

# Follow-up on Misrepresentation of Research Activity by Orthopaedic Residency Applicants: Has Anything Changed?

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**Background:** In our previous study, published in 1999, we showed that 18% of research citations listed as published by orthopaedic residency applicants were misrepresented. Since our last report, we sought to determine whether there had been any change in the behavior of applicants wishing to pursue the field of orthopaedic surgery.

**Methods:** We evaluated the research citations that were identified after a review of the Publications section of the Common Application Form from the Electronic Residency Application Service for all applicants to our orthopaedic residency program for 2005 and 2006. Inclusion and exclusion criteria were established for citations listed on candidate applications. Citations were required to be from journals listed in *Ulrich's Periodicals Directory*. The PubMed-MEDLINE database engine was used to search for citations. If searching failed to yield the cited publication, a review of the journal of alleged publication was undertaken and an interlibrary search was conducted with the use of several research databases. When no match was found, the citation was labeled as misrepresented. Misrepresentation was defined as either (1) nonauthorship of an existing article or (2) claimed authorship of a nonexistent article.

**Results:** One hundred and forty-two (35.9%) of 396 applicants during the 2005 and 2006 application periods listed publications. A total of 304 citations were claimed from these 142 applicants. Listings included articles that were in press or in print (thirty-four citations), articles in journals not found in *Ulrich's Periodicals Directory* (twenty-eight citations), book chapters (twenty-three citations), and articles recorded as having been submitted (eighty-eight citations). These 173 works were excluded from our analysis. One hundred and thirty-one citations were referenced as appearing in journals per our search criteria, and all were verified. Twenty-seven or 20.6% (95% confidence interval, 14.2% to 28.7%) of 131 citations were misrepresented.

**Conclusions:** The prevalence of misrepresented research publications from orthopaedic surgery residency applicants increased modestly to 20.6% compared with that found in our original report (18%). As we recommended in our last report, we strongly urge residency programs to require applicants to submit reprints of their publications with their residency applications. Perhaps standardized guidelines should be developed to help to prevent misrepresentation through the Electronic Residency Application Service.

The importance of a research experience is considered by many residency programs to be a valuable component of graduate medical education. The performance of clinical or basic-science research by an orthopaedic surgery residency applicant is viewed favorably by

program directors. Indeed, publication in peer-reviewed journals is among the various criteria used to judge and rank applicants in the orthopaedic residency matching process<sup>1</sup>. Our original report in 1999 found an alarming level of misrepresentation of research accomplish-

ments among orthopaedic applicants applying to a single institution during a one-year period<sup>2</sup>. We replicated our original study to determine whether applicant behavior had changed with regard to the accuracy of citations listed on applications. All publications cited

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by applicants were investigated with the identical methodologies used previously.<sup>2</sup> However, our current study was conducted at a different institution over a two-year period (2005 and 2006).

### Materials and Methods

Three hundred and ninety-six applications were submitted through the Electronic Residency Application Service to our Orthopaedic Residency Training Program during the 2005 and 2006 period. Inclusion criteria encompassed citations listing the name of the first author, the name of the applicant, the name of the journal, the volume number, the issue number, and the page numbers in journals included in *Ulrich's Periodicals Directory*.<sup>3</sup> Over 165,000 international journals are listed in this directory, and it is considered the definitive reference for the existence of a journal. Any journal that was not listed in this directory was excluded from our study because of the inability to verify authorship. Other exclusion criteria were articles that were reported as submitted, in press, or in print.

All citations were verified with use of a standard one-step process. After the applicant's Common Application Form from his or her application through the Electronic Residency Application Service was scanned into a Microsoft Word (Microsoft, Redmond, Washington) document, citations were "copied and pasted" into a PubMed-MEDLINE search engine and analyzed. This essentially negated any potential error from misspelling or miscopying of citations by the investigator. We performed all searches sequentially, using the name of the first author, the name of the applicant, the name of the journal, the volume number, the issue number, and the page numbers of the reported citation. If the citation was not listed on PubMed-MEDLINE, a review of the journal of alleged publication was undertaken, with use of an interlibrary search if appropriate. The interlibrary search utilized several research databases including EBSCOhost (containing >300,000 bibliographic entries on all subjects from >78,000 international

publishers), Web of Science (a current and retrospective multidisciplinary information source from nearly 850,000 fully indexed journal articles from approximately 8700 worldwide research journals), BIOSIS Previews (including approximately 5000 life science journals), and The National Library of Medicine's DOCLINE system (an automated interlibrary loan request routing and referral system that contains all citations of the biomedical literature catalogued by the National Library of Medicine)<sup>4-7</sup>. When no match was found in any of the above categories, the citation was considered to be misrepresented.

### Results

There were 396 applicants to our residency training program during the 2005 and 2006 application periods. Only declared published journal articles listed on the Common Application Forms of the applicants were searched. One hundred and forty-two applicants (35.9%) reported a total of 304 publications on their forms. These included thirty-four citations listed as in print or in press, twenty-eight citations to journals not listed in *Ulrich's Periodicals Directory*, twenty-three citations to book chapters, and eighty-eight citations listed as submitted. These 173 works were excluded from our analysis. One hundred and thirty-one articles were declared from 103 applicants as appearing in journals listed in *Ulrich's Periodicals Directory*, and we were able to verify all 131 of these papers per our search methodologies.

After all 131 citations were checked and verified, twenty-seven or 20.6% (95% confidence interval, 14.2% to 28.7%) were considered to be misrepresented. Misrepresentation was defined as either (1) nonauthorship of an existing article or (2) claimed authorship of a nonexistent article.

Thus, 104 true and actual publications were noted. The twenty-seven misrepresented citations came from twenty-two (21%) of the 103 applicants who had listed citations appearing in journals in *Ulrich's Periodicals Directory*. Of the twenty-seven misrepre-

sented listings, twelve citations (44%) had no authorship by the applicant on an existing article and fifteen citations (56%) involved claimed authorship of a nonexistent article. Of the 104 citations that were verified, nineteen listed the applicant as either first or second author. Furthermore, only thirty-three (32%) of 104 verified references were on orthopaedic or musculoskeletal topics.

### Discussion

Erroneous representation and falsification of physician credentials are well-documented phenomena<sup>8-10</sup>. Moreover, misrepresentation and falsification by medical students and other applicants seeking residency training positions have also been noted, with an incidence ranging from 6% to 41%<sup>2,11-19</sup>. Cohen-Gadol et al.<sup>18</sup> reported the lowest misrepresentation rate (6% of 102 applicants) in their paper and concluded that the more "honest and accurate" candidates were a reflection of the applicants' "collective integrity in representing their skills and competency to the public in their future profession." Nevertheless, Cohen-Gadol et al. later acknowledged in their report that four of the six applicants to their residency program with misrepresented publications successfully matched into a residency program.

There are many potential reasons why misrepresented publications may be so prevalent. In one of the initial papers identifying misrepresented publication rates, Sekas and Hutson<sup>11</sup> stated several possibilities. Although they had identified misrepresentation rates among gastroenterology fellowship applicants in their report, we believe their explanations are also relevant to orthopaedic surgery residency applicants. First, they mentioned that an augmented bibliography may give an applicant more of a competitive advantage during the residency selection process. Since orthopaedic surgery residency programs are continuing to attract many more applicants than there are available positions, competition to obtain a residency position is manifest,

and any advantage such as a stronger-appearing publication record may help a candidate to rank higher in the selection process. Second, some applicants may believe in a universal perception that “everyone does it,” and therefore an enhanced publication record is a standard and common practice. Third, for some applicants, the benefits of matching in their field of choice may outweigh the risks of being discovered. Fourth, some applicants may not be aware that listing an article as being in press is not the same as listing it as having been submitted or under review. Finally, misrepresented publications may be a sign of an underlying psychiatric condition of the applicant that could be associated with other undesirable behaviors.

As mentioned above, in competitive specialties such as orthopaedic surgery, applicants may be tempted to misrepresent their publications intentionally to gain an advantage over their peers. Baker and Jackson<sup>17</sup> reported a misrepresentation rate of 11% among seventy-three applicants to their radiology residency program who had listed publications, and they commented that candidates who are fraudulent in their residency applications might continue to be fraudulent in other areas of their careers such as with interactions among colleagues and patients.

However, other fields that are perhaps somewhat less competitive for obtaining a residency position have also reported high rates of misrepresentation. Roellig and Katz<sup>16</sup> reported a misrepresentation rate of 21.3% (ten of forty-seven) for applicants to their emergency medicine residency program who had listed publications, and they felt that it was reasonable to assume that misrepresented publications may indicate an unwanted behavioral pattern that would be completely unacceptable in a medical setting. Bilge et al.<sup>14</sup> reported a misrepresentation rate of 19.7% among the 147 applicants to their pediatrics residency program who had listed publications, and those authors suggested that the National Resident Matching Program use a cen-

tralized clearinghouse for all residency program applications. Any candidate with an identified misrepresented publication could then be prevented from applying to residency programs. They further insist that if misrepresentation of publications continues to be a problem, then residency selection committees should reconsider the value of authorship of peer-reviewed publications in the selection of future residents.

We hypothesized that our previous report and those of other investigators would lead to a reduction in the proportion of misrepresented citations. Instead, we found a slight increase in the misrepresentation rate (from 18% to 20.6%). There are several potential explanations for our findings. First, it is possible that candidates made typographical or clerical errors when they completed their Electronic Residency Application Service applications. However, given our rigorous process utilizing the most comprehensive medical database search engine, this seems unlikely. Also, given the applicants' level of education, such gross errors seem improbable. Second, it is possible that the listed citations for unpublished works were actually in press, submitted, or in process. However, this would also require clerical errors, an unlikely occurrence in this group of highly educated, computer-savvy applicants. Third, one may surmise that the misrepresentations were intentional. By portraying their research efforts as published, applicants might hope to garner a more favorable evaluation by review committees and program directors.

Of the 304 publications claimed by orthopaedic surgery residency applicants, including published articles from journals not listed in *Ulrich's Periodicals Directory* as well as book chapters and articles that were in press, in print, or submitted, only 104 (34.2%) were actually found to be published in journals listed in *Ulrich's Periodicals Directory*. Although published scholarly work may add bulk to an applicant's curriculum vitae, residency programs may wonder whether citations not in journals listed in *Ulrich's Periodicals Direc-*

*tory* are of any scientific importance but also whether they exist at all. In addition to perhaps being misrepresentations or fabricated references, these other so-called publications occur in non-peer-reviewed sources (e.g., pamphlets or newspapers) and are not easily accessible to clinicians, researchers, and program directors.

The most frequent listings in the Publications section of the Common Application Form were the citations labeled as submitted, in print, or in press (122 or 40% of all citations). Since there was no way of verifying these scholarly activities, they were not included in our analysis. Patel et al.<sup>9</sup> reviewed articles listed on the curriculum vitae of 151 orthopaedic fellowship applicants that were defined as accepted, in press, submitted, or in progress. After a two-year period, it was found that the actual rate of publication was only 4% (twenty-one of 532) in the combined category of papers submitted and/or in progress. This result is not totally unexpected as only 46% (668) of the 1465 scientific reports presented at three consecutive American Academy of Orthopaedic Surgeons meetings were eventually published nearly four years after presentation<sup>20</sup>.

Our retrospective study has several potential limitations. First, despite spanning a two-year period, our sample of residency applicants was relatively small. Second, while the current study was conducted at a different institution from that in our earlier report, our findings may not be generalizable to other settings. Finally, it is possible that some of the misrepresentation was due to unintentional errors in citing references. A typographic or clerical error could make it difficult to verify a citation properly. Indeed, one report analyzing misrepresentation among internal medicine residents argued that previous studies may have overestimated the magnitude of misrepresentation<sup>19</sup>. Those authors encouraged programs to contact coauthors and editors of journals since previously reported searches were not adequately comprehensive. However, in our study, all citations were searched with use of

PubMed-MEDLINE Internet search engines after the applicant's Common Application Form from his or her Electronic Residency Application Service application had been scanned into a Microsoft Word document. We are confident that this process minimized errors by the investigator resulting from misspelling or miscopying of citations onto the search engine. When a journal was not listed in PubMed-MEDLINE, an exhaustive interlibrary search as well as review of the journal of alleged publication was performed.

Because the application process for orthopaedic surgery residency programs has been streamlined recently into a single computer-based, Internet-accessed program (the Electronic Residency Application Service), applicants are limited in the manner in which they are able to report research endeavors. Currently, the Common Application Form for the Electronic Residency Application Service provides space only for the entry of publications and not for other scholarly activities (e.g., posters, presentations, or articles in press). Thus, to be considered as having research accomplishments, some applicants may feel pressured into presenting their research endeavors in publication format. After careful review of the applications to our program, it appears that many candidates failed to differentiate between published articles and other scholarship such as presentations, posters, papers in progress, papers submitted, and abstracts. Nearly all applicants using the Publications section on the Common Application Form list all types of academic endeavors including oral and poster presentations, current projects, and published articles. We found that applicants list these other activities in standard bibliography format. Thus, without careful scrutiny and monitoring, such listings may be confused with published works of scholarship. Consequently, the applicant appears to have more publications than is the case.

While the Electronic Residency Application Service program has streamlined the residency application

process, it may also provide a way for verification of cited publications. Because the proper citation of publications requires a journal title, volume, and page numbers, this information can be automatically linked to a PubMed-MEDLINE unique identifier number that can be inserted as a link into the Electronic Residency Application Service program. Thus, with this extra step, not only would program directors be able to verify instantly the authenticity of papers published in peer-reviewed journals but they could also print the articles for use in the interview and selection process. In addition, the creation of new entry fields in the Common Application Form to include abstracts, posters, presentations, articles submitted, and articles in press should greatly help to clarify any ambiguity about the representation of research projects.

In medical school, academic accomplishments are important, although not completely valid, predictors of resident performance<sup>21,22</sup>. Other criteria used to differentiate among applicants to an orthopaedic surgery residency program include research experience and published scholarship<sup>1,23</sup>. Moreover, analyses by the American Academy of Orthopaedic Surgeons and the credentialing committee of the American Board of Orthopaedic Surgery have shown that problems with attending surgeon professionalism can be predicted by unethical behavior during medical school and residency<sup>24</sup>. Since personal attributes developed prior to residency (i.e., integrity, professionalism, and communication skills) predict resident behavior, methods for assessing the personal characteristics and qualities of residents need to be improved<sup>1,25</sup>.

Simon<sup>24</sup> proposed the development of procedures to identify and eliminate individuals with deficiencies in ethical conduct before residency. Other than the current strategies of stressing professionalism and ethical standards in medical school as well as carefully reviewing all resident applications, the measurement of an appli-

cant's character is indeed challenging. The identification of misrepresented research publications should be part of the process for ensuring that residency programs select future residents with the highest level of professionalism.

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