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Financial Conflicts of Interest Among Systematic Review Authors Investigating Interventions for Achilles Tendon Ruptures

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Abstract

Background: The primary aim of our study was to evaluate the effects of undisclosed financial conflicts of interest in Achilles tendon rupture repair–focused systematic reviews.

Methods: Following a cross-sectional study design, we searched MEDLINE and Embase for Achilles tendon rupture repair systematic reviews. We performed screening and data extraction in a blind, triplicate fashion. Each systematic review was evaluated on the individual characteristics of the study, presence of undisclosed and disclosed conflicts of interest, favorability of results and conclusions, and the relationship between conflicts of interest and the favorability of results and conclusions.

Results: Our search produced 172 total systematic reviews pertaining to Achilles tendon rupture repair; of those, only 12 were included in our study. Undisclosed conflicts of interest were found in half (6/12) of the included reviews. However, no significant association was found between conflict of interest and the favorability of results and conclusions.

Conclusion: Undisclosed conflicts of interests were discovered in a large percentage of our sample. This lack of disclosure did not appear to increase the likelihood of the systematic review results or conclusions reporting favorability of the intervention being investigated.

Level of Evidence: Level II.

Keywords: Achilles tendon disorders, trauma, statistical analysis

Introduction

Systematic reviews are considered Level I or grade A evidence by the American Academy of Orthopaedic Surgeons (AAOS) and play an important role in both patient care and clinical decision making.[2] These reviews synthesize evidence from multiple randomized controlled trials in order to answer a specific research or clinical question. Ultimately, results from these studies are used to underpin clinical practice guidelines.[2] For example, Ochen et al[25] performed a systematic review and meta-analysis that found operative management of Achilles tendon rupture reduces the risk of rerupture compared to nonoperative management. Another systematic review found no difference in Achilles tendon rerupture rates between percutaneous and open repair; however, percutaneous repair was associated with decreased postoperative infection rates.[15] Thus, treatment for Achilles tendon ruptures is controversial, noted by Humbyrd and Hsu in the AAOS clinical practice guidelines for Achilles tendon

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rupture management.[1] These findings highlight the importance of systematic reviews in synthesizing the available evidence to produce conclusions that help guide clinical decision making. Given the influence of systematic reviews on clinical practice, high reporting standards are needed. One such reporting standard is the assessment of bias.

The presence of bias within systematic reviews can be detrimental to quality research. To combat bias, Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines instruct authors to clarify whether or not they assess the risk of bias and how it may affect the evidence presented in their systematic review.[21] Although adherence to PRISMA guidelines is recommended by many academic journals, bias within systematic reviews still remains underreported.[31] For example, Scott et al[31] assessed the prevalence of publication bias in systematic reviews published in high-impact orthopedic journals and found only one-fourth of the systematic reviews formally assessed publication bias. Similarly, Chess and Gagnier[8] assessed risk of bias in randomized controlled trials (RCTs) within top-rated orthopedic journals and, using Cochrane's risk of bias tool, found that less than 1% of RCTs met all 10 requirements. Given that systematic reviews collate evidence from RCTs, bias within these RCTs hinders the quality of evidence reported in systematic reviews and can lead to misrepresentation of results. Bias can distort a reader's interpretation of systematic reviews; therefore, it is important to recognize factors that can introduce bias, including conflicts of interest (COIs).

Relationships between physicians and industry have become a growing concern in medicine. For example, a systematic review and meta-analysis found that industry compensated physicians gave greater prescribing rates of the paying company's drugs, as well as increased prescribing rates of brand-name drugs compared to their generic counterparts.[6] To protect against patient-physician distrust resulting from COI, AAOS' Code of Ethics and Professionalism instructs surgeons to disclose any financial relationship when reporting on clinical research or experience with a particular procedure.[3] Despite these recommendations, COIs are still prevalent in orthopedic research. For example, Mehlman et al[20] reviewed abstract presentations from annual meetings of the AAOS and found that presentations given by authors with COI related to royalties, stock options, consulting, or employee status were significantly more likely to report positive findings. Checketts et al[7] found that many orthopedic clinical practice guideline authors received "substantial" compensation from industry, and many inaccurately disclosed their COI. Considering the importance of systematic reviews in clinical medicine and the growing concern surrounding COI, we sought to evaluate the prevalence of COI and accuracy of disclosure among systematic review authors for a common orthopedic condition—Achilles tendon ruptures. Our primary objective was to characterize the nature and type of COI (both disclosed and undisclosed) among Achilles tendon rupture systematic review authors and to determine whether results and conclusions from systematic reviews may be influenced by authors with COI.

Methods

Transparency, Reproducibility, and Reporting

This cross-sectional study did not involve human subjects; thus, it did not require institutional review board oversight.[9] Our protocol and study materials were posted on Open Science Framework to enhance the transparency and reproducibility of our results.[14] We referred to the PRISMA and Murad and Wang's guidelines for meta-epidemiologic studies while composing our manuscript.[23,27]

Search Strategy to Obtain Systematic Reviews

To generate a sample of systematic reviews and meta-analyses focusing on the treatment of Achilles tendon rupture, we searched MEDLINE (Ovid) and Embase (Ovid) on June 2, 2020, using the search strategy from a separate study developed by a librarian specializing in systematic reviews.[10] The search strategy is included in Supplemental Material S1. Following the execution of these searches, the resulting records were uploaded to Rayyan, a systematic review platform for title and abstract screening.[29]

Screening

Initial screening was performed for a previous study concerning interventions for Achilles tendon rupture.[10] Screening criteria may be viewed in our online protocol.[14] For the present study, eligibility criteria was further refined. Screening was performed by W.T.C. and C.H. in a masked, duplicate manner based on criteria listed below. Discrepancies were resolved following screening by all members of the screening team.

Eligibility Criteria

Study inclusion was limited to studies that met the PRISMA-P definition of a systematic review or meta-analysis and included a head-to-head comparison of one intervention to another intervention (or combination of interventions), placebo, or standard of care.[22] The review must also have investigated a treatment for Achilles tendon rupture. Finally, the review must have a publication date between September 1, 2016, and June 2, 2020; been published in the English language; and synthesized data from human subjects. The date limitation on our search was made to allow 36 months from the launch of the Open Payments Database, which went live in September 2013. The International Committee of Medical Journal Editors (ICMJE) recommends all financial interests—whether related or unrelated to the study—be disclosed over the previous 36 months from the time of journal submission.[16]

Training

Prior to study commencement, each investigator completed training developed by J.M.A. and M.W. Training modules consisted of thorough explanations of the methodology, objectives, study materials, and data extraction from one example systematic review. Training was recorded and is available online for reference.[14]

Data Extraction

Three investigators W.T.C., C.H., and A.C. performed data extraction in a masked, triplicate fashion using a pilot-tested Google form. The full text of each systematic review or meta-analysis was evaluated for the following general study characteristics: (1) PubMed identification number and/or DOI, (2) name of journal, (3) date of publication, (4) name of author(s), (5) treatment interventions being compared, (6) affiliation(s) for the first and last author, (7) funding source, (8) complete COI statement, (9) whether the systematic review or meta-analysis addressed risk of bias, (10) the verbatim risk of bias statement, (11) whether systematic review author(s) were also an author on 1 or more of the primary studies included in the review, (12) total number of self-cited primary studies, (13) primary outcome or the first outcome included in the systematic review, (14) whether an overall pooled effect estimate was calculated, (15) statistical significance of pooled effect estimate, (16) favorability of pooled effect estimate in regards to the primary outcome, and (17) whether narrative results and conclusions favored the treatment or comparison group (eg, placebo, standard of care, control). "Conclusion" is used to represent the combination of the discussion/conclusion sections of included reviews.

Favorability of Narrative Results and Conclusions

For all systematic reviews, including those with meta-analyses and qualitative systematic reviews, narrative results and conclusions were categorized as favorable, unfavorable, or mixed/inconclusive. With respect to results, "favorable" was assigned when positive results were reported for all study populations without mentioning negative results. Results were categorized as "unfavorable" when only negative results were reported for at least 1 study population. Finally, "mixed/inconclusive" was assigned if both positive and negative results were reported in the narrative. With respect to conclusions, "favorable" was assigned when authors stated or implied the data favored the target intervention. Conclusions were categorized as "unfavorable" when authors stated or implied the conclusions favored the control group. "Mixed/Inconclusive" was assigned when the conclusion met either "favorable" or "unfavorable" categorization (eg, reporting negative population outcome but positive subgroup analysis).

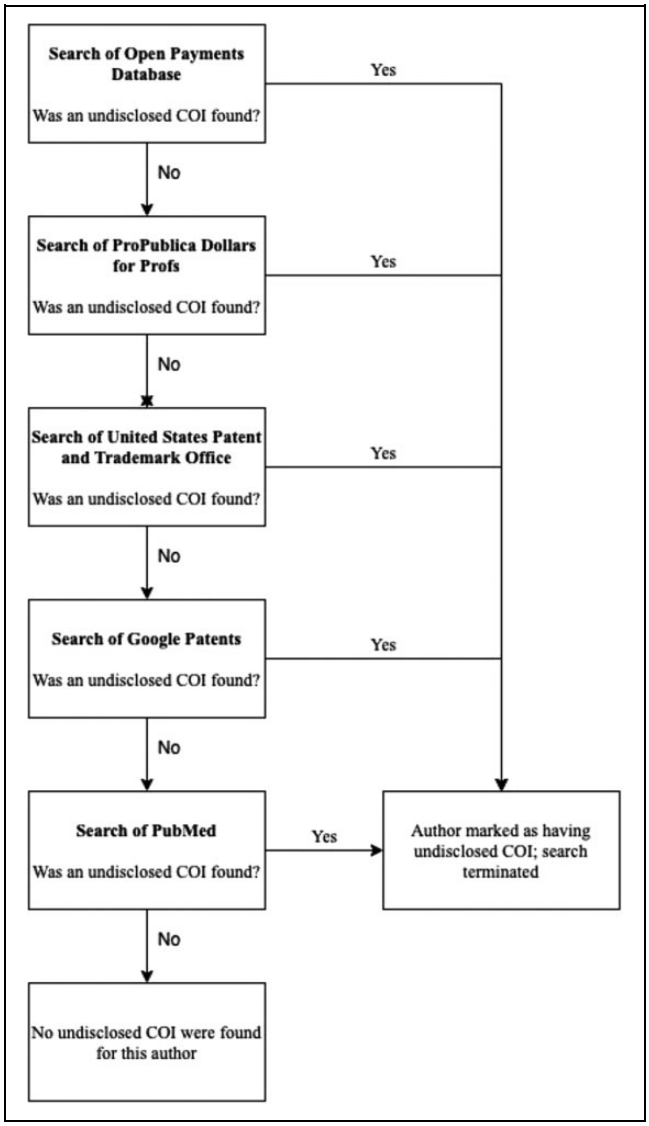

Figure 1. Stepwise search for undisclosed COI among systematic review authors.

Identification of Undisclosed Conflicts of Interest

A search was undertaken for undisclosed COI following the stepwise algorithm provided in Figure 1, modeled after the methodology by Mandrioli et al[19] while incorporating 3 additional databases—the Open Payments database, Dollars for Profs, and the United States Patent and Trademark Office (USPTO). Table 1 describes each database. We searched each systematic review author when performing searches for undisclosed COI. To ensure accuracy between investigators, a custom program was created by M.W. using the Python programming language (Python Software Foundation, https://www.python.org/) to generate search strings for PubMed, USPTO Database, and Google Patents. Searches for patents were limited to 10 years before the publication of the original systematic review because of

Table 1. Description of Databases Used to Search for Undisclosed COI Among Systematic Review Authors.

Database	Description of Database
Open Payments Database (https://openpaymentsdata.cms.gov)	Open Payments Database, created on September 1, 2013, is a congressionally mandated, openly accessible resource designed to increase the transparency within the US health care system. This database collects and publishes information regarding industry relationships between health care providers (eg, physicians and teaching hospitals) and industry (eg, drug and device manufacturers). Physicians and teaching hospitals report industry payments received in the form of research, food and beverage, travel, and consulting or speaking fees.
Pro Publicas Dollars for Profs (https://projects.propublica.org/dollars-for-profs)	Dollars for Profs provides information from state universities and the National Institutes of Health (NIH) regarding industry payments and conflicts of interest of academic professors, researchers, and other support personnel. Rationale for including this database was based on the knowledge that searching for non–health care professionals listed as an author of a systematic review included in our sample would not return beneficial information.
United States Patent and Trademark Office (USPTO) (https://www.uspto.gov)	The USPTO is responsible for the registration of US patents and trademarks in accordance with the commerce clause (Article I, Section 8, Clause 3) of the US Constitution. In addition, the USPTO "furthers effective intellectual property protection for U.S. innovators and entrepreneurs worldwide by working with other agencies to secure strong IP provisions in free trade and other international agreements." (https://www.uspto.gov/about-us)
Google Patents (https://patents.google.com)	Google Patents is a database consisting of more than 120 million patent publications from more than 100 different patent offices worldwide. In addition, Google Patents provides access to technical documents and books indexed in Google Scholar and Google Books, as well as documents included in the Prior Art Archive.
PubMed (https://pubmed.ncbi.nlm.nih.gov)	PubMed was launched in January 1996 and is one of the most widely used databases for academic research. The entire MEDLINE collection includes more than 30 million citations from biomedical literature. As part of the Enterz system of information retrieval, PubMed is maintained by the United States National Library of Medicine at the National Institutes of Health. (https://pubmed.ncbi.nlm.nih.gov/)

the longevity of patents. When conducting the PubMed searches, author searches returning studies published 36 months prior to the date of publication of the original systematic review were included. For searches returning more than 10 publications, random numbers were assigned to each of the studies, and data extraction was performed sequentially on the first 10. To broaden the search for additional publications, W.T.C., C.H., and A.C. each generated his own random samples. The stepwise search process was terminated when an undisclosed COI was discovered. That author was then counted as having an undisclosed COI. This stop process was also used by Mandrioli et al.[19]

Risk of Bias Evaluations

To evaluate the risk of funding bias in the systematic reviews, we applied the Cochrane Collaboration's criteria for assessment, which included the following 4 items from Mandrioli et al[19]: (1) whether explicit and "well defined" criteria that could be replicated by others were used to select studies for inclusion/exclusion; (2) whether an adequate study inclusion method, with 2 or more assessors selecting studies, was used; (3) whether search strategies were comprehensive; and (4) whether methodological differences that may introduce bias were controlled for. Each item was designated as either yes, no, or unclear. The risk of bias within the systematic review was considered to be low if at least 3 of the aforementioned criteria were sufficiently met. If not, the systematic review was considered to have a high risk of bias.

Statistical Analysis

Percentages and frequencies of study characteristics and COI among systematic reviews were calculated. We used Fisher's exact test to investigate the associations found within the data (COI and SR funding source, risk of bias assessment, and favorability of the summary effect, results, and discussion section). Stata 16.1 (StataCorp, LLC, College Station, TX) was used for all analyses.

Results

Our search of PubMed and Embase yielded 172 potential studies. After removing duplicates, 100 studies remained and were subsequently screened by title and abstract for inclusion. Of those, 62 were included for full-text screening. On full-text analysis, 12 systematic reviews focusing on the treatment of Achilles tendon ruptures were included in our final sample (Figure 2).

Systematic Review Characteristics

Our sample consisted of 12 systematic reviews and meta-analyses conducted by 72 authors published within 12 journals. The most common journals represented in our sample were *Foot and Ankle Surgery: Official Journal of the European*

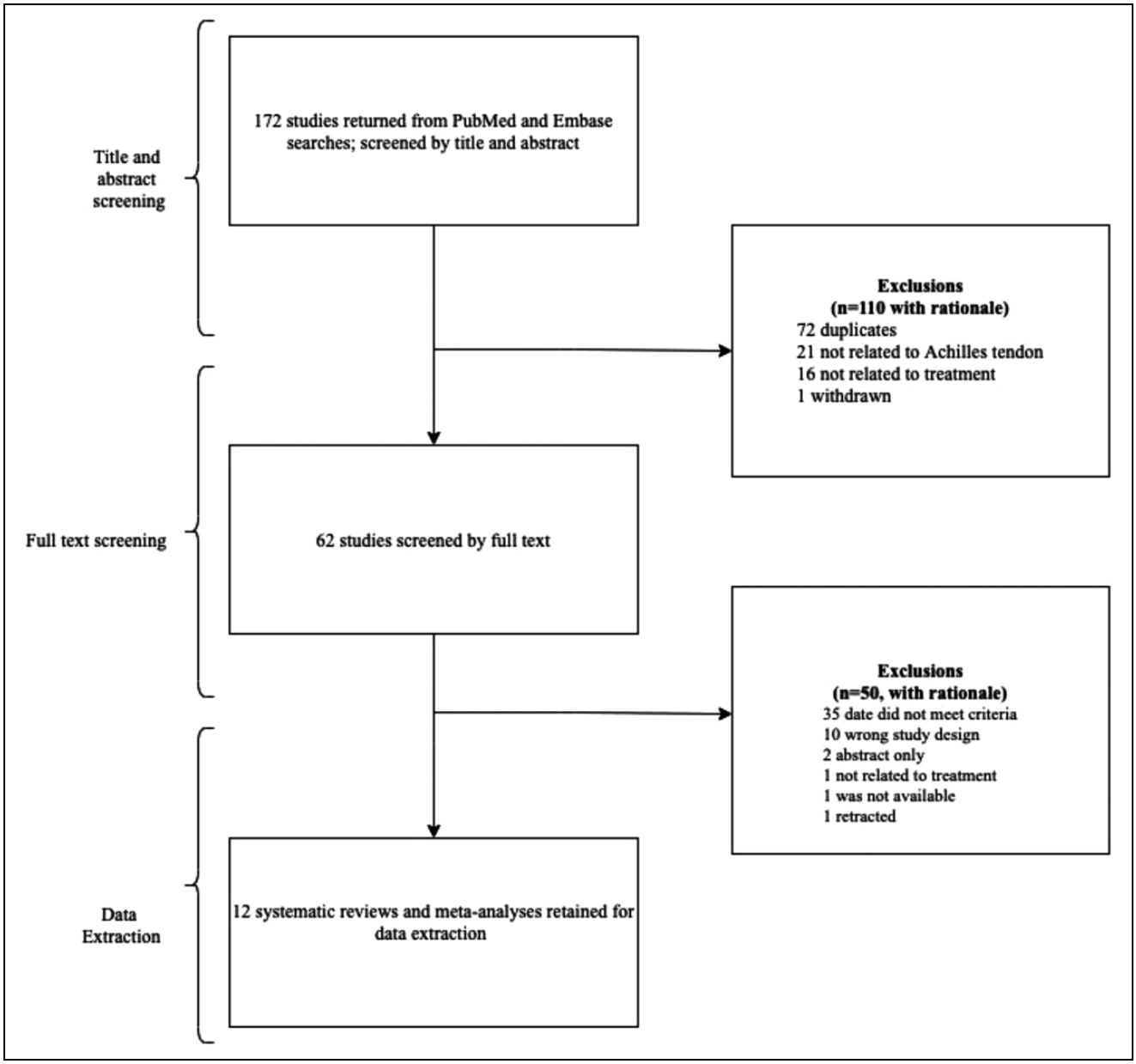

Figure 2. Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) flow diagram for included and excluded studies.

Society of Foot and Ankle Surgeons (3), followed by *International Journal of Surgery* (London, England) (2), and *The Journal of Foot and Ankle Surgery: Official Publication of the American College of Foot and Ankle Surgeons* (2). All systematic reviews evaluated operative techniques or interventions. All reviews were assessed to have a low risk of bias.

Six included reviews had at least 1 author with a COI. Of the 72 authors, 10 (13.9%) were found to have some form of COI. Of these 10 authors, 1 was found to have undisclosed COI in addition to disclosed COI, and 9 were found to have only undisclosed COI. None of the investigated authors fully disclosed their COI. Additional study characteristics are provided in Table 2.

Relationship Between Sponsorship and Favorability of Results and Conclusions

Two systematic reviews (of 12) were funded, and 10 (of 12) were not funded. The most common source of sponsorship was public funding (2/12), and none of the systematic reviews were industry-sponsored. Of the reviews receiving nonindustry support, 1 reported results favoring the treatment group and 1 reported conclusions favoring the treatment group. We found no statistically significant association between funding source and results ($P = .576$) or funding and conclusions ($P = .455$). Additional information can be seen in Table 3.

Table 2. Study Characteristics.

Characteristic	Form Response	n (%)
Journal (n = 12)	*Foot and Ankle Surgery*	3 (25.0)
	International Journal of Surgery (London, England)	2 (16.7)
	The Journal of Foot & Ankle Surgery: Official Publication of the American College of Foot and Ankle Surgeons	2 (16.7)
	Archives of Orthopaedic and Trauma Surgery	1 (8.3)
	BMJ (Online)	1 (8.3)
	Journal of Foot & Ankle Surgery	1 (8.3)
	The American Journal of Sports Medicine	1 (8.3)
	The Journal of Bone & Joint Surgery	1 (8.3)
COI (n = 72)	No financial COI	62 (86.1)
	Undisc	9 (12.5)
	Disc and undisc	1 (1.39)
Intervention type (n = 12)	Operative technique/intervention	12 (100.0)
Affiliation of first author (n = 12)	Public academic institution	10 (83.3)
	Government	1 (8.3)
	Public academic institution and government	1 (8.3)
Affiliation of last author (n = 12)	Public academic institution	9 (75.0)
	Government	1 (8.3)
	Private/industry	1 (8.3)
	Public academic institution and government	1 (8.3)
Source of Funding (n = 12)	No funding received	10 (83.3)
	Public	2 (16.7)
Conflict of interest statement (n = 12)	All authors report no COI	11 (91.7)
	One or more authors report a COI	1 (8.3)

Abbreviation: COI, conflict of interest.

Relationship Between COI and Favorability of Results and Conclusions

Of the 6 systematic reviews with 1 or more conflicted authors, 4 reported narrative results favoring the treatment group and 4 reported conclusions favoring the treatment group. Of the 6 systematic reviews with no conflicted authors, 4 reported results favoring the treatment group and 5 reported conclusions favoring the treatment group. Our results showed no statistically significant association between the presence of COI with the favorability of results ($P > .99$) or conclusions ($P = .5$). Additional information can be found on Table 4.

Discussion

Our analysis revealed one-half of systematic reviews focusing on the repair of Achilles tendon rupture had at least 1 author with an undisclosed COI.[3] Furthermore, no authors in our study disclosed any of their competing interests; a troubling finding considering orthopedic surgeons are among the top specialists to receiving payments from industry.[17] We also found that systematic review authors with an undisclosed COI reported results favoring the treatment group with similar frequency to those without a COI. Similarly, narrative discussion and conclusions in favor of the treatment group were reported almost as often by authors with and without COI.

Regardless of these high undisclosure rates, our results indicate the presence of a COI did not significantly affect the direction of narrative results and discussion. Although no associations were found in our study, others have reported the influence undisclosed FCOIs can have on research outcomes—including within systematic reviews. For example, one study by Narain et al[24] found that 90% of conflicted studies of cervical disc arthroplasty reported favorable outcomes. Furthermore, these same authors' studies with a COI were less likely to report unfavorable or nonsignificant outcomes.[24] Likewise, Guntin et al[12] concluded that lumbar disc arthroplasty studies authored by individuals with COIs were more likely to have favorable results. Within our study, 6 of 12 (50.0%) studies had an author with an undisclosed COI. Although there is no clear evidence that these COIs influenced their reporting, the existence of them in tandem with this discrepancy calls into question the authors' impartialities, thus illustrating how undisclosed COIs can taint the credibility of both the results and authors.

Although financial conflicts of interest can influence the favorability of outcomes, private funding sources have also been shown to affect the presentation of results. According to a 2014 study analyzing the influence the funding sources and COI had on the outcome and quality of spinal research, industry-funded research was shown to report favorable outcomes.[4] Mandrioli and colleagues[19] found that 81% of systematic reviews funded by industry reported favorable results. Printz et al[26] also discovered industry-sponsored

Table 3. Frequency of Favorability of Results, Discussions, and Summary Effect Estimates by Funding Sponsor (n = 12).

Review Outcomes	Funding Sponsor		
Favorability of results	Industry (n = 0)	Nonindustry (n = 2)	No Funding Received (n = 10)
Results favor treatment group	0 (0.0)	1 (8.3)	7 (58.3)
Results are mixed/inconclusive	0 (0.0)	1 (8.3)	2 (16.6)
Results favor placebo/control group	0 (0.0)	0 (0.0)	1 (8.3)
Favorability of discussion/conclusions			
Discussion favors treatment group	0 (0.0)	1 (8.3)	8 (66.7)
Discussion is mixed/inconclusive	0 (0.0)	1 (8.3)	2 (16.6)
Discussion favors placebo/control group	0 (0.0)	0 (0.0)	0 (0.0)
Risk of bias			
High risk of bias	0 (0.0)	0 (0.0)	0 (0.0)
Low risk of bias	0 (0.0)	2 (16.6)	10 (83.3)

Table 4. Frequency of Favorability of Results, Discussions, and Summary Effect Estimates by Conflicts of Interests Disclosure (n = 12).

	COI Among Systematic Reviews		
Review Outcomes	No COI, n (%)[a]	Disclosed COI, n (%)[b]	Nondisclosed COI, n (%)[c]
Favorability of results			
Results favor treatment group	4 (33.3)	0 (0.0)	4 (33.3)
Results are mixed/inconclusive	2 (16.7)	0 (0.0)	1 (8.3)
Results favor placebo/control group	0 (0.0)	0 (0.0)	1 (8.3)
Favorability of discussion/conclusions			
Discussion favors treatment group	5 (41.7)	0 (0.0)	4 (33.3)
Discussion is mixed/inconclusive	1 (8.3)	0 (0.0)	2 (16.7)
Discussion favors placebo/control group	0 (0.0)	0 (0.0)	0 (0.0)
Favorability of summary effect			
Summary effect not calculated	1 (8.3)	0 (0.0)	1 (8.3)
Summary effect not statistically significant	1 (8.3)	0 (0.0)	2 (16.7)
Summary effect favors placebo or control	0 (0.0)	0 (0.0)	0 (0.0)
Summary effect favors treatment	4 (33.3)	0 (0.0)	2 (16.7)
No specified target intervention	0 (0.0)	0 (0.0)	1 (8.3)
Risk of bias			
High risk of bias	0 (0.0)	0 (0.0)	0 (0.0)
Low risk of bias	6 (50.0)	0 (0.0)	6 (50.0)

Abbreviations: COI, conflict of interest; FCOI, financial conflict of interest.
[a]None of the listed authors on the given systematic review had disclosed or undisclosed FCOI (n = 6).
[b]FCOI among the listed authors on the given systematic review were completely disclosed within the review's COI statement, and the authors were not found to have any additional nondisclosed FCOI (n = 0).
[c]Nondisclosed FCOI were found for 1 or more systematic review authors (n = 6).

studies of osteoarthritis of the knee reported no unfavorable conclusion. Industry funding not only can influence favorable reporting of results, but it may also affect editor's acceptance of such studies into their respective journals. For instance, Mehlman et al[20] discovered a significant tie between physicians on orthopedic surgery journal editorial boards and industry in 2017. Just over three-quarters of these physicians received some type of financial compensation.[20] Although no systematic reviews reported industry sponsorship within this study, it is an issue that warrants greater exploration.

COI were frequently found to be underreported within systematic reviews for the treatment of Achilles tendon rupture. Therefore, we will outline recommendations to improve requirements on COI reporting for orthopedic journals, organizations focused on publication quality, and international authors. First, orthopedic journals need to improve their investigation of potential COIs for their authors and expand their policies to cover all potential interests. Janney et al[18] searched for undisclosed COIs of physician authors of 3 orthopedic journals: *Foot & Ankle International* (*FAI*), *The Journal of Bone & Joint Surgery* (*JBJS*), and *The Journal of Arthroplasty* (*JOA*). They found that of 1770 articles, 13% contained a first or last author with an undisclosed COI. Journals must investigate all potential COIs of their authors to avoid publishing biased literature based on financial or nonfinancial gain. Journal COI policies should also be expanded to cover all potential COIs, not just those that the author finds relevant. In a study of 4 peer-

reviewed orthopedic journals, researchers found that 58% had undisclosed COIs and 14% were relevant to the article subject matter.[30] Because there is a need for COI policy revision within orthopedic journals, organizations focused on publication quality should also follow suit.

Second, because of the serious implications that result from not disclosing COIs, we suggest amendments to guidelines of organizations concerned with publication quality such as the International Committee of Medical Journal Editors (ICMJE) and the PRISMA. ICMJE is an organization that encourages journals to publish the financial interests of their authors. Although many journals are listed on the ICMJE website claiming to adhere to their guidelines, many do not adhere to them. For example, Rasmussen et al[28] found that nearly half of Danish clinical drug trial authors had undisclosed FCOIs published in journals claiming to follow ICMJE guidelines. Because the ICMJE serves to uphold research integrity, their guidelines should be more strictly followed and enforced by the research community. PRISMA guidelines are used by many systematic review authors in the editing and submission of their manuscripts. Although the current PRISMA checklist requires authors to report sources of funding and the role of sponsors in the manuscript, there is no instruction for the disclosure of COI.[11] PRISMA should include disclosure of COI to their checklist to verify that systematic review authors are completely transparent regarding financial relationships that may affect the study. Given the role these organizations play in the quality of publications, especially systematic reviews, it is essential that their guidelines ensure complete financial transparency of all authors.

Lastly, improvement also needs to be made in furthering the accountability of international authors and their disclosure of COIs. In our study, we had trouble validating authors' COIs with origins other than the United States as there is no international equivalent to the Open Payments Database. However, we could not effectively validate whether FCOIs had any influence in their reporting as all authors originate outside the United States. Zhu and Sun found journals not enforcing COI disclosures among publishing authors is not limited to only American journals.[33] A 2020 study discovered that authors of arthroplasty manuscripts inaccurately disclosed their COIs in relation to what could be found on the Open Payments Program.[32] Findings from numerous studies, including our own, demonstrate the need for better criteria and enforcement for the disclosure of COIs and FCOIs among international authors.[5,28,33] Because international financial relationships may be common within orthopedic literature, without optimal reporting, the influence of these interests on research outcomes and interpretation will continue to go unnoticed.

Strengths and Limitations

Our study had its own unique strengths and limitations. Regarding strengths, the resources for our study (protocol, analysis scripts, forms for data extractions, and other information) were made freely available online on Open Science Framework, which promotes the reproducibility of our study. We strictly followed our established protocol, and any divergence was included in a protocol update. Study screening and data extraction were performed in a triplicate, masked process. This is one more reviewer than the gold standard recommendation from the Cochrane Collaboration.[13] A fourth, independent reviewer verified our results to ensure our study was reproducible. All reviewers also underwent extensive training on data extraction and screening to assist in standardization and allowing us to perform the highest quality study possible. Regarding our limitations, this study was limited to 12 studies. This small sample size could have introduced some form of bias and/or may not have been varied enough to represent the available literature pertaining to Achilles tendon ruptures. Searching 2 of the largest bibliographic databases, MEDLINE and Embase, may have assisted in retrieving a wide variety of studies, but it is possible not all reviews focused on Achilles tendon ruptures were retrieved. Our study was limited to systematic reviews published between September of 2016 and June of 2020, 36 months after the release of Open Payments Database. When searching the Open Payments Database, the search results were only applicable to authors in the United States. Searches of the United States Patent office as well as Google Patents were limited when an author had a common name. This study was also cross-sectional in design, so our results should not be grouped with systematic reviews published in other time periods or journals.

Conclusion

This is the first review that analyzed COI in systematic reviews related to Achilles tendon ruptures to our knowledge. The data from our study showed that COI had as much favorability as those studies without COI. Our results showed studies with an author who had an undisclosed COI reported results just as frequently favoring the treatment group. Further efforts should be made to disclose all COIs to improve the validity and credibility of future medical literature pertaining to Achilles tendon ruptures.

Ethics Approval

Ethical approval was not sought for the present study because this cross-sectional analysis did not involve human subjects and, thus, was not subject to institutional review board oversight.

Declaration of Conflicting Interests

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