

# Trends in Orthopaedic Foot and Ankle Publications

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## Abstract

**Background:** Scientific publication and original articles remain the primary method of sharing scientific findings and advancing the knowledge base of that subject. Despite the value of these publications, little research has surveyed what topics are being published. This study aims to identify and characterize the most common topics in current foot and ankle literature.

**Methods:** We reviewed all 1514 published articles in a 5.5-year period (January 2014–June 2019) in 2 foot and ankle-specific journals: *Foot & Ankle International (FAI)* and *Foot and Ankle Surgery (FAS)*. The articles were sorted into different topic domains to identify the 3 most common categories of publication. The top 3 domains were further characterized by level of evidence (LOE) as well as citations.

**Results:** The 3 most published topics in foot and ankle literature were hallux valgus (8.3%), total ankle arthroplasty (TAA) (8.3%), and ankle fracture (6.6%). These 3 subjects accounted for 351 articles (23.2%). Other common topics were patient-reported outcomes (5.0%), osteochondritis dissecans (3.9%), syndesmotic injury (3.8%), ankle instability (3.7%), hallux rigidus (3.0%), and anatomy (2.8%). The average LOE for articles on hallux valgus, TAA, and ankle fracture was 3.27 from *FAI*, and the average number of annual citations for a given article in both journals was 3.05. Based on our study, there is no correlation between LOE and number of overall citations, but there is a significant, negative linear correlation in ankle fracture data. We also found that articles on TAA had the highest impact factor and that articles from *FAI* were cited more often than articles from *FAS*.

**Conclusion:** The 3 most published topics in foot and ankle literature comprise only 23.2% of all articles. This finding is indicative of the wide variety of cases performed by orthopaedic foot and ankle surgeons. High-quality data are still needed in all topics.

**Level of Evidence:** Level III, retrospective cohort study.

**Keywords:** hallux valgus, total ankle arthroplasty, ankle fracture

## Introduction

Scientific publication and original articles are the primary means of distributing information and advancing medical knowledge.<sup>15</sup> In all specialties, the sheer quantity of published material is extensive. In 2004, a primary care group looked at the time commitment needed to review all newly published literature within 1 month. Their review showed the time commitment would be almost 630 hours a month.<sup>1</sup> Dr Nate Gross, the cofounder of Doximity, estimated that based on the volume of literature published and his own

experience, “it would take greater than 20 hours of reading each day for the average physician to comb through

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**Table 1.** Distribution of Common Publication Domains Within 2 Major Foot and Ankle Orthopaedic Journals.

	FAI (n=1062)	FAS (n=452)	Total (N=1514)
Hallux valgus	82 (7.7)	44 (9.7)	126 (8.3)
Total ankle arthroplasty	96 (9.0)	29 (6.4)	125 (8.3)
Ankle fracture	73 (6.9)	27 (6.0)	100 (6.6)
Achilles tendon	51 (4.8)	32 (7.1)	83 (5.5)

Abbreviations: FAI, *Foot & Ankle International*; FAS, *Foot and Ankle Surgery*.

everything published in their specialty.”<sup>16</sup> This is in stark contrast to a survey of physicians that revealed that the majority (66%) of physicians read less than 4 hours each week. Despite this difference, in the same survey, 98% of physicians reported that reading literature was very important to their practice.<sup>16</sup>

Within each subspecialty, there is significant variability between the topics that are published. An array of factors contributes to this variability, including the prevalence of that topic, clinical importance, operative frequency, outcomes, and previously published articles. From an editor’s perspective, certain subjects may be referenced more than others, which heightens the journal’s impact factor and increases the probability of articles of that type or subject to be published. There may also be an inherent bias to study and publish the topics most frequently encountered by the readers of that journal to obtain and maintain readership.

Given that physicians have limited time but are expected to stay up to date in their field, a higher number of articles on a few topics may hinder the ability to identify unique articles that address deficiencies in their knowledge base. Recently, several publications have looked at the peer review process and commented on its effect on the quality of publications.<sup>3,7,13</sup> We hypothesize that the most common articles in the orthopaedic foot and ankle literature would pertain to top clinical diagnoses, and research with a higher level of evidence (LOE) would be cited more often.

## Methods

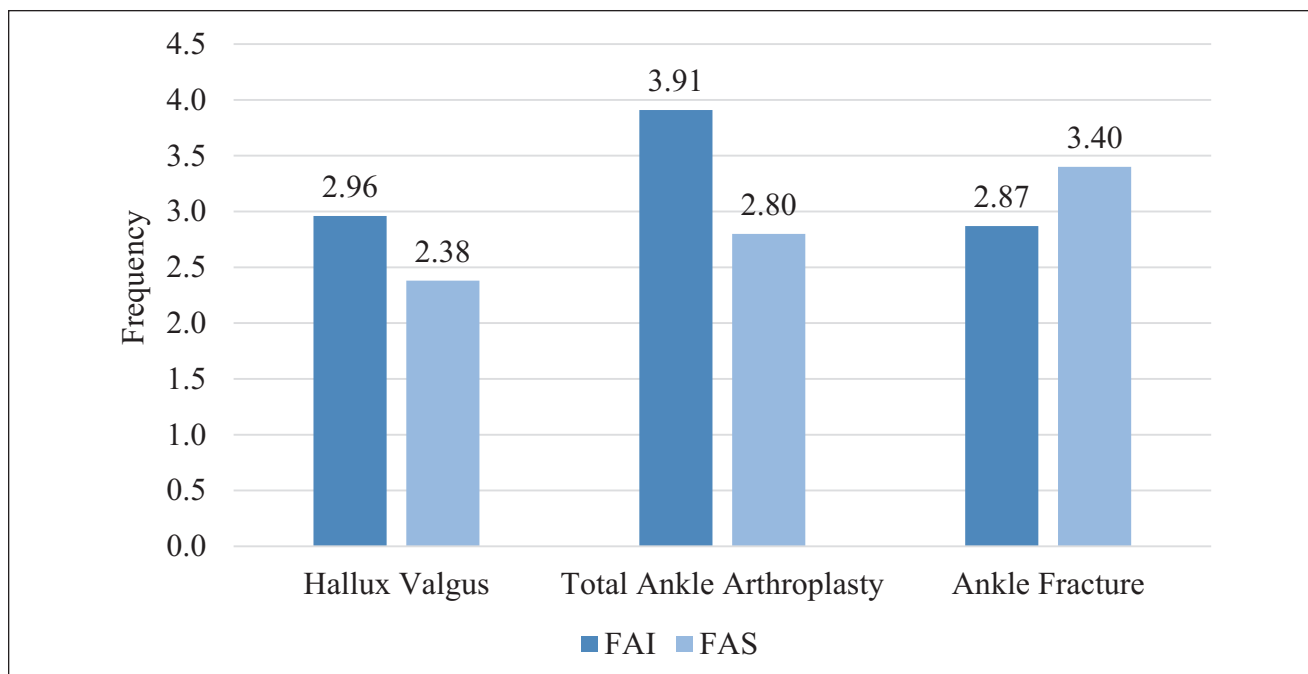
In this investigation, we reviewed all articles published in the past 5.5 years in 2 journals specific to foot and ankle surgery. We observed the most common topic domains in each journal, their LOE, and their citations per year per article in order to understand what topics are most commonly read and cited in orthopaedic foot and ankle journals. To determine which journals to include, we considered the published impact factor of orthopaedic literature. The journals with the 2 highest impact factors that are specific to orthopaedic foot and ankle surgery are *Foot & Ankle International (FAI)* and *Foot and Ankle Surgery (FAS)* with an impact factor of 2.292 and 1.776, respectively. FAI is a well-respected journal from the United States and FAS is an excellent European journal, allowing us to see the trends in articles across continents.

We reviewed all publications from January 2014 to June 2019 in these 2 journals and created common topic domains. After noting the 3 most common topics of publication, we looked specifically at the LOE for these articles. The LOE for articles written in FAI were given in the journal, but the LOE of FAS articles were rarely given. In order to maintain congruency and limit bias, we elected to dismiss the LOE for all articles from FAS in our calculations. Additionally, studies using cadavers and basic science articles were labeled as “not applicable,” and we did not calculate the LOE for these studies in our analysis.

The reference manager Mendeley (Elsevier, Amsterdam, Netherlands) identified the total number of citations for each article. We calculated the average number of citations per year by dividing the total number of citations by the time, in years, since the article’s publication, as of January 7, 2021. We performed statistical analysis using IBM SPSS Statistics for macOS (IBM Corp, Armonk, NY, USA). We used the Shapiro-Wilk test to test the normality of the data, and Spearman correlation to find the correlation between LOE and average citations per year in FAI. A Mann-Whitney *U* test determined the relationship between the average citations per year of the 2 journals. We established the relationship between the average citations per year in the top 3 topic domains of data from both journals using a Kruskal-Wallis test, followed by a Mann-Whitney *U* test.

## Results

A total of 1514 articles spanning 47 topics were published in the 2 journals between January 2014 and June 2019. During this time, the most common foot and ankle subject was hallux valgus, which accounted for 8.3% of all publications, closely followed by total ankle arthroplasty (TAA) (8.3%) and ankle fractures (6.6%). These 3 subjects accounted for 23.2% of the total articles published in both journals. Although articles pertaining to the Achilles tendon were the fourth most common overall (5.5%), they were second most common in FAS (Table 1). Other articles in the top 10 most published topics were in patient-reported outcomes (5.0%), osteochondritis dissecans (3.9%), syndesmotomic injury (3.8%), ankle instability (3.7%), hallux rigidus (3.0%), and anatomy (2.8%). In total, 51% of all articles reviewed were surrounding 10 topics.



**Figure 1.** Annual citation average of the 3 most common publication topics in 2 major foot and ankle orthopaedic journals: *Foot & Ankle International (FAI)* and *Foot and Ankle Surgery (FAS)*.

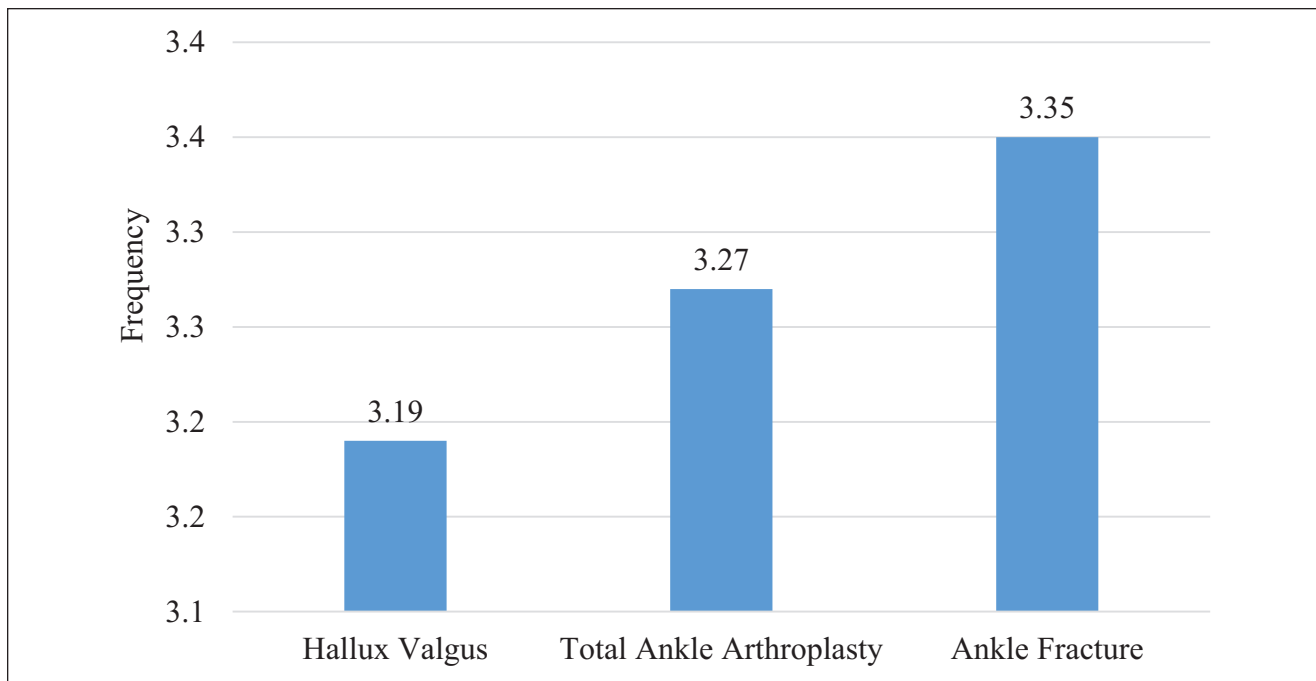
When addressing the average citations per year, we first found a significantly higher mean rank in *FAI* compared to *FAS* ( $P = .030$ ), implying the articles from *FAI* are cited more often than those from *FAS*. This corresponds with the higher impact factor for *FAI* (2.292) compared to the lower impact factor for *FAS* (1.176). The average citations per year was 3.45 in *FAI* compared to an average of 2.98 in *FAS*. The average number of citations per year for the *FAI* articles on hallux valgus, TAA, and ankle fractures was 3.25 (2.96, 3.91, and 2.87, respectively) (Figure 1). The average number of citations per year for the *FAS* articles on hallux valgus, TAA, and ankle fractures was 2.86 (2.38, 2.80, and 3.40, respectively). We then determined there was a significant difference between hallux valgus, TAA, and ankle fracture citations from both journals ( $P < .001$ ). A Mann-Whitney  $U$  test between the hallux valgus–TAA, hallux valgus–ankle fracture, and TAA–ankle fracture data identified that the TAA data had a significantly higher mean citation rank per year than hallux valgus ( $P < .001$ ) and ankle fracture ( $P = .003$ ) data.

The average LOE for articles published in *FAI* on hallux valgus, TAA, and ankle fractures was 3.27 (3.19, 3.27, and 3.35, respectively) (Figure 2). In *FAI*, 1.8% of the articles from the 3 most commonly published topics had an LOE of I, 10.0% had an LOE of II, 43.9% had an LOE of III, 28.5% had an LOE of IV, 4.4% had an LOE of V, and 11.4% had no LOE listed. Based on our analysis, there was no linear correlation between average citations per year and LOE in

*FAI* ( $r_s = -0.132$ ,  $P = .051$ ). However, when looking at the 3 topics individually, ankle fractures showed a statistically significant, negative linear correlation between LOE and average citations per year ( $r_s = -0.278$ ,  $P = .038$ ,  $n = 60$ ). This negative linear correlation indicates that articles with a higher LOE (closer to Level I) were cited more frequently. Of the articles published in *FAI* on hallux valgus, TAA, and ankle fractures, 1.8% had an LOE of I, 10.0% had an LOE of II, and 43.9% had an LOE of III, 28.5% had an LOE of IV, 4.4% had an LOE of V, and 11.4% had no LOE listed.

## Discussion

With such a large quantity of published data, it is difficult for physicians to stay up to date on the latest findings and identify possible gaps in their knowledge. For these reasons, it is important to assess and critically analyze the type and the quality of data being published within each specialty. Recently, Lemme et al<sup>9</sup> looked at the common topics published in hand surgery and noted that the majority (27%) of articles published in a 5-year period were in 3 specific topics. They concluded that this small subset of topics constitutes an outsized proportion of the hand surgery publications.<sup>9</sup> Our study found similar results, with 23.2% of all articles published coming from 3 topics in a 5.5-year time frame. The clinical relevance and economic burden of these 3 topic domains might explain why they are the most commonly published in foot and ankle literature.



**Figure 2.** Level of evidence (LOE) of the 3 most common publication topics in *Foot & Ankle International (FAI)*.

### Background on Commonly Published Domains

Hallux valgus, the most common forefoot disorder, has a high prevalence in adults, affecting 23% of adults between the ages of 18 and 65 years, and its prevalence increases to 36% in adults over the age of 65 years.<sup>5,12,19</sup> Because of its high prevalence, hallux valgus placed an economic burden of \$325 million on the Medicare population in 2011, making it the sixth highest impact on economic burden among foot and ankle procedures for patients with Medicare.<sup>2</sup> Additionally, there is a wide variety of well-known surgical procedures to correct this problem, each with unique advantages and disadvantages. Currently, there is no consensus on when to perform which procedures, and surgeons continue to differ in their treatment algorithms.<sup>19</sup>

TAA procedures are becoming increasingly common as they become a more favorable alternative to arthrodesis. From 2007 to 2013, the frequency of TAA increased from 14% of procedures for ankle arthritis in 2007 to 45% in 2013.<sup>17</sup> Increased understanding of ankle biomechanics as well as improved technology and surgeon experience have resulted in increasingly favorable outcomes for TAA.<sup>17</sup> Further research is essential for this treatment to improve.

Ankle fractures make up 9% of all fractures in adults and account for 20% of all emergency department visits each year.<sup>6</sup> The incidence of ankle fractures is between 174 and 184 cases per 100 000 people per year in the United States.<sup>2</sup> Bimalleolar and trimalleolar fractures together cost \$654.1 million, making them the third most costly foot and ankle injury experienced by the Medicare population in 2011.<sup>2</sup>

Although occurring at a lower rate, Achilles tendon ruptures have been increasing in recent years, and it is the most common tendon rupture in the lower extremity.<sup>4,6,10,14</sup> In 2016, Achilles tendon ruptures were treated at the frequency of 2.5 cases per 100 000 people in the United States.<sup>10</sup> In our literature analysis, Achilles tendon articles were the fourth most common overall, but second most common in *FAS*. As *FAS* is a European journal, this may be associated with a difference in clinical incidence between continents, as one Finnish study found that the occurrence of Achilles rupture was 21.5 cases per 100 000 people in 2011, whereas a study from the United States demonstrated an incidence of 2.1 cases per 100 000 people in 2016.<sup>8,10</sup> Moreover, Achilles tendon injuries may have increased frequency of publication because of the variety of treatment options, emerging technology, and spectrum of disease. Specifically, surgeons continue to differ in opinion regarding operative or conservative treatment for acute tears. Even if surgical management is chosen, additional debate exists over the advantages and disadvantages of percutaneous versus open repair.<sup>11,18</sup>

### Analysis of Commonly Published Domains

In addition to clinical relevance, citation analysis may provide an explanation as to why these domains are the most commonly published topics. Citation analysis is commonly used to calculate the significance of an article by comparing the average number of citations per year for that article to the impact factor of the journal in which the article is published. Articles with higher citations per year than the

journal impact factor have a positive contribution to the journal. The average citations per year in both journals for hallux valgus, TAA, and ankle fracture was 3.05 (2.67, 3.35, and 3.13, respectively) (Figure 2). The impact factor for *FAI* is 2.292 and 1.776 for *FAS*. This implies that these most frequently published topics positively contribute to the journals' impact factor relative to other topics. In addition, we found TAA to have a significantly higher mean rank of average citations per year compared to hallux valgus and ankle fractures, making these articles increasingly favorable for publication for both editors and authors.

Between the 2 journals, this study found that articles published in *FAI* are significantly more likely to be cited than those in *FAS*, but this may be inflated because of the volume of articles published in *FAI*. Accounting for only the 3 most common topic domains of hallux valgus, TAA, and ankle fractures, there were 251 articles in *FAI* vs 100 articles in *FAS*. Although our data support that the articles published in *FAI* are more likely to be cited, this is not proof that readers should prioritize material in *FAI* over other journals, including *FAS*.

The significant, negative linear correlation between the LOE and average citations per year in ankle fracture data from *FAI* shows that the quality of the study in ankle fractures may impact the number of citations it receives. In addition, when analyzing the LOE for all 3 topics, ankle fractures have the highest number LOEs compared to the other topic domains, indicating more studies with Level III and Level IV evidence. It is surprising that LOE did not have a negative correlation on citation rate. This may be due to a very low number of Level I and Level II studies in the orthopaedic literature, given the cost and time required to perform these studies. Though these studies are highly valuable, it is notable that there was no negative correlation between LOE and citation rate in any of the topics examined. Furthermore, studies regarding ankle fractures may be published in other orthopaedic literature, including trauma journals. These other journals may have more Level I and Level II studies for ankle fractures.

Despite the relative frequency of citation and high volume of articles published within these 3 domains, the articles that have been published have overall low quality of evidence, which is seen in *FAI*. The articles of lower quality of evidence may have been published during the emergence of large clinical health care databases, which resulted in a significant increase in orthopaedic publications that use these databases. As these studies are retrospective, they have an LOE of III at best. Therefore, as the use of database studies continues to increase, the average LOE of published studies is likely to decrease. Although health care database studies can yield important knowledge, their increased use may come at the expense of higher quality studies.

## Limitations

There are several limitations present in our study. The first pertains to journal selection, as we only included foot and ankle-specific journals and did not include foot and ankle articles published in other orthopaedic journals that may have a higher impact factor than the journals included in this study. Additionally, although podiatry journals were intentionally excluded from this study in favor of focusing on orthopaedic journals, these publications are considered foot and ankle literature, and their exclusion can be seen as limiting the scope of this study. Third, although the articles from *FAS* are highly regarded, the lack of published LOE limits the conclusions we can draw from this data analysis. Finally, although citation analysis is a widely accepted method for determining an article's impact, it cannot express an article's impact with complete certainty, as some authors may cite an aspect of a study's introduction instead of its methods or findings, which would artificially inflate the number of citations for certain articles.

## Conclusion

In this study focusing on 2 journals of orthopaedic foot and ankle literature, we observed that the top 3 most published topics were on hallux valgus, TAA, and ankle fracture management, which comprised 23.2% of all articles published. Although we did not find any positive correlation between LOE and citation rate of the top 3 topics, we discovered that articles on TAA had the highest impact factor. Authors should consider other new areas of investigation to help build the existing foot and ankle literature.

## Ethical approval

Ethical approval was not sought for the present study because it is not human subjects research.

## Declaration of Conflicting Interests

The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: Daniel Scott, MD, MBA, reports Grants or contracts from Arthrex (\$5000). ICMJE forms for all authors are available online.

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## References

1. Alper BS, Hand JA, Elliott SG, et al. How much effort is needed to keep up with the literature relevant for primary care? *J Med Libr Assoc.* 2004;92(4):429-437.
2. Belatti DA, Phisitkul P. Economic burden of foot and ankle surgery in the US Medicare population. *Foot Ankle Int.* 2014;35(4):334-340. doi: 10.1177/1071100713519777.
3. Callaham M, Wears RL, Weber E. Journal prestige, publication bias, and other characteristics associated with citation of published studies in peer-reviewed journals. *JAMA.* 2002;287(21):2847-2850. doi: 10.1001/jama.287.21.2847.
4. Goost H, Wimmer MD, Barg A, Kabir K, Valderrabano V, Burger C. Fractures of the ankle joint: investigation and treatment options. *Dtsch Arztebl Int.* 2014;111(21):377-388. doi: 10.3238/arztebl.2014.0377.
5. Hannan MT, Menz HB, Jordan JM, Cupples LA, Cheng CH, Hsu YH. High heritability of hallux valgus and lesser toe deformities in adult men and women. *Arthritis Care Res (Hoboken).* 2013;65(9):1515-1521. doi: 10.1002/acr.22040.
6. Herring MM. Surgical treatment of posterior malleolus fractures and posterior fixation. In: Yoon PM, ed. *Techniques in Foot & Ankle Surgery.* Wolters Kluwer Health, Inc; 2018:141-150.
7. Ho RC, Mak KK, Tao R, Lu Y, Day JR, Pan F. Views on the peer review system of biomedical journals: an online survey of academics from high-ranking universities. *BMC Med Res Methodol.* 2013;13:74. doi: 10.1186/1471-2288-13-74.
8. Lantto I, Heikkinen J, Flinkkilä T, Ohtonen P, Leppilahti J. Epidemiology of Achilles tendon ruptures: increasing incidence over a 33-year period. *Scand J Med Sci Sports.* 2015;25(1):e133-e138. doi: 10.1111/sms.12253.
9. Lemme NJ, Johnston BR, Smith BC, Prsic A, Akelman E, Drolet BC. Common topics of publication and levels of evidence in the current hand surgery literature. *J Hand Microsurg.* 2019;11(1):14-17. doi: 10.1055/s-0038-1661423.
10. Lemme NJ, Li NY, DeFroda SF, Kleiner J, Owens BD. Epidemiology of Achilles tendon ruptures in the United States: athletic and nonathletic injuries from 2012 to 2016. *Orthop J Sports Med.* 2018;6(11):2325967118808238. doi: 10.1177/2325967118808238.
11. MacMahon A, Deland JT, Do H, et al. MRI evaluation of Achilles tendon rotation and sural nerve anatomy: implications for percutaneous and limited-open Achilles tendon repair. *Foot Ankle Int.* 2016;37(6):636-643. doi: 10.1177/1071100716628915.
12. Nix S, Smith M, Vicenzino B. Prevalence of hallux valgus in the general population: a systematic review and meta-analysis. *J Foot Ankle Res.* 2010;3:21. doi: 10.1186/1757-1146-3-21.
13. Resnik DB, Elmore SA. Ensuring the quality, fairness, and integrity of journal peer review: a possible role of editors. *Sci Eng Ethics.* 2016;22(1):169-188. doi: 10.1007/s11948-015-9625-5.
14. Shamrock AG, Varacallo M. Achilles Tendon Rupture. *StatPearls.* StatPearls Publishing LLC; 2021.
15. Stross JK, Harlan WR. The dissemination of new medical information. *JAMA.* 1979;241(24):2622-2624. doi:10.1001/jama.1979.03290500030017
16. Survey: how doctors read and what it means to patients. *Business Wire.* July 22, 2014.
17. Vakhshori V, Sabour AF, Alluri RK, Hatch GF, 3rd, Tan EW. Patient and practice trends in total ankle replacement and tibiotalar arthrodesis in the United States from 2007 to 2013. *J Am Acad Orthop Surg.* 2019;27(2):e77-e84. doi: 10.5435/jaaos-d-17-00526.
18. van Maele M, Misselyn D, Metsemakers WJ, Sermon A, Nijs S, Hoekstra H. Is open acute Achilles tendon rupture repair still justified? A single center experience and critical appraisal of the literature. *Injury.* 2018;49(10):1947-1952. doi: 10.1016/j.injury.2018.08.012.
19. Wülker N, Mittag F. The treatment of hallux valgus. *Dtsch Arztebl Int.* 2012;109(49):857-867; quiz 868. doi: 10.3238/arztebl.2012.0857.