipulation – surgical care only) (Table 7). Moreover, the OR for private versus academic practice setting and the acceptance of Medicaid is 0.11 (95% CI, 0.04–0.33, $p < 0.001$) for CPT® code 99243, 0.11 (95% CI, 0.04–0.32, $p < 0.001$) for CPT® code 99213, and 0.12 (95% CI, 0.04–0.35, $p < 0.001$) for CPT® code 27786. Consequently, for a given reimbursement rate, private practices were less likely to take an adult patient with Medicaid insurance relative to an academic practice (Table 7).

Of the 260 institutions that accepted adult patients with Medicaid, 194 were considered private practice and 66 were considered academic practice. Thus, 72% (194/271) of private practices and 93% (66/71) of academic practices accepted adult patients with Medicaid (194 of 271 [72%] versus 66 of 71 [93%]; OR, 0.19; 95% CI, 0.07–0.49; $p < 0.001$) (Table 3). Regarding the private practices that accepted adult patients with Medicaid, 12% (23/194) imposed restrictions on the number of patients they see, leaving 63% of private orthopaedic practices using a full-access Medicaid model. Of the academic practices that accept adult patients with Medicaid, 6% (four of 66) imposed restrictions on the number of patients they see, leaving 87% of academic orthopaedic practices using a full-access Medicaid model. The difference between the number of private and academic practices that use this full-access model was noted (171 of 27 [64%] versus 62 of 71 [87%]; OR, 0.25; 95% CI, 0.12–0.52; $p < 0.001$) (Table 3).

(4) Do patients in Medicaid-expansion States have better access to orthopaedic care?

National Survey

When we compared states that expanded Medicaid after the PPACA with those that did not, there was no difference in access to care for adult orthopaedic patients. This was true for all practice types (OR, 1.02; 95% CI, 0.62–1.70; $p = 0.934$), for academic practices alone (OR, 1.22; 95% CI, 0.19–7.82; $p = 0.84$), and for private practices alone (OR, 1.02; 95% CI, 0.59–1.76; $p = 0.94$) (Table 8). Thus, there was no difference, with the numbers available, in access to care for adult patients with Medicaid insurance based on whether their associated state had adopted PPACA Medicaid expansion.

Discussion

Adult patients with Medicaid insurance typically have faced substantial hurdles in obtaining timely care [3, 4, 7–9, 11, 13–16, 19]. Much of the impetus for the 2009 passage of the PPACA was an effort to address this [12]. However, there are little data regarding whether the expansion of coverage to previously uninsured groups has resulted in improved access or care. Since a majority of the almost 12 million newly insured have received their coverage through Medicaid, we sought to determine whether the new orthopaedic patients with Medicaid insurance would face fewer impediments to care. We found that inequality in access to orthopaedic care based on health insurance status likely exists in the adult patient population seeking care for an acute ankle fracture in state marketplaces with expanded Medicaid. Results from the national telephone survey study likely indicate that there is no difference in access to care for patients with Medicaid across states that have adopted Medicaid expansion versus states that have foregone Medicaid expansion. Additionally, we found that lower Medicaid reimbursement rates and the private practice setting (as opposed to academic practice) are associated with limited access to orthopaedic care in the adult population with Medicaid.

The researchers could not be blinded to the insurance status of the fictitious patient and/or the responses of the contacted practice. There is potential bias introduced by the

Table 5. Summary of state-by-state Medicaid acceptance from the national survey study

State	Medicaid acceptance rate (practice type)		
	Private	Academic	Total
AL	4/5	2/2	6/7
AK**	6/6	1/1	7/7
AZ**	5/6	1/1	6/7
AR**	5/6	1/1	6/7
CA**	1/5	1/2	2/7
CO**	3/6	1/1	4/7
CT**	1/4	2/2	3/6
DE**	5/6	xx	5/6
FL	2/5	2/2	4/7
GA	2/5	2/2	4/7
HI**	3/5	1/1	4/6
ID	7/7	xx	7/7
IL**	3/5	2/2	5/7
IN**	5/6	1/1	6/7
IA**	5/6	1/1	6/7
KS	3/6	1/1	4/7
KY**	5/6	1/1	6/7
LA**	0/5	2/2	2/7
ME	7/7	xx	7/7
MD**	4/5	2/2	6/7
MA**	5/5	2/2	7/7
MI**	4/5	2/2	6/7
MN**	5/5	2/2	7/7
MS	4/6	1/1	5/7
MO	0/5	2/2	2/7
MT**	7/7	xx	7/7
NE**	5/5	2/2	7/7
NV**	2/6	1/1	3/7
NH**	5/6	1/1	6/7
NJ**	1/5	2/2	3/7
NM**	6/6	1/1	7/7
NY**	1/5	2/2	3/7
NC	5/5	2/2	7/7
ND**	7/7	xx	7/7
OH**	2/5	2/2	4/7
OK	5/6	1/1	6/7
OR**	5/5	2/2	7/7
PA**	3/5	1/2	4/7
RI**	1/5	1/2	2/7
SC	3/5	2/2	5/7
SD	2/2	1/1	3/3
TN	4/5	1/2	5/7
TX	1/5	1/2	2/7
UT	5/6	1/1	6/7
VT**	5/5	1/1	6/6
VA	4/5	2/2	6/7
WA**	5/6	1/1	6/7
WV**	4/5	2/2	6/7
WI	4/5	2/2	6/7
WY	7/7	xx	7/7

*Values obtained from Kaiser Foundation Medicaid-to-Medicare Fee Index; **states that have expanded Medicaid; xx = unobtainable owing to statewide variation in CPT® code reimbursement via Medicaid.

Table 6. Reasons for limited or no access to care

Reason	Number
Total number of practices that limit or do not accept Medicaid	109
Unknown reason why the practice limits/does not accept Medicaid	78
Emergency room patients	3
Physician preference	6
Referral required	4
Patients with a specific Managed Care Organization only	8
Case-by-case basis	8
Only accepts children with Medicaid	2

fictitious caller, which may artificially reduce the rate of appointment scheduling; practices might be more likely to appoint the same person if they were referred from a hospital where the practice is affiliated and provides call coverage, or if a referral came from an associated or known practice. The simulated patient survey construct was used to minimize potential researcher bias with the use of a script and identical presentation of information in preappointment screenings. The use of a fictitious patient in the simulated patient survey eliminated the potential for the office contacted to be aware of its participation in a research study, eliminating bias via the observer effect and allowing a more-accurate assessment of access to care. The sample size used in the simulated patient survey and national survey studies may be inadequate to show differences that truly exist, allowing the possibility of a Type II error. Calls were made consecutively and spaced over 4 weeks, which could have resulted in sampling bias owing to an unforeseen confounder. This was preferred over call randomization, as it was presumed that calls made to the same practice during a shorter interval may have introduced bias. The national survey study was limited by an inability to fully access participating practices' policy on Medicaid insurance acceptance. In many cases, the person

Table 7. Private vs academic practice and Medicaid reimbursement for access to care

CPT® code	Private vs academic practice			Medicaid reimbursement rate		
	Odds ratio	95% CI	p Value	Odds ratio	95% CI	p Value
99243	0.11	(0.04–0.33)	< 0.001	1.03	1.02–1.04	< 0.001
99213	0.11	(0.04–0.32)	< 0.001	1.05	1.03–1.07	< 0.001
27786	0.12	(−0.04 to 0.35)	< 0.001	1.01	1.00–1.01	< 0.001

Table 8. Medicaid acceptance in PPACA expansion states versus nonexpansion states

Practice setting	Expansion states Medicaid acceptance	Nonexpansion states Medicaid acceptance	Odds ratio	95% CI	p Value
Total	167/220 (76%)	93/122 (76%)	1.02	0.62–1.70	0.936
Private	125/175 (71%)	69/96 (72%)	1.22	0.19–7.82	0.838
Academic	42/45 (93%)	24/26 (92%)	1.02	0.59–1.76	0.942

PPACA = Patient Protection and Affordable Care Act.

completing the survey could not and/or would not provide explanations of the practices' Medicaid acceptance policies.

The results of our study corroborate those of previous studies, which consistently show that patients with Medicaid face increased challenges during the course of orthopaedic care; patients with Medicaid must travel farther to obtain orthopaedic care, wait a longer time before accessing care, are delayed in receiving the diagnosis of an acute orthopaedic injury, experience disruption in continuity of ambulatory care, and experience worse outcomes after surgery compared with patients with different health insurance [3, 9, 11, 19]. Pierce et al. [14] observed that the pediatric patients with Medicaid seeking outpatient care for an ACL tear before Medicaid expansion were 57 times less likely to receive an appointment within 2 weeks compared with a child with private insurance.

The results of the simulated patient survey study suggest that this inequality may be present to varying degrees on a state-by-state basis, as differences were observed in Medicaid acceptance rates among states surveyed. This was supported by our findings in the national survey, where access to orthopaedic care increased with increasing Medicaid reimbursement rates as well as the academic practice setting on a nationwide scale. Before the PPACA, Skaggs et al. [16] observed a state-by-state variation in access to care for pediatric orthopaedic patients, reporting that state-based access to care improved as state-determined physician reimbursement rates for treatment of a nondisplaced radius and ulna fracture without manipulation increased. Kim et al. [11] had similar findings, observing increased success in appointment scheduling for patients with Medicaid in states with a direct relationship between increased Medicaid reimbursement rates.

Our study and several others [11, 13, 16] showed that limited access to orthopaedic care for the Medicaid population is associated with low physician reimbursement rates. While individuals responding to phone surveys in both studies rarely cited low Medicaid reimbursement as a reason to limit care, this correlation suggests that financial remuneration does play a role in access to orthopaedic care. Prevention of discrepancies in access to care attributable to reimbursement disparities between the Medicaid and private insurance populations is in part why the equal access provision of the Medicaid Act was implemented in the Social Security Act [18]. This requires physician reimbursement rates to be "sufficient to enlist enough providers so that services under the plan are available to recipients at least to the extent that those services are available to the general population" [18]. Despite this provision, the reimbursement rate disparity between private insurance and Medicaid continues to be substantial, as does the disparity between Medicaid and Medicare rates [10]. Additionally, for a given reimbursement rate, private practices were less likely to take an adult patient with Medicaid insurance relative to an academic practice.

Our national study found no difference in access to orthopaedic care between states that have adopted Medicaid expansion and those that have not. Lack of a prior study on access to orthopaedic care in Pennsylvania, New Jersey, Delaware, and Maryland before Medicaid expansion prevents us from quantifying the effects that Medicaid expansion has had on access to orthopaedic care in these states. The effects of Medicaid expansion on access to orthopaedic care are not fully understood. Patterson et al. [13] found that access to orthopaedic care was decreased in areas with high population density and areas in close proximity to an academic orthopaedic center. They posited

that areas with high population density have a larger orthopaedic patient base, which may allow practices to operate with increasingly stringent patient-payer selection criteria while practices in less populous areas may lack this capability. Additionally, practices in areas of lower population density may feel uncomfortable informing patients of the need to travel long distances to seek care at an academic center [13]. However, Kim et al. [11] reported that patients with Medicaid pursuing orthopaedic appointments for primary TKA witnessed successful appointment scheduling rates of 22.8% in states foregoing Medicaid expansion and 37.7% in states with expanded Medicaid ($p = 0.011$). Importantly, Kim et al. [11] also reported that patients with Medicaid seeking orthopaedic care in states with expanded Medicaid programs experienced longer waiting times for appointments obtained ($p = 0.001$).

Patients with Medicaid insurance face a greater barrier to accessing a timely standard of care relative to patients with commercial health insurance. Unfortunately, this trend appears to have continued despite Medicaid expansion, likely indicating that increases in Medicaid coverage availability are not sufficient to increase access to orthopaedic care for the underinsured. Current expansions in Medicaid have likely realized minimal gains for the underinsured as policy has focused only on increasing the patient pool qualified for coverage. As more and more adults obtain coverage through Medicaid expansion and "compete" for a limited number of appointments, it may become more difficult for these patients to obtain an orthopaedic appointment. Policy aimed to improve access to care for orthopaedic patients with Medicaid must encourage greater Medicaid participation by orthopaedic surgeons. Although further research is needed to clearly delineate physician-patient-payer selection criteria, Medicaid reimbursement rates may need to be increased to incentivize the care of these patients and alleviate the pervasive inequality they experience in accessing orthopaedic treatment.

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Does Insurance Status Affect Access to Care Among Ankle Fracture Patients? An Institutional Retrospective Study

Haley M. McKissack, BSc[1], Gean C. Viner, MD[1], James T. McMurtrie, MD[2], Bradley K. Alexander, BS[1], Aaradhana J. Jha, MD[1], John T. Wilson, BS[1], Ashish B. Shah, MD[3]

[1] *Research Fellow, Department of Orthopaedic Surgery, University of Alabama, Birmingham, Birmingham, AL*
[2] *Resident Physcian, Department of Orthopaedic Surgery, University of Alabama, Birmingham, Birmingham, AL*
[3] *Associate Professor, Department of Orthopaedic Surgery, University of Alabama, Birmingham, Birmingham, AL*

A R T I C L E I N F O

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A B S T R A C T

Delayed access to care for patients with ankle fractures may increase risk of complications, particularly if surgical management is warranted. Medicaid is a state and federal insurance program in place for those with low income, which has previously been associated with delayed access to care among patients with ACL tears and total hip arthroplasties. The purpose of this study is to assess whether patient insurance status affects access to care for ankle fracture patients, using data from a single institution. A retrospective cohort study (N = 311 patients) was performed on individuals that underwent open reduction and internal fixation for an ankle fracture between years 01/2008 and 12/2018. Patients with polytraumatic injuries, open injuries, Medicare, no insurance, indigent/charity insurance, self-pay, or whose insurance information was not available were excluded. Time from date of injury to date of surgery, injury to first visit, and first visit to surgery was compared between patients with private insurance and Medicaid. Average time from injury to first appointment was 1.2 days and 6.2 days for privately insured and Medicaid patients, respectively ($p < .001$). Average time from injury to surgery was 8.3 days and 16.1 days for privately insured and Medicaid patients, respectively ($p < .001$). Patients enrolled in Medicaid have significantly delayed access to care compared to those with private insurance. For ankle fracture patients this is a critical healing time, and delayed care may result in increased costs, increased utilization of healthcare resources, higher complication rates, and poorer patient outcomes.

In 2010, the Patient Protection and Affordable Care Act passed with the intent of increasing accessibility to health insurance, supporting lower-cost medical care models, and expanding the Medicaid program (1). As of 2017, approximately 74 million low-income American citizens were enrolled in Medicaid(2). Despite this increase in Medicaid enrollment, studies show that patients with Medicaid have delayed access to nonemergent care, longer waits to appointments and increased difficulty scheduling (3-5). Odds of Medicaid acceptance among providers have been shown to increase with increasing reimbursement rates (6).

Under the Emergency Medical Treatment and Labor Act, the federal law guarantees emergent treatment to any patient who presents to the Emergency Department in the United States (7). However, access to outpatient follow-up care has been shown to be inhibited by financial and insurance restraints (8). Additionally, patients may require consultation with specialists in an outpatient clinical setting for the appropriate treatment of their ailment. Several studies in the orthopedic literature show, primarily through hypothetical patient phone calls, that patients with Medicaid have more difficulty accessing care (4,6,9). Ankle fractures are a common orthopedic injury presenting to the emergency department that can often be temporized with closed reduction and splinting and discharged for follow-up in the outpatient setting. However, many cases warrant operative fixation to ensure that the fracture is appropriately reduced and stabilized. In these cases, although patients may be temporarily splinted in the emergency department, a consult to an orthopedic specialist is warranted for definitive operative fixation and postoperative care.

No study to date has reported differences in access to orthopedic care and follow-up time for patients with ankle fractures requiring open reduction and internal fixation using historical data from the medical record. The purpose of this study was to compare average time from injury to first visit, and time from injury to surgery between patients with private insurance and patients with Medicaid who required open reduction and internal fixation of an ankle fracture. We secondarily aimed to assess differences in average follow-up times

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Address correspondence to: Ashish Shah, MD, Department of Surgery, University of Alabama, Birmingham, School of Medicine, 1313 13th Street South, Suite 226, Birmingham, AL 35205.
E-mail address: ashishshah@uabmc.edu (A.B. Shah).

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between the 2 patient groups. Our hypothesis was that patients with Medicaid would experience delayed access to initial orthopedic care as well as surgical intervention. We undertook a retrospective cohort study to compare time to care of patients that have Medicaid insurance vs those with private insurance who suffered an ankle fracture.

Patients/Materials and Methods

This study was reviewed and approved by the Institutional Review Board per the established Declaration of Helsinki. A retrospective chart review was performed for all patients above 18 years of age at a single institution with a diagnosed medial malleolar, lateral malleolar, bimalleolar, or trimalleolar ankle fracture requiring open reduction and internal fixation from January 2008 through December 2018. Patients were identified by current procedural terminology codes 27766, 27769, 27784, 27792, 27814, 27822, and 27829. Exclusion criteria included polytraumatic injuries, open injuries, enrollment in Medicare, lack of insurance, indigent or charity insurance, Veterans' Insurance, self-paying patients, or patients with no verifiable insurance information. Insurance information for each patient was retrospectively identified from the study institution's billing department.

Date of injury, date of first visit, date of surgery, and date of final follow-up pertinent to the ankle fracture were identified and recorded for each patient. Date of first visit was defined as date of first visit to the study institution for the pertinent ankle injury, including emergency department, urgent care, or scheduled clinic visits. Times from date of injury to the date of first visit, date of injury to date of surgery, and date of surgery to date of final follow-up were calculated in days and compared between the 2 groups of patients. Preoperative variables collected included age at the time surgery, sex, race, body mass index, history of tobacco use, and current alcohol or substance abuse.

Statistical Analysis

Statistical analysis was performed using SAS software (SAS Institute, Cary, NC). Means calculated for patient demographics and average time to care after injury were compared using analysis of variances (ANOVA). Fischer's exact test was used to compare frequencies for patient demographics, substance use, and patient follow-up. The chi-square test (x^2 test) was used to compare the categorical variable of patient ethnicity. Statistical significance was set at $p < .05$.

Results

A total of 311 patients met inclusion criteria for this study. Of these, 73 (23.5%) were enrolled in Medicaid and 238 (76.5%) were privately insured. Table 1 shows baseline patient demographics, of which average age, sex, tobacco use, alcohol use, and illicit drug use significantly differed between the 2 groups. Average (mean) age was significantly younger for the Medicaid group (38.1 years), compared to the privately-insured group (41.7 years) ($p = .038$). The majority of the Medicaid group included a significantly greater proportion of females (71.2%), than the privately-insured group (51.6%) ($p = .003$). Tobacco use and illicit drug use were significantly more prevalent among the Medicaid group ($p < .001$ and $p = .001$, respectively), while alcohol use was significantly more common among the privately-insured group ($p = .005$).

Table 1
Patient demographics

	Medicaid	Private Insurance	Total	*p* Value
Total patients	73	238	311	
Average age	38.1 (± 12.9)	41.7 (±13.1)		.038
Mean BMI (±S.D.)	32.4 (±7.9)	31.2 (±6.7)		.198
Sex				.003
Male (N)	21 (28.8%)	115 (48.3%)	136	
Female (N)	52 (71.2%)	123 (51.6)	175	
Ethnicity				.137
White	30 (41.1%)	121 (50.84)	151	
Black/African-American	42 (57.5%)	106 (44.5%)	148	
Hispanic/Latino	0 (0.0%)	4 (1.68%)	4	
Other	1 (1.37%)	6 (2.52%)	7	
Decline	0 (0.0%)	1 (0.42)		
Tobacco use	41 (56.2%)	77 (32.5%)	118	<.001
Alcohol use	25 (34.3%)	126 (53.2%)	151	.005
Illicit drug use	14 (19.2%)	15 (6.3%)	29	.001

Table 2
Comparisons of time to care and follow-up between patients with private insurance and patients with Medicaid

	Private Insurance	Medicaid	*p* Value
Average time from injury to first visit (days)	1.2	6.2	<.001
Average time from injury to surgery (days)	8.3	16.1	<.001
Average time from surgery to final date of follow-up (days)	256.8	219.2	.279
Number of patients with at least 6 months (180 days) follow-up	109 (46.2%)	34 (47.2%)	.877
Number of patients with at least 365 days follow up	50 (21.2%)	12 (16.7%)	.403

Table 2 shows comparisons of time to care and follow-up between privately-insured and Medicaid-insured patients. Mean time from injury to first orthopedic appointment was found to be more than 5 times longer among patients with Medicaid (average 6.2 days) than among patients with private insurance (average 1.2 days). This difference was statistically significant ($p < .001$). Mean time from injury to surgery among patients with Medicaid in comparison to patients with private insurance was also found to be high enough to reach statistical significance (16.2 days vs 8.3 days respectively; $p < .001$). No significant differences were found between patients with private insurance vs Medicaid with respect to average length of postoperative follow-up ($p = .279$), number of patients with at least 6 months of follow up ($p = .877$), or number of patients with at least one year of follow up ($p = .403$).

Discussion

The results of this study suggest that patients enrolled in Medicaid experience significant difficulty in scheduling timely appointments for ankle fracture care and may be less inclined to seek out care from an emergency department or urgent care center after sustaining an injury. The results of which, could be detrimental to patients' overall healing process and complication rate. Although the Patient Protection and Affordable Care Act has provided millions of Americans with government-funded medical insurance, coverage does not confer access to care. Patients with Medicaid experienced wait times more than 5 times as long as those with private insurance for scheduling initial appointments, and average time from injury to surgery was significantly increased among patients with Medicaid as well.

The impact of insurance status appointment accessibility has been previously assessed in the literature, primarily using methodology which entails making phone calls to various medical facilities as a fictitious patient to establish a theoretical injury-to-appointment timeline. The results of the current study are consistent with literature assessing access to care using this approach. Labrum et al. (2017) analyzed differences in time to care for patients with ankle fractures by calling several practices in the Northeast region of the U.S. to schedule an appointment for a fictitious patient. Appointment success rate was significantly greater for patients with private insurance than Medicaid in both Medicaid-expanded and Medicaid nonexpanded states, and patients with Medicaid had significantly longer average wait times until first appointment than patients with private insurance (6). Using similar phone call methodology, Medford-Davis et al. (2016) also studied access to care among ankle fracture patients. Results showed a greater average wait time for an appointment as well as a lower acceptance rate among Medicaid-enrolled patients compared to those who were privately insured (8). Although each of these studies provides insight as to potential timelines for access to care among ankle fracture patients with private insurance and Medicaid, they do not use documented visits but rather create hypothetical estimates. By utilizing a retrospective review, true patterns of time to care were assessed.

This is the first study which compares differences in time to surgery among ankle fracture patients. The importance of timely surgical intervention cannot be overemphasized to ensure appropriate healing and prevent postoperative complications. The biological sequence for fracture healing consists of an inflammatory phase followed by soft callus formation, then finally hard callous formation and bone remodeling. Within the first week following a fracture, the inflammatory phase resolves and transitions into callus formation (10). Application of micromotion has been shown to increase periosteal healing response (11). Delay of ankle stabilization or fixation may therefore lead expedited callus formation with malaligned bone fragments. Clinical studies have also demonstrated improved outcomes among those who undergo early fracture fixation. A systematic review by Schepers et al. (2013) found that patients who underwent operation after 24 hours postinjury had significantly greater risk of wound complications than those treated within 24 hours (12). Carragee et al. (1991) demonstrated that patients with operations performed after 4 days postinjury had a minor complication rate of almost twice that of patients with operations performed within 4 days; major complication rate was even greater, with more than 3 times the incidence among the delayed group. Additionally, anatomic reduction rate was higher in the early surgery group (13).

Studies across a variety of specialties have demonstrated similar results to those published for ankle fractures. A study by Wiznia et al. (2017) again utilized phone call methodology to assess differences in access to care between those with Medicaid and those with private insurance, but the fictitious patient had suffered a meniscus tear. Comparable results to those of Labrum (6) were found, with a significantly lower appointment success rate and increased wait time among patients with Medicaid as compared to private insurance (4). Some studies have utilized retrospective chart reviews, as was done in the current study, to identify discrepancies in care. Baraga et al. (2012) demonstrated that among patients with ACL injuries, those receiving Medicaid were diagnosed a median of 56 days after the injury in contrast to those with private insurance, who were diagnosed at a median of just 14 days, although time to first visit was not specifically evaluated. Additionally, patients with Medicaid had more medical visits prior to diagnosis than those with private insurance (3). These studies do call attention to health care disparities between patients with private insurance and patients with Medicaid. However, they do not provide information specific to ankle fractures.

At the institution at which this study was performed, all physicians accept new patients enrolled in Medicaid. This is particularly important for the surrounding population, as an estimated 41% of the state population was rural as of 2010 (14). Anecdotal experience from the senior author suggests that many patients who present for surgical consultation after a delayed period of time have been denied appointments at the medical center nearest their home, and are advised to schedule an appointment at the study institution. We therefore hypothesize that the delay in care for patients enrolled in Medicaid was likely as a result of denial of care elsewhere, or of patients being referred from emergency departments or medical centers without on-site orthopedic specialists. Further studies which specifically document and assess why patients enrolled in Medicaid present after a delay in their injury would be beneficial for elucidating specific targets for changes in practice. Nonetheless, the present study calls attention to a need to address delayed care among these patients.

The results of this study must be interpreted with several limitations. As with any retrospective chart review, results are contingent upon accuracy and completeness of the medical record from which the data is collected. Additionally, insurance information was not available for all patients who were identified by ankle fracture current procedural terminology codes, which may have precluded patients from either group from being included in analysis. Furthermore, patients were sampled from a single institution which may introduce a bias associated with the type of institution as well as the geographic location. Delays due to not seeking care were also not considered separately, which could have also affected average time to care. It was also noted that patient characteristics including average age, sex, tobacco use, alcohol use, and illicit drug use differed significantly between the 2 groups. However, because this study assessed time to care rather than patient outcomes, it is highly unlikely that these variables would have any impact on our results. Finally, a power analysis was not conducted for the current study which may have been beneficial due to the disproportion amount of privately insured patients compared to those with Medicaid. However, this type of analysis is difficult due to the lack of available data regarding this subject and the results of this study can act as a guide to researchers who are looking to appropriately power future articles that discuss this important topic.

In conclusion, patients who are enrolled in Medicaid have significantly delayed access to care as compared to those who have private insurance. For ankle fracture patients this is a critical healing time, and delayed care may result in increased costs, increased utilization of healthcare resources, higher complication rates, and poorer patient outcomes. Therefore, it is important that the orthopedic community continues to progress toward improvising and expanding access to care for all patients.

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National Cost Comparisons Between Orthopaedics and Podiatry in Ankle Fracture Fixation

James Meyers, BA; Eric Gokcen, MD; Meghan Kelly, MD, PhD; Jashvant Poeran, MD, PhD; Alexander Lieber, MD; Joshua Luginbuhl, MD; Nicole Zubizarreta, MPH; Ettore Vulcano, MD

Category: Trauma; Ankle; Sports; Other

Keywords: Ankle Fracture; Cost; Practice Models

Introduction/Purpose: Increasing overlap exists between surgical care provided by orthopedic foot and ankle surgeons and podiatrists. Use of either specialty depends on numerous factors including perceived costs. Unfortunately, large scale cost comparisons between the two are lacking. Such data is increasingly important given the current climate of payment reform and cost containment in healthcare. Using national Medicare claims data, we therefore aimed to compare per-case Medicare payments between orthopedic foot and ankle surgeons and podiatrists for ankle fracture fixation. We additionally aimed to describe any differences between groups that may drive differences in payments.

Methods: This IRB-exempt retrospective study included patients undergoing either unimalleolar, bimalleolar, or trimalleolar ankle fracture repair as recorded in the national Medicare Limited Data Set (2013-2019). Type of surgeon (orthopedic foot and ankle surgeon or podiatric surgeon) was determined using publicly available healthcare provider taxonomy information available from the Washington Publishing Company (www.wpc-edi.com) and maintained by the National Uniform Claim Committee (www.nucc.org); crosswalks between Medicare Specialty Code and Provider Taxonomy are publicly available. The primary outcome was total Medicare payments specific to the procedure, as a surrogate for cost (inflation-adjusted to 2019 US dollars). Additionally, patient demographics and hospital characteristics were compared between groups to determine if any specific factors associated with costs may influence group differences. Univariable tests (chi-squared and t-tests; non-parametric tests where appropriate) assessed significance of group differences.

Results: Overall, 16,927 unimalleolar; 17,244 bimalleolar; and 11,717 trimalleolar fracture repairs were included. Of these, orthopedic surgeons performed more procedures than podiatrists (86.7% vs 13.3% for uni-; 92.4% and 7.6% for bi-; 92.2% and 7.8% for trimalleolar fracture repairs respectively). The mean and median age (71.6 - 72.7 [70-71] years) as well as the mean and median Charlson-Deyo Comorbidity Index (0.6 - 0.7 [0]) did not significantly differ between patients treated by an orthopedic surgeon or podiatrist ($p = 0.157$ and $p = 0.890$ respectively). Regionally, podiatrists saw patients more often in the West and Midwest whereas providers in the South were more often orthopedic surgeons ($p < 0.001$). Median procedure-specific Medicare payments for all three categories of ankle fracture repairs were significantly lower for orthopedic surgeons compared to podiatrists: $4,156 vs $4,300 for uni-, $4,205 vs $4,379 for bi-, and $4,396 vs $4,525 for trimalleolar, respectively (all $p < 0.001$).

Conclusion: In this analysis comparing Medicare payments between orthopedic foot and ankle surgeons and podiatrists we found that ankle fracture fixation procedures performed by the orthopedic surgeons were less expensive and that cost differences do not appear to be driven by patient characteristics. Additionally, we were able to discern geographic differences regarding practice location of both surgeon types. These data will inform future discussions on how to optimize costs of foot and ankle surgical care.

Ankle Fracture Fixation Variables							
	Orthopedists n = 19,412			Podiatrists n = 2,351			
	Uni- n = 14,682	Bi- n = 15,940	Trimalleolar n = 10,806	Uni- n = 2,245	Bi- n = 1,304	Trimalleolar n = 911	p-value
Mean [Median] Age	71.9 [71]	72.7 [71]	71.9 [70]	71.6 [70]	72.5 [71]	71.8 [70]	0.157
Mean [Median] Comorbidity Index	0.6 [0]	0.7 [0]	0.6 [0]	0.7 [0]	0.7 [0]	0.7 [0]	0.890
Region (%)							
North Central	27.4%	23.2%	23.3%	32.2%	27.5%	30.1%	**< 0.001**
Northeast	12.6%	13.2%	14.4%	11.6%	13.5%	10.4%	
South	43.1%	46.7%	43.0%	26.8%	30.6%	29.3%	
West	16.9%	16.9%	19.2%	29.4%	28.5%	30.2%	
Cost	$ 4,156	$ 4,205	$ 4,396	$ 4,300	$ 4,379	$ 4,525	**< 0.001**

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National Trends in Orthopaedic Surgery Resident Adult Case Logs

Todd P. Pierce, MD, Daniel Ermann, BS, Anthony J. Scillia, MD, Anthony Festa, MD, Arash Emami, MD, and Vincent K. McInerney, MD

St. Joseph's University Medical Center, Department of Orthopaedic Surgery, Paterson, New Jersey

OBJECTIVE: Our purpose was to assess United States data to determine if there were changes in the number of adult cases that graduating orthopaedic surgery resident logged.

DESIGN: We assessed the Accreditation Council for Graduate Medical Education data from 2010 to 2016 to identify the number of cases that were reported by graduating orthopaedic surgery residents through the United States. Specifically, we analyzed the mean total number of adult cases per graduating resident. We substratified the data based on the subspecialty to include total number of cases performed in: (1) upper extremity; (2) lower extremity; (3) spine; (4) oncology; and (5) trauma.

SETTING: All data collection was performed at the Seton Hall School of Health and Medical Sciences.

PARTICIPANTS: All United States orthopaedic surgery residents were considered participants

RESULTS: During the study period, the total number of cases performed by each resident had decreased from 1791 to 1311 ($p = 0.0001$). There was only an increase in the number of pelvis/hip cases ($p = 0.0001$). Among upper extremity cases, there was a decrease in each subtype of cases ($p = 0.0001$). There was a decrease in the number of femur/knee, leg/ankle, and foot/toes cases per resident ($p = 0.0001$). Furthermore, there was a decrease in the number of spine and trauma cases performed ($p = 0.0001$). There was no difference in the number of oncology cases performed ($p = 0.47$).

CONCLUSIONS: We noted a decrease in the number of cases logged by graduating residents over the past 6 academic years. This provides a great deal of insight into the need for residencies to ensure that the appropriate Accreditation Council for Graduate Medical Education bench marks are met. Future studies should analyze how cases may be increased. (J Surg Ed 76:893−897. © 2019 Published by Elsevier Inc. on behalf of Association of Program Directors in Surgery.)

KEY WORDS: orthopaedic surgery, resident education, case logs, ACGME, residency

COMPETENCIES: Practice-Based Learning and Improvement, Medical Knowledge, System-Based Practice

INTRODUCTION

Effective training throughout the orthopaedic surgery residency is predicated on performing the appropriate amount and diversity of cases. As such, it is imperative that residents are exposed to a variety of cases in order to meet the requirements and benchmarks set by the Accreditation Council for Graduate Medical Education (ACGME). With incorporation of work hour restrictions in 2005, there were concerns that residents would not be able to meet the ACGME case requirements.[1] Although the strengths in case-loads for residencies across the country vary based on a number of factors, it is imperative that programs continue to evaluate ways to continue to improve on the number of cases performed by residents to ensure training that facilitates their ultimate independence as practitioners.

There have been previous studies that have shown variability in the number of case and the variability of types of cases that are being performed by orthopaedic surgery residents in the United States.[2-6] However, given the continued changes in duty hours and the increase in the number of orthopaedic surgery residents within the United States, there remains a need for an updated analysis on the number of cases each resident may perform during their training.

Therefore, the purpose of this study was to assess the number of mean cases per orthopaedic surgery resident that were performed between over the last 6 academic

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Correspondence: Inquiries to Anthony Scillia, MD Seton Hall University, School of Health and Medical Sciences, Department of Orthopaedics, 400 S Orange Ave, South Orange, NJ 07079; e-mail: anthonyjscillia@gmail.com

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years. Specifically, we evaluated: (1) total adult; (2) upper extremity; (3) lower extremity; (4) spine; (5) oncology; and (6) trauma cases per graduating resident.

METHODS

Appropriate Institutional Review Board approval was obtained prior to the initiation of this study. The resident case logs of all orthopaedic surgery residency programs between the academic years of 2010 and 2016 within the United States were queried. All adult cases were identified and tabulated. They were further subclassified into the following categories: (1) shoulder; (2) humerus/elbow; (3) forearm/wrist; (4) hand/fingers; (5) pelvis/hip; (6) femur/knee; (7) leg/ankle; (8) foot/toes; (9) spine; (10) oncology; and (11) trauma.

We analyzed the mean number of cases per resident performed total and within each category between 2010 and 2016 for any potential differences. In addition, we evaluated the data regarding the differences in the number of mean cases per resident that were in the 10th and 90th percentile for total amount as well as the aforementioned subclassifications.

All data were inputted into a Microsoft Excel spreadsheet (Excel, Microsoft Corporation, Redmond, Washington). Graph Pad Prism version 5.01 (GraphPad Software Inc., La Jolla, California), was used for all statistical calculations, and student's *t* test was used to compare the difference among the means at different time points. A 95% confidence interval (CI) in the mean difference per year was calculated. A p value of less than or equal to 0.05 was considered significant.

RESULTS

Between 2010 and 2016, there were substantially lower mean total adult cases performed by each resident (mean = 1791-1311 cases per resident; 95% CI, 439.25-520.75; p = 0.0001). During this time, there has been a substantial difference between the 10th and 90th percentile mean cases per resident for each year (p = 0.0001; Fig. 1).

Additionally, there has been a change in the number of upper extremity cases performed during this time-period. Specifically, there was a decrease in the number of cases seen in shoulder (191-130 cases per resident; 95% CI, 53.24-68.76; p = 0.0001), humerus/elbow (58-48 cases per resident; 95% CI, 7.85-12.15, p = 0.0001), forearm/wrist (109-91 cases per resident; 95% CI, 13.71-22.29; p = 0.0001), and hands/fingers cases (110-80 cases per resident; 95% CI, 25.15-34.85; p = 0.0001; Table 1).

Lower extremity cases saw increases in a certain type of case with decreases in the remaining subtypes. Specifically, there was an increase in the number of pelvis/hip cases performed (183-199 cases per resident; 95% CI, 9.06-22.94; p = 0.0001). There was a decrease in the

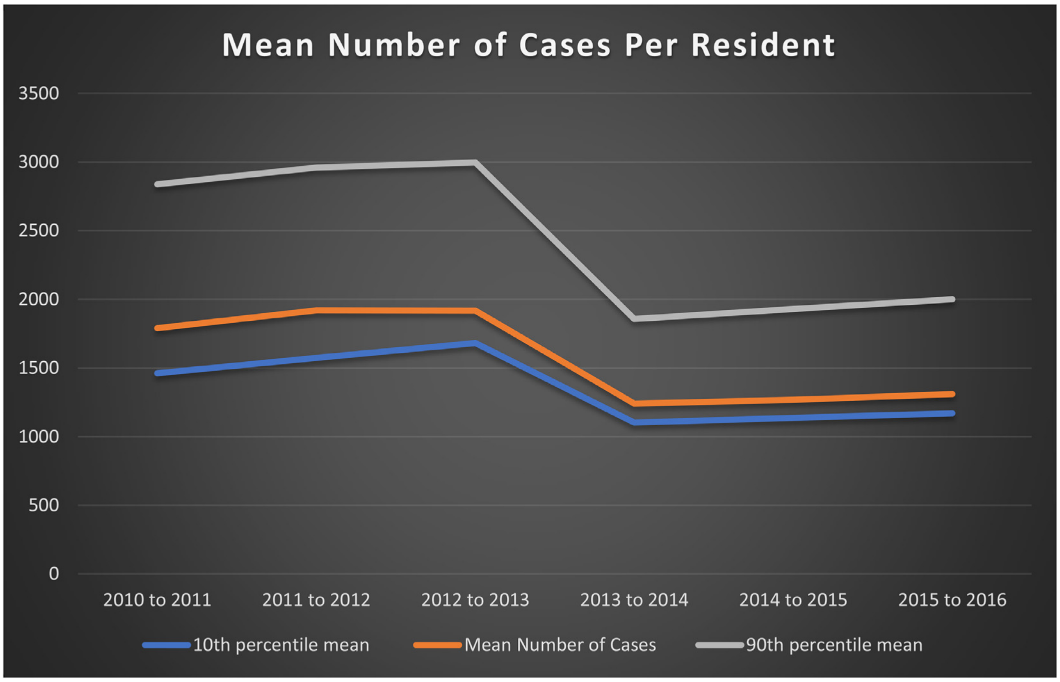

FIGURE 1. Total number of cases showing decrease in mean number.

TABLE 1. Mean Upper Extremity Cases Performed

Academic Years	Shoulder ± SD	Humerus/elbow ± SD	Forearm/Wrist ± SD	Hand/Fingers ± SD
2010-2011	191 ± 91	58 ± 23	109 ± 45	110 ± 53
2011-2012	208 ± 101	60 ± 27	112 ± 49	113 ± 58
2012-2013	211 ± 95	59 ± 22	113 ± 42	111 ± 49
2013-2014	120 ± 46	45 ± 16	87 ± 35	76 ± 36
2014-2015	123 ± 48	47 ± 17	88 ± 33	78 ± 36
2015-2016	130 ± 50	48 ± 17	91 ± 35	80 ± 37
p value	0.0001	0.0001	0.0001	0.0001
95% CI, mean difference	53.24-68.76	7.85-12.15	13.71-22.29	25.15-34.85

TABLE 2. Mean Lower Extremity Cases Performed

Academic Years	Pelvis/Hip	Femur/Knee	Leg/Ankle	Foot/Toes
2010-2011	183 ± 65	390 ± 119	171 ± 58	86 ± 49
2011-2012	198 ± 77	417 ± 152	179 ± 70	94 ± 64
2012-2013	200 ± 65	401 ± 113	173 ± 59	91 ± 50
2013-2014	183 ± 61	301 ± 80	126 ± 44	51 ± 27
2014-2015	190 ± 67	304 ± 88	131 ± 42	55 ± 28
2015-2016	199 ± 65	310 ± 83	139 ± 43	57 ± 26
p value	0.0001	0.0001	0.0001	0.0001
95% CI, mean difference	9.06-22.94	69.12-90.88	26.58-37.42	24.86-33.14

number leg/knee (390-310 cases per resident; 95% CI, 69.12-90.88; p = 0.0001), leg/ankle (171-139 cases per resident; 95% CI, 26.58-37.42; p = 0.0001), and foot/toes cases performed (86-57 cases per resident; 95% CI, 24.86-33.14; p = 0.0001; Table 2).

There was a decrease in the number of spine cases performed per resident from 137 to 62 cases per resident (95% CI, 66.76-83.24; p = 0.0001). There was no difference in the number of oncology cases performed (31-32 cases per resident; p = 0.47). However, the number of trauma cases per resident decreased from 416 to 388 (95% CI, 11.74-44.26; p = 0.0007).

See Table 3 for a detailed analysis of the differences between the 10th and 90th percentile cases per resident for the total and types of cases.

DISCUSSION

The ability to practice medicine independently is predicated on having the appropriate volume of cases. Thus, it is imperative to ensure that all orthopaedic surgery residents are performing at or beyond what are considered the minimum case requirements set out by the ACGME.

TABLE 3. Fold Difference Between 10th and 90th Percentile Cases

Case Type	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016
Shoulder	3.24	3.15	3.30	2.80	2.74	2.66
Humerus/elbow	2.67	2.81	2.50	2.44	2.63	2.63
Forearm/wrist	2.93	2.80	2.72	2.69	2.66	2.69
Hand/fingers	3.49	3.33	3.42	3.13	3.21	3.51
Pelvis/hip	2.48	2.42	2.24	2.33	2.25	2.24
Femur/knee	2.19	2.11	2.03	2.03	2.08	1.93
Leg/ankle	2.41	2.46	2.39	2.51	2.27	2.18
Foot/toes	4.45	4.50	3.79	3.86	3.68	3.25
Spine	9.41	7.35	6.18	4.09	4.35	4.58
Oncology	71.00	27.00	7.82	6.67	5.00	4.83
Trauma	2.75	2.59	2.34	2.32	2.29	2.32
Total all procedures	1.94	1.88	1.84	1.72	1.78	1.78

Therefore, aimed to determine if the mean case-loads of residents over 6 academic years have experienced any changes. We noted an overall decrease in the number of cases being performed by residents over the past 6 academic years with a notable difference between those within the 10th and 90th percentiles for each type of case as well as the total number of cases. The most prominent decrease came between 2012 and 2014 with a slight increase occurring between 2014 and 2016. The implications of these findings are crucial as the overall decrease in cases has a deleterious effect on the ability of residency programs to train physicians who can practice independently.

Our study has several limitations. It is possible that the case-loads may not be accurately reported by residents or precisely tracked by ACGME. Secondly, the ACGME does not make publicly available the number of residents who are unable to meet their minimum case log criteria. However, we would speculate that the vast majority of residents meet their minimum case benchmarks in order to continue their accreditation. Furthermore, we were unable to glean program-specific information regarding cases. For instance, some programs may have more of a case volume regarding certain type of cases as oppose to others. Additionally, programs located within different regions of the country or a larger number of residents may have differences in the volume of cases performed. Moreover, the drop in case logs due to performance of some of cases in surgery centers may not fully explain in the decrease in case volumes for procedures not typically performed at outpatient surgical centers. Despite these limitations, we believe that this study represents an updated picture regarding the cases residents will perform prior to graduating their residency.

Our study contradicts 1 previously published study that showed an overall increase in cases per resident. Gil et al. evaluated the resident case logs from 2007 to 2013.[2] They found that there was a 17% increase in the total number of adult cases performed by residents during that time period (1953-2291 cases per resident; $p = 0.0004$). Additionally, there was an increase in each type of case performed: shoulder (167-218 cases per resident; $p = 0.0001$), humerus/elbow (81-94 cases per resident; $p = 0.001$), forearm/wrist (136-153 cases per resident; $p = 0.0001$), hands/fingers (123-127 cases per resident; $p = 0.01$), pelvis/hip (206-225 cases per resident; $p = 0.006$), femur/knee (427-453; $p = 0.03$), leg/ankle (203-214 cases per resident; $p = 0.01$), foot/toes (110-114 cases per resident; $p = 0.009$), spine (145-181 cases per resident; $p = 0.009$), and oncology (29-52 cases per resident; $p = 0.003$). In our study, the only cases that increased over our study period were pelvis/hip. Furthermore, the decrease in cases seen was most pronounced between 2012 and 2014 with slight increase seen between 2014 and 2016. The difference in our findings may be attributed to several factors. There has been an increase in the number of same-day surgical centers, which has been driven by cost savings.[7,8] Although we cannot be sure why there was a drop in case logs, it may be speculated that cases that may have originally been performed in inpatient centers are now being performed in these outpatient surgery centers. Thus, residents may not have the ability to perform cases during the time which there was a decrease in number of cases logged. Additionally, the increase in the number of graduating residents—650 to 705—may also be causing a decrease in the number of cases performed. Furthermore, although it cannot be proven, some trauma cases that were originally managed at academic trauma centers are now being managed by orthopaedic traumatologists at nonacademically affiliated hospitals.

Among each case subtype, the 1 type of case where there was an increase over our study time period was in pelvis/hip cases. It is not clear what may be the reason behind this anomalous finding. However, it is known that the number of total hip arthroplasties performed in the United States is expected to increase by 173% from 2005 to 2030.[9] It is quite possible given that the majority of total hip arthroplasties are still performed in the inpatient setting, this allowed for an increase in resident exposure to pelvis/hip cases.

In conclusion, we found an overall decrease in the number of adult cases being performed by residents. We believe that this decrease in cases performed by graduating residents is multifactorial. This change provides a great deal of insight into the need for residencies to ensure that the appropriate ACGME bench marks are being met for cases. Furthermore, residency programs must continue to explore ways to increase the amount of cases residents are exposed to so they may be capable of practicing independently. Future studies should focus on cases performed based on program location and size of residency.

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Podiatry SOP Emails:

Joseph Treadwell on Medicaid:

Attached are a few articles. I tried to keep them in the last decade so they are relevant although one is 2005. You will be able to tell there is no inherent Podiatry bias in these articles as you unmask the data.

Does Medicaid Insurance Confer Adequate Access to Adult Orthopaedic Care in the Era of the Patient Protection and Affordable Care Act

- Insurance Status and Access to Urgent Ambulatory Care Follow-up Appointments
- Impact of Insurance and Practice Type on Access to Orthopaedic Sports Medicine
- "I Broke My Ankle": Access to Orthopedic Follow-up Care by Insurance Status
- The Effect of Insurance Type on Patient Access to Ankle Fracture Care Under the Affordable Care Act (DONE OUT OF YALE)

The last study done out of Yale I included all the text but I have requested delivery of actual article via PUBMED. The supplied text is all inclusive but I know many people prefer the article published format. I will forward once received.

These are mainly about access. I did not feel a need to discuss access at the last meeting as I know the DPH representatives are more aware of the problems with Medicaid and the underinsured patients' access to care moreso than doctors. However it was obvious at our discussion that many of the doctors feel there is no issue with access, and we can further discuss it next week.

Dr. Gray on New York SOP:

Out of interest here is the NYS information regarding the extent of Podiatric scope of practice and the parameters for ankle surgical requirements. Total Ankle Replacement is excluded as are Pilon fractures. I found it interesting that the minimum standard of bone and soft tissue procedures required to report upon application around the ankle is no less than ten in 5 years prior to the application. At least 5 of each. This means one could have just 6 procedures of each in the prior 5 years. If I have interpreted it correctly this seems awfully low for any meaningful experience.

Option 2

- Residency – The applicant must have graduated on or after June 1, 2006 from a 3-year residency program in podiatric medicine and surgery accredited by the Council on Podiatric Medical Education;
- Board qualification – The applicant must be board qualified, but not yet certified, in reconstructive rearfoot and ankle surgery by a national certifying board having certification standards acceptable to the State Education Department. The American Board of Foot and Ankle

Surgery (formerly the American Board of Podiatric Surgery) has been determined to have certification standards acceptable to the Department; and

- Additional training and experience – The applicant must submit acceptable documentation that he or she has acceptable training and experience that consists of not less than 10 ankle procedures in the five years immediately preceding application, provided that:
- not less than 5 procedures shall be osseous procedures, and
- not less than 5 procedures shall be soft tissue procedures.

It might be useful to reach out to the NYS equivalent dept. that has scope jurisdiction to see why they have this excluding language.

https://www.op.nysed.gov/professions/podiatry/podiatric-ankle-surgery-privileges

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Dr. Treadwell in response to Dr. Gray:

We do not need to reach out to NY as they created their law after ours and used ours as a model, but feel free to do so. Our ankle permits had much more stringent requirements not out of need but out of compromise.

The CT permit process was eventually removed. Hospital credentialing works around the country and in Connecticut and continues to do so even since the removal of the permit process. Surgeons apply for what they are trained to do and prevented from doing what they are not trained to do. There has not been an increase in privilege requests since the removal of the permit process. Podiatrists in other states, that have full scope of practice privileges inclusive of total joint replacement and pilon fractures, do not apply for for those procedures if they do not have the training for them.

Below was our permit process before it was appropriately removed.

The Regulations of Connecticut State Agencies are amended by adding sections 20-54-1 to 20-54-2, inclusive, as follows:

(NEW) Sec. 20-54-1. Definitions. For the purposes of sections 20-54-1 to 20-54-2, inclusive, of the Regulations of Connecticut State Agencies:

> (1) “Advanced ankle surgery procedures” means procedures which include ankle fracture fixation, ankle fusion, ankle arthroscopy, insertion or removal of external fixation pins into or from the tibial diaphysis at or below the level of the myotendinous junction of the triceps surae, and insertion and removal of retrograde tibiotalocalcaneal intramedullary rods and locking screws up to the level of the myotendinous junction of the triceps surae, but shall not include the surgical treatment of complications within the tibial diaphysis related to the use of such external fixation pins.
>
> (2)   “Standard ankle surgery procedures” means procedures that include soft tissue and osseous procedures.

(NEW) Sec. 20-54-2. Required training and experience in standard or advanced midfoot, rearfoot and ankle procedures.

(a) The training and experience required under section 20-54(c) of the Connecticut General Statutes to qualify for a permit to independently engage in standard ankle surgery procedures shall constitute acceptable training and experience when all of the criteria specified below are satisfied.

(1) A total of one hundred and ten (110) cases involving midfoot, rearfoot or ankle soft tissue and osseous procedures shall be documented as follows:

(A) Soft tissue procedures: fifty (50) total cases are required, including but not limited to a minimum of five (5) ankle ligament stabilization procedures. No more than seventeen (17) cases may be taken from any one of the below sections, unless all cases are specific to the ankle. If all cases are specific to the ankle, no more than twenty-four (24) cases may be included from that section.

- (i) plastic surgery flaps;
- (ii) tendon debridement/repair;
- (iii) open or endoscopic tendon lengthening;
- (iv) tendon transfer;
- (v) ankle ligament repair/reconstruction;
- (vi) nerve decompression/excision/repair; and
- (vii) excision tumor/mass.

(B) Osseous procedures: sixty (60) total cases are required, including but not limited to a minimum of fifteen (15) fusions. No more than twenty (20) cases may be taken from any one of the below sections, unless all cases are specific to the ankle. If all cases are specific to the ankle, no more than twenty-nine (29) cases may be included from the fusion and fracture sections.

- (i) Exostectomy;
- (ii) Fracture/dislocation open reduction and internal fixation;
- (iii) Osteotomy;
- (iv) Fusion;
- (v) Corticotomy/osteotomy with callus distraction/correction complex deformity; and
- (vi) Osteomyelitis management.

(2) Documentation of such procedures shall be in the form of residency logs, practice logs, supervision logs, or a combination thereof. In at least thirty-three percent (33%) of all cases from residency logs the podiatrist shall have performed at least fifty percent (50%) of the procedure under the direct supervision of the attending surgeon. In at least thirteen (13) of the fifty (50) soft tissue cases and fifteen (15) of the sixty (60) osseous cases required in this subsection, documentation of such procedures shall be in the form of practice or supervision logs and the podiatrist shall have performed at least fifty percent (50%) of the procedure under the direct supervision of the attending surgeon.

(b) The training and experience required under section 20-54(c) of the Connecticut General Statutes to qualify for a permit to independently engage in advanced ankle surgery procedures shall constitute acceptable training and experience when all of the criteria specified below are satisfied.

(1) A total of either fifty-five (55) or sixty-five (65) cases involving advanced midfoot, rearfoot and ankle procedures, which may include cases submitted to fulfill the requirements of subsection (a) of this section, shall be documented as follows:

(A) Ankle fractures: twenty (20) total cases are required, including but not limited to a minimum of ten (10) binalleolar, trimalleolar, or pilon fractures. No more than ten (10) cases may be unimalleolar fractures.

(B) External fixation: twenty (20) total cases are required, including but not limited to a minimum of five (5) cases that involve pins within the tibia;

(C) Ankle fusions: five (5) total cases are required; and

(D) Arthroscopy: either twenty (20) total cases, including but not limited to at least ten (10) ankle arthroscopy procedures, or ten (10) cases and ankle arthroscopy skills course approved by the American College of Foot and Ankle Surgeons are required.

(2) Documentation of such procedures shall be in the form of residency logs, practice logs, supervision logs, or a combination thereof. In at least thirty-three percent (33%) of all cases from residency logs the podiatrist must have performed at least fifty percent (50%) of the procedure under the direct supervision of an attending surgeon. In all cases submitted from practice or supervision logs, the podiatrist shall have performed at least fifty percent (50%) of the procedure under the direct supervision of an attending surgeon.

Dr. Gray Response to Dr. Treadwell:

In my opinion, it is a matter of opinion that hospital credentialing works well around the country. I presented literature data outlining large problems in many states in the process. Below are a couple articles that outline the challenges and outline mistakes. There are many more if one looks a lot. It might still be of interest to know why NYS has its language as it does. I have no independent knowledge that they just took a short cut and adopted CT language. Maybe they did their own independent research, committee meetings, public testimony? I just do not know.

https://medicallicensuregroup.com/hospital-credentialing-errors/

https://www.linkedin.com/pulse/your-hospital-making-critical-credentialing-mistakes

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Dr. Gambardella to Melia/the group on experience:

In terms of minimum requirements to demonstrate meaningful experience, it should be noted that according to ACGME's document regarding "Orthopedic Surgery Minimum Numbers", the minimum requirement for a graduating orthopedic resident is that of 15 ankle fracture fixation surgeries, and a TOTAL OF 5 MIDFOOT/HINDFOOT/ANKLE ARTHRODESIS PROCEDURES, which is exceptionally less than the standard used for podiatric foot and ankle surgeons. I do not believe an orthopedic surgeon needs to complete a fellowship to boost these numbers prior to obtaining surgical privileges at a hospital to perform foot/ankle surgery, I can be wrong. I have attached the link below

https://www.acgme.org/globalassets/pfassets/programresources/260_ors_case_log_minimum_numbers.pdf

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Dr. Aronow in response to Dr. Gambardella:

I have a few comments in response to Dr. Gambardella's email:

1. The link provided is to a 2014 ACGME document
2. The current CPME standard used for podiatric foot and ankle surgeons (https://www.cpme.org/files/CPME/2022-4_CPME_320.pdf) requires 0 ankle fracture fixation surgeries, and a TOTAL OF 0 MIDFOOT/HINDFOOT/ANKLE ARTHRODESIS PROCEDURES, which I do not consider to be exceptionally more than a ***minimum*** of 15 and 5, respectively.
3. This process specifically addresses tibial pilon fractures, total ankle replacement, and amputations of the entire foot. Isolated malleolar/ non pilon ankle fractures and ankle arthrodesis are already in the scope of practice for podiatrists that meet the requirements in CT statute Chapter 375 section 20-54(c). Midfoot and hindfoot arthrodesis are in the scope of practice of all podiatrists licensed in Connecticut.

a. This is why at the last Thursday's meeting we requested that the CPMA provide the Committee with the total number of a) tibial pilon fractures; b) total ankle replacements; and c) amputations of the entire foot that each podiatric resident during the past 5-10 years at the three CT podiatry residencies performed during their 3 year residency. The data should distinguish between first and differentiating between first and second assist cases, which the surgical case logs each resident is required to maintain should contain.

    i. Levels of Resident Activity for Each Logged Procedure

        1. First assistant: The resident participates actively in the procedure under direct supervision of the attending.

4. Second assistant: The resident participates in the procedure. Participation may include retracting and assisting, or performing limited portions of the procedure under direct supervision of the attending.

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Racial, Socioeconomic, and Payer Status Disparities in Utilization of Total Ankle Arthroplasty Compared to Ankle Arthrodesis

Jessica Schmerler, BS[1], Suraj A. Dhanjani, MD[2], Alyssa Wenzel, MD[2], Shyam J. Kurian, MD[2], Umasuthan Srikumaran, MD, MBA, MPH[2], James R. Ficke, MD[2]

[1] *The Johns Hopkins University School of Medicine, Baltimore, MD*
[2] *Department of Orthopaedic Surgery, The Johns Hopkins University School of Medicine, Baltimore, MD*

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Level of Clinical Evidence: 3

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ankle osteoarthritis surgeries
insurance disparities
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ABSTRACT

Total ankle arthroplasty is increasingly being used for the treatment of ankle osteoarthritis when compared to arthrodesis. However, there has been limited investigation into disparities in utilization of these comparable procedures. This study examined racial/ethnic, socioeconomic, and payer status disparities in the likelihood of undergoing total ankle arthroplasty compared with ankle arthrodesis. Patients with a diagnosis of ankle osteoarthritis from 2006 through 2019 were identified in the National Inpatient Sample, then subclassified as undergoing total ankle arthroplasty or arthrodesis. Multivariable logistic regression models, adjusted for hospital location, primary or secondary osteoarthritis diagnosis, and patient characteristics (age, sex, infection, and Elixhauser comorbidities), were used to examine the effect of race/ethnicity, socioeconomic status, and payer status on the likelihood of undergoing total ankle arthroplasty versus arthrodesis. Black and Asian patients were 34% and 41% less likely than White patients to undergo total ankle arthroplasty rather than arthrodesis ($p < .001$). Patients in income quartiles 3 and 4 were 22% and 32% more likely, respectively, than patients in quartile 1 to undergo total ankle arthroplasty rather than arthrodesis ($p = .001$ and $p = .01$, respectively). In patients <65 years of age, privately insured and Medicare patients were 84% and 37% more likely, respectively, than Medicaid patients to undergo total ankle arthroplasty rather than arthrodesis ($p < .001$). Racial/ethnic, socioeconomic, and payer status disparities exist in the likelihood of undergoing total ankle arthroplasty versus arthrodesis for ankle osteoarthritis. More work is needed to establish drivers of these disparities and identify targets for intervention, including improvements in parity in relative procedure utilization.

Ankle osteoarthritis (OA) is a disabling condition, with a quality-of-life impact similar to that of hip arthritis (1). Surgical management is an important strategy, particularly given the lack of evidence regarding the efficacy of nonoperative management (2). Total ankle arthroplasty (TAA) has emerged over the past 2 decades as an alternative to ankle arthrodesis for surgical treatment of ankle OA (3). Although the majority of TAA components through the early 2000s were removed from the market due to high complication and failure rates (4), TAA use has been on the rise in the past 20 years, especially compared with arthrodesis (5,6). Several meta-analyses comparing TAA and ankle arthrodesis have demonstrated similar outcomes for the 2 procedures (7-9), and head-to-head prospective trials also have shown similar efficacy (10). Surgeons' selection of a surgical management approach may therefore be driven by a variety of external factors beyond the relative efficacy of either procedure, and thus it is important to investigate whether any disparities exist in relative utilization of the 2 procedures.

To date, there has been little investigation into potential racial/ethnic, socioeconomic, or payer status disparities in utilization of the procedures. One study demonstrated that Black patients were less likely than White patients to undergo TAA and that this disparity increased significantly between 1998 and 2011 (11). However, the study did not compare TAA with arthrodesis, nor did it isolate patients by ankle OA diagnosis. Another study examined the use of TAA compared with arthrodesis in patients with ankle OA, but it focused solely on disparities in payer status, establishing that patients with Medicaid were less

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Conflict of Interest: Dr. Srikumaran has held leadership positions with AAOS, ASES, and IASES and consultant/advisory roles with Fx Shoulder, Orthofix, and Tigon Medical; has been a stock owner with Quantum OPS, ROM3, Sonogen, and Tigon Medical; has received research funding from Arthrex, Depuy/Syntheses, Smith & Nephew, Wright Medical, ASES, and Omega; has provided expert testimony for Fx Shoulder; and has received other compensation from Arthrex, Depuy, Stryker, Wright Medical, and royalties/licenses from Tigon Medical and Thieme. Dr. Ficke has held a leadership position with OREF and has received research funding from the Department of Defense.

Address correspondence to: James R. Ficke, MD, Department of Orthopaedic Surgery, The Johns Hopkins University, 601 N Caroline St, 5th Floor, Baltimore, MD 21287.

E-mail address: jficke1@jhmi.edu (J.R. Ficke).

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likely than patients with Medicare or private insurance to undergo TAA (12). The 2002 Institute of Medicine report *Unequal Treatment* drew attention to racial disparities in health care (13), and more recently, the Affordable Care Act and the Health and Human Services (HHS) Action Plan to Reduce Racial and Ethnic Health Disparities have targeted these disparities. Some of the goals of the HHS Disparities Action Plan include promoting expansion of Medicaid, providing blueprints for health systems to implement culturally appropriate services, creating the Community Transformation Grants Program to fund community-level prevention programs, and increasing availability and use of data on health disparities (14). Examining utilization of TAA and arthrodesis may uncover disparities not only in patient access but also in surgeons' adoption of newer or more expensive treatment options, which may be indicative of the success or lack thereof of these recent policies.

To our knowledge, no studies have examined racial/ethnic or socioeconomic disparities in patient utilization of TAA compared with ankle arthrodesis. We hypothesize that significant disparities exist, and thus we seek to fill this gap in the literature. In addition, to expand on the literature examining disparities by payer status, we examine a wider time period than previously studied and control for a broad index of comorbidities that may contribute to the disparities previously reported. Elucidating such disparities may shed light on their underlying drivers, including subjectivity in relative procedure utilization, and help to identify targets for intervention and further investigation.

Patients/Materials and Methods

This study was exempt from institutional review board approval.

Data Source and Study Population

Using the National Inpatient Sample (NIS) maintained by the Healthcare Cost and Utilization Project, we identified patients using International Classification of Diseases, Ninth Revision (ICD-9) and Tenth Revision (ICD-10), diagnosis and procedure codes for the period January 2006 to December 2019. Patients ages 50 years and older with a diagnosis of primary or secondary ankle OA (ICD-9: 715.17, 715.27, 715.37, or 715.97; ICD-10: M19.07, M19.17, or M19.27) were included and then subcategorized as having undergone either a TAA (ICD-9: 81.56; ICD-10: 0SRF0J or 0SRG0J) or ankle arthrodesis (ICD-9: 81.11; ICD-10: 0SGF or 0SGG). A cut-off age of 50 years old was selected because age under 50 years traditionally has been considered a contraindication for TAA, and studies are still ongoing into the use of TAA in patients younger than 50 (15,16). Patients with a diagnosis of peripheral neuropathy or a history of Charcot neuropathy were excluded, as these patients are also often not considered candidates for TAA.

Variables of Interest

Outcomes of Interest. Our primary outcome was likelihood of TAA compared with arthrodesis by race/ethnicity, socioeconomic status, and payer status. Payer status disparities were examined only in patients ages under age 65, because patients over 65 years old predominantly have Medicare coverage. Races/ethnicities analyzed were White, Black, Hispanic, Asian and Pacific Islander, Native American, and other. Socioeconomic status was defined using the proxy of quartile classification (income quartile 1 [Q1], the lowest, through income quartile 4 [Q4], the highest) of the estimated median household income of residents in the patient's zip code (Supplementary Table 1). Payer statuses analyzed were Medicare, Medicaid, private insurance, and self-pay.

Covariates. Age, sex, hospital region, and diagnosis (primary or secondary OA) were included as covariates. Each of the 31 individual comorbidities included in the Elixhauser Comorbidity Index (ECI) was identified using the Elixhauser Stata package. Elixhauser comorbidities that were significantly different ($p < .05$) between the TAA and arthrodesis cohorts, as well as the specific diagnosis of infection, were included as covariates (Supplementary Table 2). Hospital regions analyzed were Northeast, Midwest, South, and West. Only patients for whom data on all covariates and primary outcome measures were available were included in the analysis.

Statistical Analysis

We analyzed demographic data and independent variables using chi-square tests for categorical variables and *t*-tests for continuous variables. We then developed multivariable logistic regression models to examine the effects of each independent variable on the odds ratio (OR) of TAA to arthrodesis. Each model controlled for all other independent variables as well as the covariates listed previously.

Data were analyzed using Stata Statistical Software: Release 17; 2021 (StataCorp; College Station, TX). A p value of <.05 was considered statistically significant.

Results

Patient Characteristics

Table 1 presents the characteristics of patients undergoing TAA and arthrodesis. There were 6362 patients who underwent TAA and 4289 patients who underwent arthrodesis over the study period. Female patients made up 45.4% of patients who underwent TAA and 47.1% of patients who underwent arthrodesis (p = .08). Patients who underwent TAA were significantly older than patients who underwent arthrodesis (66.6 ± 8.4 vs 65.1 ± 8.9, $p < .001$).

Disparities in Odds of TAA Compared With Ankle Arthrodesis

The likelihood of undergoing TAA versus arthrodesis varied significantly by patient race/ethnicity, income quartile, and payer status ($p <$ .001 for all) and by primary versus secondary ankle OA diagnosis ($p <$ .001). Table 2 presents the full results of outcome modeling by each factor. Black and Asian patients were 34% and 41% less likely, respectively, than White patients to undergo TAA rather than arthrodesis (OR 0.66, CI 0.53-0.83, $p < .001$; OR 0.59, CI 0.40-0.89, p = .01; respectively). Patients in income quartiles Q3 and Q4 were 22% and 32% more likely, respectively, than patients in Q1 to undergo TAA rather than arthrodesis (OR 1.22, CI 1.08-1.38, p = .002; OR 1.32, CI 1.16-1.49, $p < .001$; respectively). Among patients under 65 years of age, patients with

Table 1
Characteristics of patients undergoing total ankle arthroplasty and ankle arthrodesis (N = 10,651 patients)

Parameter	Total Sample	TAA	Ankle Arthrodesis	p Value
N	10,651	6362	4289	
Age (SD)	66.0 (8.6)	66.6 (8.4)	65.1 (8.9)	<.001
Sex (%)				.08
Male	5741 (53.9%)	3473 (54.6%)	2268 (52.9%)	
Female	4910 (46.1%)	2889 (45.4%)	2021 (47.1%)	
Type of OA diagnosis (%)				<.001
Primary OA	4413 (41.4%)	3142 (49.4%)	1271 (29.6%)	
Secondary OA	6238 (58.6%)	3220 (50.6%)	3.018 (70.4%)	
Race/ethnicity (%)				<.001
White	9476 (89.0%)	5743 (90.3%)	3733 (87.0%)	
Black	366 (3.5%)	160 (2.5%)	217 (5.1%)	
Hispanic	375 (3.5%)	202 (3.2%)	173 (4.0%)	
Asian and Pacific Islander	107 (1.0%)	55 (0.9%)	52 (1.2%)	
Native American	36 (0.3%)	19 (0.3%)	17 (0.4%)	
Other	280 (2.6%)	183 (2.9%)	97 (2.3%)	
Socioeconomic status (%)				<.001
Income Q1	2076 (29.5%)	1138 (17.9%)	938 (21.9%)	
Income Q2	2797 (26.3%)	1630 (25.6%)	1167 (27.2%)	
Income Q3	2900 (27.2%)	1769 (27.8%)	1131 (26.4%)	
Income Q4	2878 (27.0%)	1825 (28.7%)	1053 (24.6%)	
Payer status (%)*				<.001
Medicare	802 (17.4%)	379 (15.1%)	423 (20.2%)	
Medicaid	339 (7.4%)	132 (5.3%)	207 (9.9%)	
Private	3120 (67.8%)	1835 (73.1%)	1285 (61.5%)	
Self-pay	39 (0.9%)	14 (0.6%)	25 (1.2%)	
No charge	†	†	†	
Other	298 (6.5%)	151 (6.0%)	147 (7.0%)	
Hospital region (%)				<.001
Northeast	1865 (17.5%)	973 (15.3%)	892 (20.8%)	
Midwest	2552 (24.0%)	1601 (25.2%)	951 (22.2%)	
South	3500 (32.9%)	2081 (32.7%)	1419 (33.1%)	
West	2734 (25.7%)	1707 (26.8%)	1027 (23.9%)	

Abbreviations: OA, osteoarthritis; SD, standard deviation; TAA, total ankle arthroplasty.
* Only patients age <65 were included in the payer status analysis.
† Cells with values ≤10 and their corresponding rows are not reported in order to avoid deidentification of National Inpatient Sample data.

Table 2
Odds of total ankle arthroplasty versus arthrodesis by primary variable of interest (N = 10,651 patients)

Variable of Interest	Odds Ratio	95% Confidence Interval	*p* Value
Race/ethnicity			
Black	0.66	0.53-0.83	<.001
Hispanic	0.85	0.68-1.06	.15
Asian and Pacific Islander	0.59	0.40-0.89	.01
Native American	0.89	0.50-1.77	.75
Other	1.29	0.995-1.68	.05
White*	-	-	-
Socioeconomic status			
Income Q2	1.10	0.97-1.24	.15
Income Q3	1.22	1.08-1.38	.002
Income Q4	1.32	1.16-1.49	<.001
Income Q1*	-	-	-
Payer status†			
Medicare	1.37	1.04-1.81	.03
Private insurance	1.84	1.43-2.37	<.001
Self-pay	0.93	0.45-1.92	.85
No charge‡	-		
Other	1.41	1.01-1.97	.04
Medicaid*	-	-	-
Hospital region			
Midwest	1.62	1.42-1.84	<.001
South	1.50	1.33-1.70	<.001
West	1.54	1.35-1.75	<.001
Northeast*	-	-	-
Sex			
Female	1.00	0.92-1.09	.93
Male*	-	-	-
OA diagnosis			
Primary OA	2.41	2.21-2.63	<.001
Secondary OA†	-	-	-

Abbreviation: OA, osteoarthritis.
* Reference groups.
† Only patients age <65 were included in the payer status analysis.
‡ Analysis was not reported for variables that had values of ≤10 in either subgroup in order to avoid deidentification of National Inpatient Sample data.

private insurance and patients with Medicare were 84% and 37% more likely, respectively, than patients with Medicaid to undergo TAA rather than arthrodesis (OR 1.84, CI 1.43-2.37, $p < .001$; OR 1.37, CI 1.04-1.81, $p = .03$; respectively).

Discussion

Disparities in utilization and outcomes of different orthopedic procedures have been well documented, and the results of this study add evidence that disparities exist in the likelihood of undergoing TAA versus arthrodesis. These results expand on those of studies that have examined TAA alone, providing evidence of racial/ethnic, socioeconomic, and payer status disparities among patients that reflect disparities in relative utilization of 2 procedures with comparable efficacy.

Racial/Ethnic Disparities

In this study, Black patients were significantly less likely than White patients to undergo TAA rather than arthrodesis. These results are in line with the literature regarding TAA utilization. Singh et al. (11), for example, showed that the rate of TAA among Black patients was 2-fold lower than among White patients in 1998 and 4-fold lower in 2011. One potential explanation for this disparity could be that the hospitals where minority patients receive care do not offer total ankle replacements. Reddy et al. (3) showed that TAA is more likely to be performed at large teaching hospitals, with propensity to perform TAA correlating with surgical volume. Non-White patients have been shown to be more likely to receive care at low-volume hospitals (17), and this may contribute to the difference in utilization of TAA compared to arthrodesis identified in this study.

Numerous studies have shown racial disparities in the utilization of total joint arthroplasties (TJAs) (18-21). For example, studies have estimated that Black patients are anywhere from 13% to 53% less likely than White patients to undergo primary total knee arthroplasty (22-28) and anywhere from 43% to 56% less likely to undergo primary total hip arthroplasty (22,27,29). Disparities in the use of TJAs have been shown to persist despite policies such as the Affordable Care Act and the Health and Human Services Action Plan and initiatives such as the Healthy People 2020 Initiative (30). These policies and initiatives have promoted expanded access to insurance and care, community-level patient health education programs, and data utilization and monitoring, all of which may have the potential to drive a reduction in disparities in specialty fields such as orthopedic surgery. The results of our study, however, provide additional evidence of an area in which disparities persist and highlight the need for further improvement.

Socioeconomic Disparities

Disparities were also observed in the use of TAA compared with arthrodesis based on socioeconomic status. Although no previous studies have investigated this relationship, studies have shown that decreased median household income is associated with lower preoperative patient-reported outcome measures before TJA (31). TAA is typically the treatment of choice over arthrodesis for patients with greater preoperative range of motion who seek to maintain their mobility (32). Similarly, although recent evidence has demonstrated that TAA is a viable option in the case of moderate to severe deformity in ankle OA, studies in the mid-2000s showed a higher rate of complications and poor clinical outcomes for TAA in these patients, leading to recommendations against TAA in coronal plane deformity exceeding 15° (33). Although the present study controlled for comorbidities, it is possible that patients from lower income quartiles are seen later in the course of ankle OA and therefore have lower preoperative mobility or a higher degree of deformity, increasing the likelihood of a recommendation for arthrodesis over TAA. Furthermore, obesity has been associated with worse outcomes after TAA, and at least one study has recommended consideration of obesity status in the choice between TAA and arthrodesis (34). Although obesity is one of the ECI comorbidities controlled for in this study, prior literature has shown that ICD codes for BMI are markedly underutilized (35,36). Lower socioeconomic status has been shown to be associated with increased rates of obesity (37,38), and it is possible that BMI could be a mediating factor in the relationship between socioeconomic status and use of TAA versus arthrodesis. Patients from lower income quartiles may also be more likely to be employed in fields that involve heavy physical labor, which might be considered a relative contraindication to TAA (39). Thus, occupation may also be a mediating factor in the relationship between socioeconomic status and utilization of TAA vs. arthrodesis. Finally, surgeon experience has been shown to impact TAA outcomes (40,41), which may limit the number of surgeons who are willing to perform the procedure. Although this study controlled for geographic location broadly, the disparity in utilization of the 2 procedures may be attributed to local-level differences in access to surgeons experienced with, and thus willing to perform, TAA.

Payer Status Disparities

Patients under 65 years of age with private insurance or Medicare were significantly more likely than patients with Medicaid to undergo TAA rather than arthrodesis. Studies have previously shown that, compared with patients with private insurance or Medicare, patients with Medicaid have limited access to care and consultation for TAA as well as longer wait times for appointments (42). This disparity in wait times was significantly reduced for patients undergoing total hip arthroplasty and total knee arthroplasty in states that expanded Medicaid under the Affordable Care Act (43). However, although this disparity may contribute to a lower likelihood of surgical management, it may not sufficiently explain the difference in utilization of 2 comparable surgical procedures after access to care has been established.

The finding that patients with Medicare or private insurance are more likely than patients with Medicaid to undergo TAA rather than arthrodesis is in line with current literature. Heckmann et al. (12) demonstrated that patients with Medicare and private insurance were approximately 3 times more likely than patients with Medicaid to undergo TAA rather than arthrodesis. Given that TAA has been established as not only non-inferior but also a cost-effective alternative to arthrodesis (44,45), clinical decision-making regarding which procedure to use should be in the hands of the treating orthopedic surgeon. However, because the difference in cost between TAA and arthrodesis is substantial and Medicaid typically reimburses less than Medicare or private insurance, hospitals and orthopedic surgeons may still be incentivized to provide the less costly procedure. As a result, patients with Medicaid may be limited in their access to orthopedic foot and ankle surgeons at hospitals where TAA is offered rather than arthrodesis. Further work to investigate the underlying cause of the disparity by payer status and to identify areas for intervention is critical.

Although this study provides compelling evidence of disparities in utilization of TAA compared with arthrodesis using a large nationally representative sample, the results must be viewed in light of several limitations. As this study is a retrospective analysis, the claims put forth may only be interpreted in terms of association, not causality. Additionally, although NIS is frequently checked for quality, the data are entered by human coders, which introduces a potential source of error. The analysis conducted in this study was also limited to the variables included in the NIS. There may be other variables, such as patient BMI, patient occupation, and degree of hard labor, severity of OA, and surgeon experience, that contribute to the disparities observed. Similarly, NIS classifies race and ethnicity together, rather than separately, so patients who identify as Hispanic are classified primarily as such, regardless of race. This may have introduced bias into our results, as both White and non-White patients may have been included in the Hispanic category. NIS also only includes patients who underwent procedures in an inpatient setting; thus, patients who underwent TAA or arthrodesis in an outpatient setting were not included in the analysis. Finally, the data analyzed in NIS were drawn from the period 2006 to 2019, across the conversion from ICD-9 to ICD-10 codes, and the use of different sets of codes to identify patients in different years could have introduced error.

In conclusion, significant disparities by race/ethnicity, socioeconomic status, and payer status were noted among patients in the likelihood of undergoing TAA compared with arthrodesis from 2006 through 2019. All patients included in the analysis had a diagnosis of ankle OA, and the multivariate models controlled for many, although not all, comorbidities and other confounding variables that may contribute to these disparities. In addition, the disparities existed despite the implementation of various policies and recommendations aimed at reducing disparities, as well as evidence for the clinical equivalence of the more novel procedure, TAA, with the traditional standard of care, arthrodesis. These results may be driven by a number of external factors such as degree of deformity and occupation, which could not be explored through this analysis but which may influence disparities in the procedures recommended by orthopedic surgeons. More work is thus needed to understand the drivers of and reduce these disparities and to promote parity in the use of different surgical procedures for the treatment of ankle OA.

IRB Statement

This study was exempt from institutional review board approval.

Supplementary Materials

Supplementary material associated with this article can be found in the online version at https://doi.org/10.1053/j.jfas.2023.08.004.

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Original Research

Impact of Insurance and Practice Type on Access to Orthopaedic Sports Medicine

Weilong Shi,* MD, Albert Anastasio,* MD, Ndeye F. Guisse,* BS, Razan Faraj,* BS, Omolola P. Fakunle,* BS, Kirk Easley,* MS, MApStat, and Kyle E. Hammond,*† MD

Investigation performed at Emory University, Atlanta, Georgia, USA

Background: The Patient Protection Affordable Care Act has expanded Medicaid eligibility in recent years. However, the provisions of the act have not translated to improved Medicaid payments for specialists such as orthopaedic surgeons. The number of health care practitioners who accept Medicaid is already decreasing, with low reimbursement rates being cited as the primary reason for the trend.

Hypothesis: Private practice orthopaedic groups will see patients with Medicaid or Medicare at lower rates than academic orthopaedic practices, and business days until appointment availability will be higher for patients with Medicaid and Medicare than those with private insurance.

Study Design: Cross-sectional study.

Methods: Researchers made calls to 2 regular-sized orthopaedic practices, 1 small orthopaedic practice, and 1 academic orthopaedic practice in each of the 50 states in the United States. Callers described a scenario of a recent injury resulting in a bucket-handle meniscal tear and an anterior cruciate ligament tear seen on magnetic resonance imaging at an outside emergency department. For a total of 194 practices, 3 separate telephone calls were made, each with a different insurance type. Data regarding insurance acceptance and business days until appointment were tabulated. Student *t* tests or analysis of variance for continuous data and χ^2 or Fisher exact tests for categorical data were utilized.

Results: After completing 582 telephone calls, it was determined that 31.4% (n = 59) did not accept Medicaid, compared with 2.2% (n = 4) not accepting Medicare and 1% (n = 1) not accepting private insurance ($P < .001$). There was no significant association between type of practice and Medicaid refusal ($P = 0.12$). Mean business days until appointment for Medicaid, Medicare, and private insurance were 5.3, 4.1, and 2.9, respectively ($P < .001$).

Conclusions: Access to care remains a significant burden for the Medicaid population, given a rate of Medicaid refusal of 32.2% across regular-sized orthopaedic practices. If Medicaid is accepted, time until appointment was significantly longer when compared with private insurance.

Keywords: knee; ACL; meniscus; epidemiology; insurance; Medicaid

Socioeconomic factors have always been an important part of many fields of medicine. Studies[1,14,22,32] have repeatedly shown that low socioeconomic status is a risk factor for everything from trauma to chronic kidney disease and diabetes. Patients with lower socioeconomic status face higher mortality rates when compared with those with higher socioeconomic status.[12]

Patients with Medicaid were found to have high infection and complication rates after spine surgery.[15,25] Medicaid patients also have a high 30-day readmission rate in orthopaedics.[6]

The Patient Protection Affordable Care Act (PPACA) has expanded Medicaid eligibility in recent years.[18] However, the provisions of the act that improved Medicaid payments for primary care physicians have not translated to improved Medicaid payments for specialists such as orthopaedic surgeons.[18] This is unfortunate in a time when the number of Medicaid-accepting health care practitioners is already decreasing, with low reimbursement rates being cited as the primary reason for the trend.[10,16,28] In a study

†Address correspondence to Kyle E. Hammond, MD, 1968 Hawks Lane, Atlanta, GA 30329, USA (email: kyle.hammond@emory.edu) (Twitter: @kylehammondmd).

*Emory University, Atlanta, Georgia, USA.

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by Kim et al,[20] it was shown that Medicaid patients could schedule an appointment only 20% of the time compared with 89% for Medicare and 97% for Blue Cross Blue Shield. Patients with Medicaid had similar difficulties in getting an appointment for knee arthroplasty, and when they did obtain an appointment, they had longer waiting periods compared with those covered by Medicare or private insurance.[18] Medicaid patients were found to need more referrals and have longer waiting periods in addition to fewer successful appointments for foot and ankle care when compared with Medicare and private insurance patients.[19] Finally, while this study was completed before the PPACA, it was found that children with Medicaid insurance had limited access or no access to orthopaedic care in 38% of offices nationwide.[30] They reported a statistically significant relationship between access to care for Medicaid patients and physician reimbursement rates.[30]

Common sports injuries, including those to the anterior cruciate ligament (ACL), have a better outcome when diagnosed and treated early. Patients with ACL injuries that have been delayed for more than 6 months have an increased medial meniscal tear rate.[4] In addition, early ACL reconstruction results in decreased knee instability episodes and better long-term results than delayed reconstruction.[11]

Bucket-handle meniscal tears are another common injury in sports and can be seen combined with ACL tears. These particular meniscal tears result in significant patient disability because of symptoms such as locking and catching.[31] Sood et al[31] found that noninsured patients experienced delay to surgery for their bucket-handle meniscal tears. They also found that bucket-handle meniscal tears have a decreased rate of repairability as time from injury increased. Owing to the urgency for immediate treatment of certain sports injuries, access to care is very important for better long-term outcomes. The purpose of this study was to explore Medicaid patients' access to sports medicine orthopaedic care after the passing of the PPACA.

METHODS

We organized a nationwide survey of orthopaedic sports providers by searching for 4 offices with board-certified orthopaedic sports surgeons from each state. The search criteria "Orthopedic Sports Surgeon (State)" was used in Google Maps. A list of available practices was generated and subsequently randomized in Microsoft Excel. After randomization, the first 2 regular-sized orthopaedic practices, the first small orthopaedic practice, and the first academic orthopaedic practice in each of all 50 states from the United States were chosen to be included in the survey. A small orthopaedic practice was defined as a physician group of $\leq$3 physicians. A regular-sized practice was defined as a physician group of $\geq$4 physicians. An academic practice was defined as an orthopaedic practice attached to a medical university. In certain states, such as Alaska and North Dakota, no academic orthopaedic sports program exists, and so an academic practice was not included from these states. If a clinic was unable to be contacted, then the next office in the list that was congruent with the particular type of practice was called.

Researchers made telephone calls to these practices describing a scenario of a recent soccer injury resulting in an "ACL tear with a bucket-handle meniscal tear" seen on magnetic resonance imaging (MRI) at an outside emergency department and were ordered by the outside emergency department to follow-up with an orthopaedic sports surgeon. If asked about their symptoms, callers were to reply that symptoms were progressing. If asked about imaging, callers were to reply that the MRI was obtained and available on a disk. Three separate telephone calls with 3 separate patient scenarios were made, 1 researcher claiming to be a patient having Medicaid, 1 claiming to have Medicare, and 1 claiming to have a form of private insurance. The private insurance was chosen as the largest private insurance provider in that particular state. Each researcher attempted to schedule an appointment, given their chosen form of insurance. If a patient concluded the call with a scheduled appointment, the caller was instructed to cancel the appointment in a later call so as to not interfere with the office scheduling system. If an appointment was refused, this was documented. Moreover, data were separated into Medicaid expansion states and non-Medicaid expansion states.[17]

The generalized estimating equation approach introduced by Liang and Zeger[23] was used to analyze the insurance denial outcome and the business days until appointment outcome. This approach helps model the correlation among the 3 telephone calls made by the same researcher at each orthopaedic practice. Uni- and multivariable analyses were performed.

The analysis for the insurance denial outcome was implemented using the SAS GENMOD procedure (Version 9.4; SAS Institute) with an exchangeable correlation structure for the repeated telephone calls within researcher (binomial-logit model). The statistical model provided estimates of the percentages of practices that denied insurance (plus 95% CIs) for 2 predictors (type of insurance and type of orthopaedic practice). The model-based estimates were unbiased with unbalanced and missing data, as long as the missing data were noninformative (missing completely at random). The multivariable analysis simultaneously included the 2 predictors in the model. The outcome "business days until appointment" was also analyzed with the generalized estimation equation approach with an exchangeable correlation structure for the repeated telephone calls within researcher (normal distribution model). The statistical model provided estimates of mean business days until appointment (plus 95% CIs) for the 2 predictors.

RESULTS

A total of 194 practices were called, and each practice was assessed regarding whether they accepted Medicaid, Medicare, and private insurance, for a total of 582 calls. Private insurance had the highest acceptance rate of 99.5%, followed by 97.8% acceptance by Medicare and 68.6%

TABLE 1
Statistics by Type of Insurance

	Overall (n = 582)	Type of Insurance			
		Medicaid (n = 194)	Medicare (n = 194)	Private (n = 194)	*P*
Business days until appointment[a]	4.0 ± 5.7	5.3 ± 8.9	4.1 ± 4.3	2.9 ± 2.3	<.001
Accept insurance, n (%)[b]					
No	64/562 (11.4)	59/188 (31.4)	4/186 (2.2)	1/188 (0.5)	<.001
Yes	498/562 (88.6)	129/188 (68.6)	182/186 (97.8)	187/188 (99.5)	

[a]Data are reported as mean ± SD business days until appointment.
[b]Several practices (n = 20) could not be reached despite repeat telephone calls and were therefore not included in the analysis.

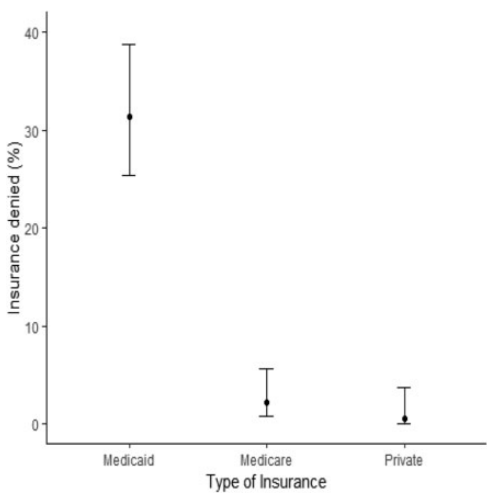

Figure 1. Percentage of insurance denial by type of insurance (N = 194 orthopaedic sports medicine practices). Error bars indicate CIs.

acceptance by Medicaid (Table 1, Figure 1). There was a significant difference in rejection for Medicaid patients compared with Medicare and private insurance patients ($P < .001$; Table 1). In addition, private insurance had the quickest turnaround regarding business days until the appointment at 2.9 days, followed by 4.1 days for Medicare and 5.3 days for Medicaid (Table 1) ($P < .001$). Academic practices accepted a significantly higher overall percentage of patients regardless of insurance (92.1%; $P < .001$), but also had the longest wait until the appointment (5.8 business days; $P = .001$) (Table 2). Last, in Medicaid expansion states, there was a similar percentage of Medicaid-accepted patients (65.5% in no expansion, 69.2% in expanded states; $P = .61$), along with a similar wait time to the appointment (5.2 days vs 5.4 days; $P = .88$) (Table 3).

Further analysis shows that academic practices and small practices accepted a similar percentage of Medicaid patients (79% vs 72.9%, respectively) (Table 4). Regular-sized practices accepted a significantly lower amount of Medicaid patients compared with academic practices (61.2% vs 72.9%, respectively; $P = .02$) (Table 4). When looking at patients with Medicaid or private insurance, there was no statistically significant difference in the percentage of practices from each practice type that accepted these patients (Tables 5 and 6).

DISCUSSION

Access to care in orthopaedics, especially after the PPACA, has been a popular topic of discussion in orthopaedic research.[13,18,29] This study sought to examine access to orthopaedic care for urgent sports medicine patients based on the insurance they possessed. In the literature, there was a similar study published in 2017 looking at access to care based on insurance.[34] They found a similar result in that Medicaid patients had a harder time getting an appointment along with long wait times until an appointment.[34] In addition, they found that the Medicaid expansion versus nonexpanded states did not have any significant difference in access to care.[34]

Multiple other studies[2,21,26] have looked at access to care for orthopaedics among other subspecialties. A previous study[35] showed that Medicaid patients with operative ankle fractures had similar difficulty scheduling an appointment. In addition, there was also no difference between Medicaid expansion and nonexpanded states.[35] In a similar study conducted with regard to access to orthopaedic spine surgeons, patients with Medicare were unable to book appointments.[29]

Studies have shown that patients with low socioeconomic status have a negative disparity in their health.[7,27] The purpose of Medicaid is to provide low-income patients with insurance,[33] and while expanding Medicaid may provide some patients with insurance that they would otherwise lack, it fails to grant them equal access to care when compared to patients with other insurance types. Our study showed that fewer orthopaedic practices will schedule an appointment for a patient with Medicaid insurance and meniscal and ACL tears in comparison with the same patient with Medicare or private insurance, which suggests that patients with Medicaid may have to go through more trouble to get an appointment. While academic institutes accepted Medicaid patients more frequently, they also had the longest wait before the appointment. This study adds further data to the current literature that the Medicaid expansion certainly improved access to care for the previously uninsured but may not have equalized that access

TABLE 2
Statistics by Type of Practice

	Overall (n = 582)	Type of Practice: Small (n = 150)	Regular (n = 300)	Academic (n = 132)	*P*
Business days until appointment[a]	4.0 ± 5.7	4.1 ± 6.5	3.3 ± 3.9	5.8 ± 7.6	.001
Accept insurance, n (%)[b]					
No	64/562 (11.4)	13/143 (9.1)	41/293 (14)	10/126 (7.9)	.12
Yes	498/562 (88.6)	130/143 (90.9)	252/293 (86)	116/126 (92.1)	

[a]Data are reported as mean ± SD business days until appointment.
[b]Several practices could not be reached despite repeat telephone calls and were therefore not included in the analysis.

TABLE 3
Descriptive Statistics by Medicaid Expansion

	Overall (N = 194)	Medicaid Expansion[a]: No (n = 55)	Yes (n = 136)	*P*
Business days until appointment[b]	5.3 ± 8.9	5.2 ± 9.5	5.4 ± 8.9	.88
Accept insurance, n (%)[c]				
No	59/188 (31.4)	19/55 (34.5)	40/130 (30.8)	.61
Yes	129/188 (68.6)	36/55 (65.5)	90/130 (69.2)	

[a]Status unknown for n = 3.
[b]Data are reported as mean ± SD business days until appointment.
[c]Several practices could not be reached despite repeat telephone calls and were therefore not included in the analysis.

TABLE 4
Descriptive Statistics by Type of Practice for Medicaid Insurance

Accept Medicaid, n (%)[a]	Overall (N = 194)	Type of Practice: Small (n = 50)	Regular (n = 100)	Academic (n = 44)
No	59/188 (31.4)	13/48 (27.1)	38/98 (38.8)	8/42 (19)
Yes	129/188 (68.6)	35/48 (72.9)	60/98 (61.2)	34/42 (81)

[a]*P* (χ^2 test) = .05.

TABLE 5
Descriptive Statistics by Type of Practice for Medicare Insurance

Accept Medicare, n (%)[a]	Overall (N = 194)	Type of Practice: Small (n = 50)	Regular (n = 100)	Academic (n = 44)
No	4/186 (2.2)	0/47 (0)	3/97 (3.1)	1/42 (2.4)
Yes	182/186 (97.8)	47/47 (100)	94/97 (96.9)	41/42 (97.6)

[a]*P* (χ^2 test) = .48.

among different insurance types, showing that socioeconomically disadvantaged populations still have a ways to go.

Given documented delays in the first appointment scheduling date for patients indicating Medicaid payer status, our study raises the question as to whether delays in appointment time have a significant clinical effect. Without doubt, delay in treatment time affects clinical outcomes, particularly with regard to ACL injuries.[3,11] Early operative intervention, as defined by Dunn et al[11] as surgery within 6 weeks of injury, faired variably with regard to reduction in knee instability and a hastened return to preinjury activity level. Our study demonstrated a mean time of 5.3 days to appointment for patients with Medicaid and a mean time of 2.9 days to appointment for patients with

TABLE 6
Descriptive Statistics by Type of Practice for Private Insurance

		Type of Practice		
Accept private insurance, n (%)[a]	Overall (N = 194)	Small (n = 50)	Regular (n = 100)	Academic (n = 44)
No	1/188 (0.5)	0/48 (0)	0/98 (0)	1/42 (2.4)
Yes	187/188 (99.5)	48/48 (100)	98/98 (100)	41/42 (97.6)

[a] P (χ^2 test) = .17.

private practice insurance options, representing a mean difference of 2.4 days. Although unlikely that a time difference of 2-3 days will have clinical significance, additional research is needed to ascertain whether this difference of several days in time to evaluation would ultimately negatively affect clinical outcome. While this time difference may represent only a minor clinically relevant statistic, our study did not evaluate downstream delays to operative intervention in patients reporting Medicaid payer status. It is reasonable to assume that delays would not be limited to only time of initial appointment, but also to time of reconstructive procedure as well as time to access postoperative adjuncts such as physical therapy. This would require additional research, as our study did not focus on any future delays in care.

The results of this study necessitate discussion regarding why private orthopaedic sports medicine practices generally prefer patients with private insurance payer status rather than patients with Medicaid payer status. Without doubt, Medicaid reimbursement rates for common orthopaedic surgical procedures are not consistent across state lines.[8] Rates can be as low as 20.6% of Medicare reimbursement rates.[8] In an economic environment where maintaining a privately functioning orthopaedic surgical practice is becoming increasingly difficult,[24] perhaps surgeons are reticent to take a financial risk, given the inconsistency in Medicaid payments. Our study demonstrates higher acceptance rates of Medicaid payer status in smaller orthopaedic surgical practices, with 72.9% of these practices accepting patients with Medicaid versus 61.2% of regular-sized orthopaedic groups. These data may indicate that smaller practices may be struggling for a market share, lacking the ability for widespread marketing and a larger network of referrals; thus, there may be more willingness to accept any insurance type. If this trend negatively affects their reimbursements, then they may be forced out of the market. On the other hand, increasing malpractice litigation[9] against orthopaedic surgeons over the past 3 decades has caused rising malpractice insurance costs, which may be burdensome to smaller-sized practices. A general perception that patients with Medicaid status will be more likely to pursue malpractice lawsuits exists.[5] However, this idea is not borne out in the available literature, with documented rates of litigation being identical across insurance payer statuses.[5]

There are some limitations to this study. First, an academic center was not able to be reached in all states. Second, there is a similar study on access to orthopaedic sports medicine surgeons.[34] However, the current study expands on some very important categories. This study compares different types of practices. In addition, we also have surveyed the entire country comparing Medicaid expansion and nonexpansion states. These subcategories help to counsel patients with Medicaid about which type of practice is most likely to accept their insurance.

CONCLUSION

This study investigated access to an orthopaedic sports medicine surgeon based on the patient's insurance and type of orthopaedic practice. The results of this study support the investigator's hypothesis that there is still a significant barrier to orthopaedic care for Medicaid patients with ACL injuries. This manifests most prominently as refusal of care because of insurance type. Though academic institutions more readily accept Medicaid patients, the disparity should alert orthopaedic surgeons to the barriers that still remain after Medicaid expansion.

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Podiatry Residency Resource

Surgical Procedure Summary Report

Kim, Jae Yoon (PGY-3)	
Category :	Digital Surgery, First Ray Surgery, Other Osseous Foot Surgery, Other Soft Tissue Foot Surgery, Reconstructive Rearfoot/Ankle Surgery
Attending :	Babu, Nina DPM, Choung, Daniel DPM, Graham, Jonathan DPM, Jordan, Thomas DPM, Kernbach, Klaus DPM, Lin, David , Lopez, Kenneth DPM, Mallon, Zachary MD, Omlin, Ninveh DPM, Paterno, Ronald DPM, Peace, Ruth DPM, Pulido, Elizabeth DPM, Schule, Steven MD, Seibert, Steven DPM, Sellenriek, Steven DPM, Williams, Gray DPM, Willson, Camilla DPM, Willson, Kyle DPM, Yee, Theodore MD
Institution:	Kaiser Hospital Santa Rosa, Kaiser Hospital-San Rafael, Kaiser Permanente Medical Center - Vallejo, CA
Date Range :	07/01/2021-11/16/2023

Procedure	2nd	1st	Total 1st+2nd
11 - Partial Ostectomy/Exostectomy	2	3	5
110 - Management of Bone/Joint Infection	1	0	1
111 - Open Management of Digital Fracture/Dislocation	1	1	2
113 - Other Osseous Digital Procedure Not Listed Above	1	0	1
12 - Phalangectomy	0	1	1
13 - Arthroplasty (Interphalangeal Joint [IPJ])	21	46	67
16 - Phalangeal Osteotomy	0	1	1
17 - Fusion (IPJ)	11	20	31
18 - Amputation	8	75	83
211 - Bunionectomy (partial ostectomy/Silver procedure), with or without capsulotendon balancing procedure	0	1	1

2110 - Bunionectomy double correction with osteotomy and/or arthrodesis	2	1	3
213 - Bunionectomy with Phalangeal Osteotomy	0	5	5
214 - Bunionectomy with Distal First Metatarsal Osteotomy	2	22	24
216 - Bunionectomy with First Metatarsocuneiform Fusion	14	24	38
217 - Metatarsophalangeal Joint (MPJ) Fusion	10	19	29
219 - MPJ Arthroplasty	1	0	1
221 - Cheilectomy	2	12	14
226 - MPJ Fusion	9	12	21
228 - MPJ Arthroplasty	0	2	2
2310 - Other First Ray Procedure Not Listed Above	1	1	2
232 - Osteotomy (e.g., Dorsiflexory)	1	3	4
233 - Metatarsocuneiform Fusion (Other Than For Hallux Valgus or Hallux Limitus)	3	1	4
234 - Amputation	1	16	17
236 - Management of Bone/Joint Infection (With or Without Bone Graft)	1	0	1
239 - Revision/Repair of Surgical Outcome (e.g., non-union, hallux varus)	0	5	5
31 - Excision of Ossicle/Sesamoid	0	4	4
310 - Excision of soft tissue tumor/mass (without reconstructive surgery: includes foot, ankle or leg)	10	29	39
312 - Plastic Surgery Techniques (Including Skin Graft, Skin Plasty, Flaps, Syndactylization, Desyndactylization, and Debulking Procedures Limited to The Forefoot)	1	8	9

314 - Other Soft Tissue Procedures not Listed Above (Limited to The Foot)	1	0	1
316 - External neurolysis/decompression(including tarsal tunnel)	0	3	3
317 - Decompression of compartment syndrome (includes foot or leg)	0	1	1
32 - Excision of Neuroma	4	5	9
33 - Removal of Deep Foreign Body (Excluding Hardware Removal)	1	7	8
34 - Plantar Fasciotomy	1	3	4
36 - Tendon Repair, Lengthening, or Transfer Involving the Forefoot (Including Digital Flexor Digitorum Longus Transfer)	12	9	21
38 - Incision and drainage/wide debridement of soft tissue infection(includes foot, ankle or leg)	4	48	52
39 - Plantar fasciectomy/plantar fibroma resection	0	4	4
41 - Partial Ostectomy (including the talus and calcaneus) (includes foot, ankle or leg)	6	11	17
410 - Amputation (Lesser Ray, Transmetatarsal Amputation)	2	43	45
412 - Management of Bone Tumor/Neoplasm Distal to The Tarsometatarsal Joints (With or Without Bone Graft)	2	1	3
413 - Open Management of Tarsometatarsal Fracture/Dislocation	0	1	1
415 - Tarsometatarsal Fusion	6	5	11
418 - Other Osseous Procedures Not Listed Above (Distal to the Tarsometatarsal Joint)	1	0	1
419 - Detachment/Reattachment of Achilles Tendon with Partial Ostectomy	3	8	11
42 - Lesser MPJ Arthroplasty	0	1	1
43 - Bunionectomy of The Fifth Metatarsal Without Osteotomy	0	1	1

44 - Metatarsal Head Resection (Single or Multiple)	3	9	12
46 - Central Metatarsal Osteotomy	7	6	13
47 - Bunionectomy of The Fifth Metatarsal With Osteotomy	0	10	10
48 - Open Management of Lesser Metatarsal Fracture(s)	0	3	3
49 - Harvesting of bone graft (includes foot, ankle or leg)	1	4	5
511 - Plastic Surgery Techniques Involving The Midfoot, Rearfoot, or Ankle	0	1	1
512 - Tendon Transfer Involving the Midfoot, Rearfoot, Ankle, or Leg	3	3	6
513 - Tendon Lengthening Involving The Midfoot, Rearfoot, Ankle, or Leg	2	13	15
515 - Delayed Primary or Secondary Repair of Ligamentous Structures	7	2	9
516 - Tendon Augmentation/Supplementation/Restoration	5	7	12
519 - Other elective rearfoot reconstructive/ankle soft tissue surgery not listed above	2	0	2
521 - Operative Arthroscopy	6	1	7
521 - Operative Arthroscopy Without Removal of Loose Body or Other Osteochondral Debridement	1	0	1
5210 - Corticotomy or Osteotomy With Callus Distraction/Correction of Complex Deformity of The Midfoot, Rearfoot, Ankle, or Tibia	1	1	2
5211 - Other Elective Rearfoot Reconstructive/Ankle Osseous Surgery not Listed Above	1	0	1
523 - Subtalar Arthroeresis	1	0	1
524 - Midfoot, Rearfoot, or Ankle Fusion	17	11	28
525 - Midfoot, Rearfoot, or Tibial Osteotomy	2	4	6

528 - Ankle Arthrotomy/Arthroscopy with Removal of Loose Body or Other Osteochondral Debridement	2	4	6
529 - Ankle Implant	15	16	31
531 - Repair of Acute Tendon Injury	2	3	5
532 - Repair of Acute Ligament Injury	0	1	1
534 - Excision of soft tissue tumor/mass of the foot, ankle or leg (with reconstructive surgery)	1	0	1
537 - Other Non-Elective Rearfoot Reconstructive/Ankle Soft Tissue Surgery not Listed Above	1	0	1
542 - Open Repair of Adult Rearfoot Fracture	2	10	12
543 - Open Repair of Adult Ankle Fracture	36	82	118
544 - Open Repair of Pediatric Rearfoot/Ankle Fractures or Dislocations	0	1	1
545 - Management of Bone Tumor/Neoplasm (With or Without Bone Graft)	0	1	1
546 - Management of Bone/Joint Infection (With or Without Bone Graft)	1	5	6
548 - Other Non-elective Rearfoot Reconstructive/Ankle Osseous Surgery not Listed Above	2	0	2
549 - Application of multiplanar external fixation midfoot, rearfoot, ankle (does not include mini or mono rails)	1	3	4
Total Procedures	268	664	932

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The Effect of Insurance Type on Patient Access to Ankle Fracture Care Under the Affordable Care Act

Daniel H Wiznia 1, Mike Wang, Chang-Yeon Kim, Michael P Leslie

Affiliations collapse

Affiliation

1Department of Orthopaedics and Rehabilitation, Yale University School of Medicine, New Haven, CT. daniel.wiznia@yale.edu.

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Abstract

The purpose of this study is to assess the effect of insurance type (Medicaid, Medicare, private insurance) on the ability for patients with operative ankle fractures to access orthopedic traumatologists. The research team called 245 board-certified orthopedic surgeons specializing in orthopedic trauma within 8 representative states. The caller requested an appointment for their fictitious mother in order to be evaluated for an ankle fracture which was previously evaluated by her primary care physician and believed to require surgery. Each office was called 3 times to assess the response for each insurance type. For each call, information was documented regarding whether the patient was able to receive an appointment and the barriers the patient confronted to receive an appointment. Overall, 35.7% of offices scheduled an appointment for a patient with Medicaid, in comparison to 81.4%and 88.6% for Medicare and BlueCross, respectively (P < .0001). Medicaid patients confronted more barriers for receiving appointments. There was no statistically significant difference in access for Medicaid patients in states that had expanded Medicaid eligibility vs states that surgeons and more complex barriers to receiving appointments. A more robust strategy for increasing care-access for patients with Medicaid would be more equitable.

Conflict of interest statementhad not expanded Medicaid. Medicaid reimbursement for open reduction and internal fixation of an ankle fracture did not significantly correlate with appointment success rates or wait times. Despite the passage of the Affordable Care Act, patients with Medicaid have reduced access to orthopedic

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Clinical Research

Musculoskeletal Urgent Care Centers Restrict Access for Patients with Medicaid Insurance Based on Policy and Location

Laurie C. Yousman BS[1], Walter R. Hsiang BS[1], Grace Jin BS[1], Michael Najem BS[1], Alison Mosier-Mills BS[1], Akshay Khunte BS[1], Siddharth Jain BS[1], Howard Forman MD, MBA[2], Daniel H. Wiznia MD[3]

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Abstract

Background As the urgent care landscape evolves, specialized musculoskeletal urgent care centers (MUCCs) are becoming more prevalent. MUCCs have been offered as a convenient, cost-effective option for timely acute orthopaedic care. However, a recent "secret-shopper" study on patient access to MUCCs in Connecticut demonstrated that patients with Medicaid had limited access to these orthopaedic-specific urgent care centers. To investigate how generalizable these regional findings are to the United States, we conducted a nationwide secret-shopper study of MUCCs to identify determinants of patient access.

Questions/purposes (1) What proportion of MUCCs in the United States provide access for patients with Medicaid insurance? (2) What factors are associated with MUCCs providing access for patients with Medicaid insurance? (3) What barriers exist for patients seeking care at MUCCs?

Methods An online search of all MUCCs across the United States was conducted in this cross-sectional study. Three separate search modalities were used to gather a complete list. Of the 565 identified, 558 were contacted by phone with investigators posing over the telephone as simulated patients seeking treatment for a sprained ankle. Thirty-nine percent (216 of 558) of centers were located in the South, 13% (71 of 558) in the West, 25% (138 of 558) in the Midwest, and 24% (133 of 558) in New England. This study was given an exemption waiver by our institution's IRB. MUCCs were contacted using a standardized script to assess acceptance of Medicaid insurance and identify barriers to care. Question 1 was answered through determining the percentage of MUCCs that accepted Medicaid insurance. Question 2 considered whether there was an association between Medicaid acceptance and factors such as Medicaid physician reimbursements or MUCC center type. Question 3 sought to characterize the prevalence of any other means of limiting access for Medicaid patients, including requiring a referral for a visit and disallowing continuity of care at that MUCC.

Results Of the MUCCs contacted, 58% (323 of 558) accepted Medicaid insurance. In 16 states, the proportion of MUCCs that accepted Medicaid was equal to or less than 50%. In 22 states, all MUCCs surveyed accepted Medicaid insurance. Academic-affiliated MUCCs accepted Medicaid patients at a higher proportion than centers owned by private practices (odds ratio 14 [95% CI 4.2 to 44]; $p < 0.001$). States with higher Medicaid physician

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Ethical approval for this study was waived by the Yale University Institutional Review Board.

[1]Yale School of Medicine, New Haven, CT, USA

[2]Department of Radiology, Yale School of Medicine, New Haven, CT, USA

[3]Department of Orthopaedics and Rehabilitation, Yale School of Medicine, New Haven, CT, USA

D. Wiznia ✉, Department of Orthopaedics and Rehabilitation, Yale University School of Medicine, 800 Howard Avenue, New Haven, CT 06520, USA, Email: daniel.wiznia@yale.edu

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reimbursements saw proportional increases in the percentage of MUCCs that accepted Medicaid insurance under multivariable analysis (OR 36 [95% CI 14 to 99]; $p < 0.001$). Barriers to care for Medicaid patients characterized included location restriction and primary care physician referral requirements.

Conclusion It is clear that musculoskeletal urgent care at these centers is inaccessible to a large segment of the Medicaid-insured population. This inaccessibility seems to be related to state Medicaid physician fee schedules and a center's affiliation with a private orthopaedic practice, indicating how underlying financial pressures influence private practice policies. Ultimately, the refusal of Medicaid by MUCCs may lead to disparities in which patients with private insurance are cared for at MUCCs, while those with Medicaid may experience delays in care. Going forward, there are three main options to tackle this issue: increasing Medicaid physician reimbursement to provide a financial incentive, establishing stricter standards for MUCCs to operate at the state level, or streamlining administration to reduce costs overall. Further research will be necessary to evaluate which policy intervention will be most effective.

Level of Evidence Level II, prognostic study.

Introduction

Because it is challenging to access musculoskeletal care [19] from overcrowded emergency departments [14, 15], an increasing number of patients are turning to musculoskeletal-specific urgent care centers (MUCCs) for accessible, affordable care. Treatment at MUCCs has many benefits, such as decreasing emergency department overcrowding, providing more cost-effective care, and offering patients shorter wait times for care [2, 5, 15, 16, 21, 25]. In addition, MUCCs have an advantage over general-purpose UCCs, as they are staffed by dedicated orthopaedic providers, allowing for expedited access to specialty musculoskeletal care [2].

The existing studies on Medicaid acceptance at UCCs either focus only on general-care urgent care centers or have an extremely limited geographic scope [10, 26]. In a 2018 study of MUCCs in Connecticut, the authors found that there were policies in place designed to limit the proportion of patients with Medicaid insurance. All 29 MUCCs in Connecticut were owned by private practices. Of these MUCCs, 66% did not accept any form of Medicaid insurance, and 21% had a variety of barriers in place including location restrictions and referral out after the initial visit to reduce the number of patients with Medicaid who would receive treatment [26]. Although centers may not outright refuse to care for patients with Medicaid, refusing to accept Medicaid insurance and requiring cash payment is likely to act as a significant barrier to care [22]. This may have been a function of the relatively low Medicaid physician reimbursement in Connecticut. According to an industry whitepaper from the Urgent Care Association, on average, 400 to 500 new UCCs open each year, with numbers swelling from 6400 in 2014 to 8774 UCCs in 2018. Additionally, the whitepaper predicts a continued rise in specialty UCCs, in particular, MUCCs [23]. Given the overall low proportion of Medicaid acceptance by MUCCs in Connecticut and the expanding presence of MUCCs nationally, it is important to investigate patient access to MUCCs on a national level to identify the variables associated with Medicaid acceptance based on state-level policies, including Medicaid reimbursements.

Therefore, we comprehensively surveyed all MUCCs across all 50 states and asked: (1) What proportion of MUCCs in the United States provide access for patients with Medicaid insurance? (2) What factors are associated with MUCCs providing access for patients with Medicaid insurance? (3) What barriers exist for patients seeking care at MUCCs?

Materials and Methods

Our cross-sectional study used a secret-shopper methodology, as set out in previous studies [10, 13, 26], to evaluate access to MUCCs. Our study population included all MUCCs in the 50 states of the United States, located using Google Maps [6], Solv Health [20], and the Urgent Care Association's Find an Urgent Care Database [24]. Three separate search modalities were used to maximize MUCCs identified and gather a complete list. The search terms "MSK," "musculoskeletal," or "orthopedic" with "walk-in clinic" or "urgent care center" were used. We included any MUCC self-labeled as such a facility. To be considered an MUCC, we required that the center have its own website, share a website with a medical or surgical practice, or have a unique location marker on Google Maps. We excluded general UCCs and orthopaedic clinic offices. We included MUCCs that were co-located with a clinic office. We identified 565 MUCCs across the United States that met these criteria. In June 2019, the authors called each center following a standardized script (Fig. 1). Responses were obtained from 558 of the 565 MUCCs.

Investigators posed as fictitious patients seeking a consultation for a sprained ankle. The primary outcome measure was the acceptance of Medicaid insurance. Investigators inquired about acceptance of both state-run and managed care organization Medicaid plans such as Centene, Amerigroup, or WellCare. Managed care organization acceptance was determined by comparing plans named using the Kaiser Family Foundation's list of Medicaid managed care organization plans [11].

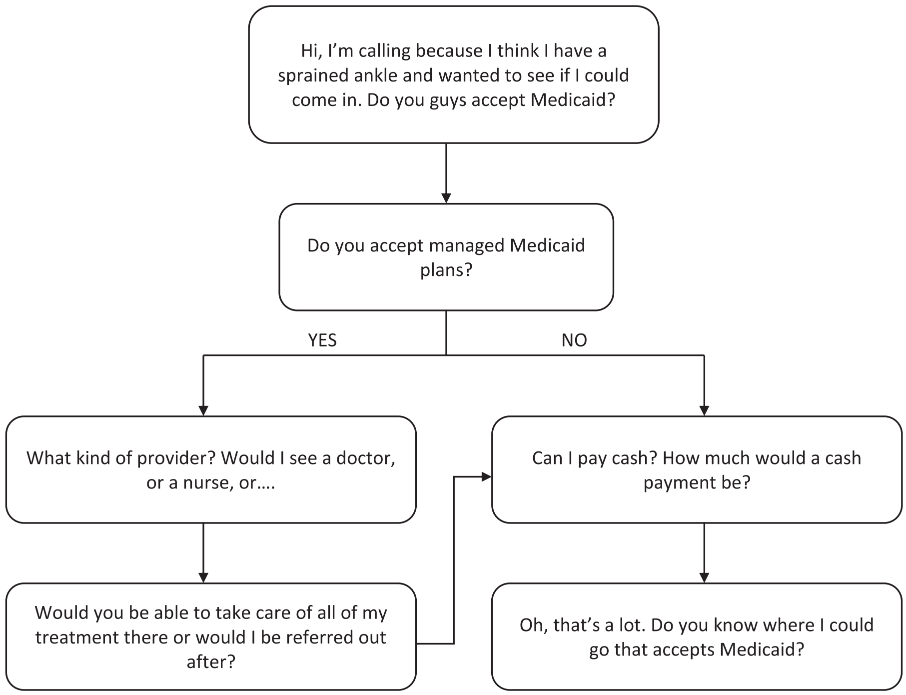

Fig. 1 The call script used by researchers when contacting MUCCs.

Secondary outcomes included barriers to care. At the conclusion of each call, no appointments were confirmed to avoid inconveniencing providers.

Individual MUCCs were classified into three categories: 6% (31 of 558) were nonaffiliated, defined as an MUCC with no connection to a hospital or practice; 86% (479 of 558) were extension, defined as an MUCC affiliated with an independent private practice or with a nonacademic health system; and 9% (48 of 558) were academic, defined as an MUCC associated with a teaching hospital. Classifications were chosen based on organizations having similar business models and patterns of behavior within each group. Geographic region of MUCCs was characterized as well, with 39% (216 of 558) of centers located in the South, 13% (71 of 558) in the West, 25% (138 of 558) in the Midwest, and 24% (133 of 558) in New England. Demographic information including Joint Commission Accreditation status, Urgent Care Association Accreditation Status, total patient population in the MUCC's ZIP code, and ZIP code median household income were collected for each MUCC. MUCCs were located in ZIP codes with an average median household income of USD 72,200. State Medicaid expansion status was determined using the Kaiser Family Foundation's Status of State Action page [12]. State median income and the proportion of the state population that was uninsured were determined from United States Census data. Medicaid physician reimbursements for a Level III new patient were obtained from individual states' Medicaid website physician fee schedules.

Primary and Secondary Study Outcomes

Our primary study goal was to characterize the acceptance of Medicaid at MUCCs and variables related to acceptance of Medicaid. To achieve this, we calculated the proportion of MUCCs in the United States that provide access for patients with Medicaid insurance. Access was defined as acceptance of Medicaid insurance. This was done by assessing the Medicaid acceptance policies of all MUCCs characterized via a secret-shopper phone survey. To further our investigation, we examined the factors that are associated with MUCCs providing access for patients with Medicaid insurance. We combined our results from this phone survey with center-specific and state-level information, including center classification and state Medicaid physician reimbursements. These data on MUCC characteristics collected outside of the phone survey were then analyzed for potential relationships with Medicaid acceptance.

Our secondary study goal was to identify any other barriers to care for Medicaid patients at MUCCs. To achieve this, we investigated the barriers that exist for patients seeking care at MUCCs. This was assessed through the secret-shopper phone survey. In addition to general

Table 1. Characteristics of individual centers (n = 558)

Characteristic	Population parameter
Overall Medicaid acceptance	58 (323)
Classification of center	
Independent	6 (31)
Extension of hospital or physician practice	86 (479)
Academic	9 (48)
Population per UCC ZIP code	33,315 ± 14,001
Household median income per UCC ZIP code in USD	72,200 ± 27,844

Data presented as % (n) or mean ± SD.

acceptance of Medicaid, MUCCs were also questioned about any other stipulations related to treatment of patients with Medicaid insurance. Barriers anticipated included geographic restriction on Medicaid acceptance and mandatory referrals limiting care.

Ethical Approval

Our study design was reviewed and received an institutional review board exemption waiver by the Yale University Institutional Review Board.

Statistical Analysis

Statistical analysis was conducted using JMP Pro 13. We performed univariable and multivariable regressions to evaluate the association of center demographics with the acceptance of Medicaid insurance. We explored factors like state Medicaid expansion status, the proportion of state on Medicaid, physician reimbursement, and center classification in a univariable model, and advanced those that were associated with a p value < 0.05 to a multivariable model. For the individual center-level analysis, the following factors were thus advanced and considered in that multivariable model: classification of center, median household income by ZIP code, and population by ZIP code. In the state-level analysis, Medicaid physician reimbursement, the proportion of the state uninsured, and state median income were considered in that multivariable model.

Results

Proportion of MUCCs that Accept Medicaid Insurance

A total of 58% (323 of 558) of the MUCCs accepted Medicaid insurance, either state-run or managed care organization (Table 1). We found that there was substantial variation by state in availability of MUCC access to patients with Medicaid insurance. In 22 states, all MUCCs surveyed accepted Medicaid insurance. However, in 16 states, the proportion of MUCCs accepting Medicaid was at or below 50% (Fig. 2).

Factors Associated with Accepting Medicaid Insurance

We found that a higher proportion of academic-affiliated MUCCs (88% [42 of 48] versus 36% [11 of 31]; odds ratio 14 [95% CI 4.2 to 44]; p < 0.001) accepted patients with Medicaid than did independent centers (Table 2). The individual state Medicaid physician reimbursement (OR 36 [95% CI 14 to 99]; p < 0.001), the proportion of the state's population who were uninsured (OR 0.007 [95% CI 0.002 to 0.021]; p < 0.001), and state median income (OR 0.12 [95% CI 0.05 to 0.30]; p < 0.001) were factors associated with

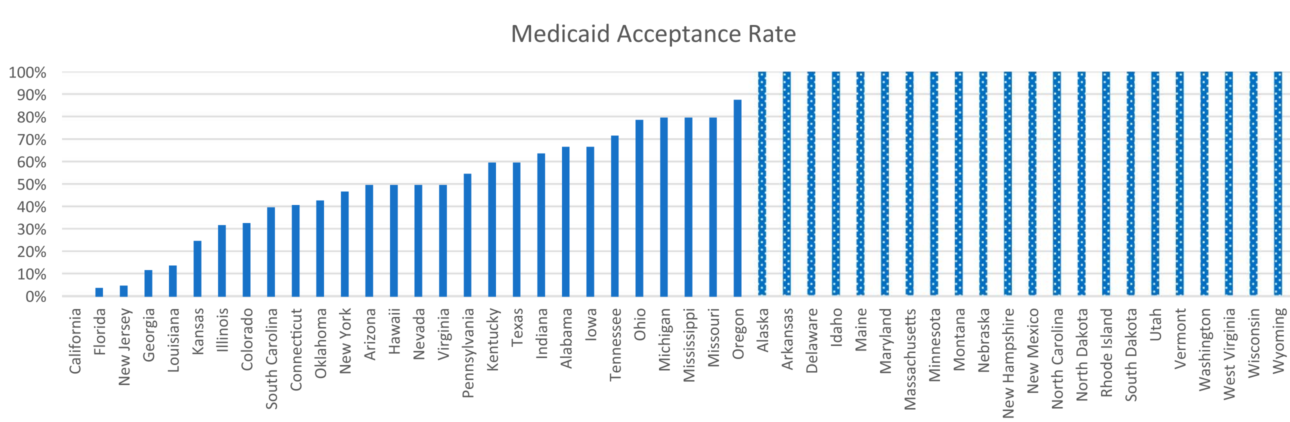

Fig. 2 This graph displays the Medicaid acceptance proportion by state.

Table 2. Variables associated with Medicaid acceptance (individual centers)

Parameter	Medicaid acceptance, % (n)	Multivariable OR/range OR (95% CI)	p value
Classification of center			
Independent (n = 31)	35 (11)	Ref.	
Extension of hospital or physician practice (n = 479)	56 (270)	2.1 (0.9-4.6)	0.08
Academic (n = 48)	88 (42)	14 (4.2-44)	< 0.001
Median household income by ZIP code		0.012 (0.003-0.05)	< 0.001
Population by ZIP code		0.23 (0.07-0.75)	0.01

higher odds of Medicaid acceptance at MUCCs (Table 3). We did not observe a difference in the proportion of Medicaid acceptance between MUCCs located in states that had expanded Medicaid under the Affordable Care Act and MUCCs located in states that did not expand Medicaid (56% [192 of 342] versus 61% [131 of 216]; OR 1.2 [95% CI 0.85 to 1.7]; p = 0.29).

Other Barriers to Access

We identified other barriers, including: 5% (17 of 323) of centers accepted Medicaid but restricted Medicaid coverage based on a patient's location of residence, 27% (88 of 323) required a referral for a patient with Medicaid's initial visit, and 8% (26 of 323) mandated a referral out of the MUCC after the first visit as opposed to continuing care at the MUCC. In some cases, referrals may reflect state-specific legal Medicaid regulations and not an individual clinic decision. Of the MUCCs surveyed, 39% (127 of 323) accepted Medicaid but had one type of barrier in place. One percent (4 of 323) had more than one barrier in place.

Discussion

MUCCs continue to rise in relevance as their numbers grow across the United States [23], with more individuals seeking out shorter wait times and lower costs. However, it has been demonstrated that the urgent care model may disproportionately limit access to care for patients on Medicaid, as indicated by studies with a narrow geographic focus on MUCCs and studies that focused on general UCCs [10, 26]. Our study sought to characterize the phenomenon of disparities in care for Medicaid patients previously characterized in the evidence [1, 7, 13, 18, 27], but specifically regarding Medicaid-insured patients seeking musculoskeletal urgent care. We found that there is large variation in Medicaid acceptance rates across the country, indicating a need for state-specific legislation to tackle disparities in acceptance. Additionally, privately owned centers and centers located in states with low Medicaid physician reimbursement had lower levels of Medicaid acceptance, demonstrating that any policy change must tackle some aspect of MUCCs' profit-driven motivations, whether that be incentivizing them or legislatively tempering them.

Table 3. Variables associated with Medicaid acceptance (state-level data)

Parameter	Multivariable OR/range OR (95% CI)	p value
Reimbursement (bivariate fit)		
	36 (14-99)	< 0.001
Proportion of state uninsured (bivariate fit)		
	0.007 (0.002-0.021)	< 0.001
State median income (bivariate fit)		
	0.12 (0.05-0.30)	< 0.001

Limitations

Our study has several limitations. First, no centralized database of MUCCs exists, so our research team needed to conduct an online search. Although we intended our search to be comprehensive of all MUCCs across the United States, it is possible that some MUCCs were not contacted because of a lack of an identifying presence on the internet. However, we used broad search terms to identify MUCCs to maximize the likelihood of a comprehensive list. Additionally, an individual MUCC's decision to accept Medicaid is a complex choice that ultimately factors in many cost of practice variables, including each state's individual Medicaid policies, liability and malpractice environment, and administrative paperwork burden. Physician reimbursement takes into account cost of practice. However, although we considered reimbursement for part of our analysis, we did not take into account cost of practice. Despite this, in evaluating the very strong association between reimbursement and Medicaid acceptance as well as evaluating the profit-driven motives of an MUCC, there likely are much greater factors that drive the relationship.

Further, there are limitations with regard to variation in rural and urban locations. Functionality of location analysis on the basis of ZIP code is limited, as there is likely a substantial amount of crossover from ZIP codes located close to each other in urban areas with drastically different demographic features. Further, urban areas are more likely to have more options for musculoskeletal care nearby, while those in rural areas may have fewer options and possibly limited to MUCCs. Although the analysis has its limitations, the instances of crossover between ZIP codes is a smaller factor compared with the overall trend of ZIP code demographics.

Additionally, another limitation in our dataset is the sparseness of centers classified as independent or academic compared to those classified as extension of hospital or physician practice. Due to this, the confidence interval of the odds ratio is quite wide, yielding an imprecise estimate of exactly how much more likely an academic center is to accept Medicaid than an independent center. However, while the magnitude of this relationship is not precisely estimated, the overall direction of the relationship is still clear.

Proportion of MUCCs that Accept Medicaid Insurance

We found that there was substantial variation by state in the availability of MUCC access to patients with Medicaid insurance, with an overall proportion of Medicaid acceptance of 58%. In particular, California and Florida had the lowest proportions of Medicaid acceptance, of 0.00% and 0.04%, respectively (Figure 2). This indicates a widespread lack of treatment at MUCCs for a large segment of the Medicaid-insured population. This finding gives a national perspective to a previous regional study that concluded MUCCs in Connecticut decline to treat Medicaid-insured patients [26]. This variation by state suggests that state-level policy changes could be preferred over federal changes, possibly by strengthening regulations and requiring MUCCs to accept Medicaid patients as a prerequisite for state-level licensing. Our findings also contrast with a recent study that characterized the proportion of nonspecialized urgent care center Medicaid acceptance as 79% [10]. Although both general and specialized urgent care center business models are profit-driven, the much lower proportion of MUCCs that accept Medicaid may be explained by some other factor related to their orthopaedic focus. In this instance, urgent care centers providing specialty care seem to be less likely to accept patients with Medicaid than those providing general care.

Factors Associated with Accepting Medicaid Insurance

We found that center classification as academic as opposed to privately owned and higher Medicaid physician reimbursement were associated with an MUCC being more likely to provide access. In fact, 8 of the 10 highest reimbursement states had 100% Medicaid acceptance rates. This finding clearly indicates that MUCCs operate on a profit-driven model and may be motivated to broaden access through financial incentives such as raising reimbursements in states with lower proportions of Medicaid acceptance. This follows a general pattern of increased physician reimbursements correlating with improved access to care by patients with Medicaid. One previous study that evaluated the effect of insurance type on access to knee arthroplasty and revision found that higher Medicaid physician reimbursements were directly correlated with Medicaid patient appointment success for both procedures [13]. Another study found that increases in the Medicaid-to-Medicare reimbursement ratio raises the rates of outpatient physician visits, emergency department use, and prescription fills [4]. Increasing Medicaid physician reimbursements may be a powerful lever to increase patient access to care, especially in profit-driven settings such as MUCCs.

Other Barriers to Access

Even at centers that accept Medicaid-insured patients, Medicaid patients continue to face additional barriers, including residence restrictions, requirement of a referral for the initial treatment, and a referral after the initial visit. Referral requirements specific to Medicaid-insured patients were found across the United States; this is a well-known policy usually enforced by state Medicaid programs to control costs. Because of this referral requirement, patients with Medicaid have more difficulty scheduling appointments with healthcare providers, even though those providers accept their insurance [8, 9]. If state Medicaid programs are seeking to cut down on costs, possible solutions lie in streamlining the overhead required for healthcare administration, as proposed by both reform advocates and government healthcare bureaucrats [3, 17]. For example, an updated Medicaid reimbursement model proposed by the New York State Department of Health could be established for urgent care providers that recognizes the facility as direct, streamlining the reimbursement accounting process by directing reimbursements to the facility as opposed to each individual provider.

Conclusion

Based on the results of our national secret-shopper survey, we found that MUCCs limit access to patients with Medicaid, and the disparity between privately owned and academic MUCCs indicates that financial pressures influence clinic policies. A possible solution lies in adjusting Medicaid physician reimbursements. However, physician reimbursements are just one of many factors that influence practice policy decisions in complex state healthcare economic environments. As privately run MUCCs pursue privately insured patients and place a disproportionate financial burden on academic safety net centers, it may become necessary to require Medicaid acceptance for state licensing to avoid collapse of public and academic hospitals. On an even greater scale, large inefficiencies lie in healthcare administration, hindering budgets for the Medicaid program. Reforms to streamline administration, especially in the relationship between Medicaid and MUCCs, are necessary to free up more dollars for actual patients instead of overhead. Further investigation is needed to determine the effect of reimbursement and state policy on patient access to care at MUCCs.

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