Discussion of 2021-1751

GENDER DISPARITY IN THE CITATION OF SURGICAL RESEARCH

**DR JE "BETSY" TUTTLE** (Greenville, NC): In this paper, the authors discuss the impact of first and last author gender in research publications, as reflected by individual author's age index. The number of literature citations can be used as a measurement, implicitly and often explicitly, and affect successful career promotion for the individual author, independent of academic rank. This is a unique study, in that it is an examination of author gender (as determined by the authors) and citations using article type, presence of NIH funding, and the US as a country, in a set of the top 50 and 25 highly respected surgical journals. Although there was no significant difference in the type of literature published by women as first authors, women as last authors were more likely to publish randomized clinical trials, which is, in theory, our gold standard for evidence. Significant difference in citation by gender seems to disappear when the analysis is restricted to the top 25 surgical journals, but remains when the top 50 surgical journals, including some subspecialty journals, are examined.

The conclusion of this study is very concerning. It suggests that the disparity in citation could be related to gender bias. This lack of a larger presence of women authors in the literature could potentially contribute to the persistent disparity in academic rank for women in surgery, as well as positions for academic women surgeons in leadership positions, including deans, chairs and journal editors. I am grateful to the authors for reporting that recognition of the issue is the first step. Its resolution, as well as the recognition of the potential cumulative impact of citation difference, as with pay disparity over the lifespan of an academic career, is very concerning. Currently, there are only 21 women surgical chairs in the US and Canada, and that number is much lower in Europe and Africa. With the recent addition of Drs K Marie King and Andrea Hayes as chairs of surgery, who are now the first women of color to be chairs of surgery in the country, and with Dr Caprice Greenberg, a guest this year, Dr Mary Killackey, Dr Melina Kibbe, who is now the dean at the University of Virginia (UVA), and Dr Amy Goldberg, who was transitioning to be the dean at Temple, the number of women in chair positions has remained stable over the last 5 years. We still represent only 6% of chairs among all surgical departments in the country. There is not only a leaky pipeline, but potentially a glass ceiling for leadership positions for senior women, and a glass cliff. I would argue that our mistakes are not tolerated as well as some of our other colleagues.

Organizations such as the Southern Surgical Association, the Society of Surgical Chairs, the Womens’ Subcommittees, the mentorship program run by Dr Doug Tyler and Dr Mary Hawn, who are members of this organization, and other national organizations are focused on increasing diversity in their membership and mentorship programs supporting, as well as promoting diverse members.

While these data and conclusions regarding not just gender but also issues of underrepresented minorities in surgery are incredibly concerning, I am hopeful that we are at a tipping point. Certainly, over the course of my career, I have seen diversity and gender equity become much more accepted topics in conversation. However, I would argue that we need to intentionally focus our intervention not just at a national level but at a local level, and I am speaking to my fellow chairs in the audience. I think we need to focus on residents, and even earlier, teach residents, students, and all learners methods of leadership and research skills that are often glossed over in the new medical school curriculum.

I think that we need to focus on that at a local level, as much as we focus on technical skills and operative judgment. Additionally, we need to focus on faculty development at an individual level. This will go a long way to mitigate gender and other diversity, equity, and inclusion issues as potential discriminators in promotion tenure and, especially, retention in the academic setting.

Lack of citation based on gender is an interesting and disturbing finding. I would ask the authors, in reviewing your data, the citation rate disparity seems to disappear when the journal quality increases. How can you discern that the lack of citation based on gender is a lack of citation based on the quality of the journal?

In examining these data, could this be better than it has been in the past? This is only a snapshot in time. As more women have achieved leadership status in academic surgery, though there is the suggestion that bias exists, could it be improving over time?

Finally, what interventions are you going to study moving forward at a local level and potentially a national level that would mitigate this bias and improve our society for underrepresented minorities and women in surgery?

**DR RONDA HENRY‑TILLMAN** (Little Rock, AR): Gender disparity in surgery is well documented, as you just heard, so much so that the first female surgeon spent her entire career pretending to be a man. Imagine not feeling comfortable enough to show up as your authentic self in a profession you are more than qualified to practice. Imagine not being afforded the same respect and opportunity as your counterparts, simply because you are a woman.

Although some progress has been made (we alluded to the first 2 African American female chairs just this year), female surgeons still face significant implicit and explicit gender bias that limits their careers. Not only does this bias place limitations on women, but it also affects the healthcare system by marginalizing the medical concerns of women. Bias is not only a concern at the individual provider level. It is deep‑rooted in the system, beginning in medical school, and extending to academic careers.

I would like to commend the authors on this cross‑sectional analysis of publications from the top surgical journals, assessing the impact on gender bias on citation across the surgical literature. The granular breakdown in this article shows that publications by women as first or last author were less cited compared with publications cited by male authors in 24 to 48 journals. This concludes that female‑male and male‑female first and last authorship is a barrier to women as it relates to the publication citation, further impacting and widening the disparity that exists between men and women in promotion and rank in academic institutions.

We are slowly seeing a slight narrowing of the impact of disparity, but bias and disparity can still clearly disable a group. The future of the surgical profession depends on recruiting and promoting talented people, irrespective of gender. Although there is now increasing awareness of the impact of and explicit biases on the careers of female surgeons, action on these issues is still lagging. To see real change, surgery cannot wait for expert women to push the changes alone.

What do you suggest and how should we face our biases, so that we can change the environments in which we live and work?

I typically cite my name as R Henry‑Tillman, as does my mentor, VS Klimberg. Given that most citations have last names and first initials, they are gender‑neutral. What are your thoughts regarding why female authors are less cited, as an authors’ gender may not be easily identifiable?

Lastly, how do we go from documentation to action, and how long will it take?

**DR SUSAN GALANDIUK** (Louisville, KY): Approximately one‑fifth of the top 50 surgical journals are neurosurgery and orthopaedic journals, specialties that have a very low percentage of women participation. Have the authors done a sensitivity analysis to see if that skews their results?

**DR ELIZABETH SHAUGHNESSY** (Cincinnati, OH): In an academic career, authorship and publication citation carry significant weight, not only in the processes of promotion, career development, and society membership, but also in indirectly and directly affecting pay.

I am curious as to whether the authors may have looked at exactly who the authors were that were necessarily relative to those citations and whether there was a gender inequity.

**DR AVRIL SOMLYO** (Charlottesville, VA): I am a basic scientist, not a surgeon. My specialty is in vascular biology, and I was asked to comment on this topic. I wanted to make the point that this gender bias in citations and other aspects is not exclusive to surgery. It exists across all disciplines, and in fact, if you look at economists and physicists, it is a much more egregious.

It has been widely studied. For example, *Nature* reported gender bias in Nobel prizes, with women being strongly underrepresented across all disciplines. Reports in *Nature* and *Physics Today* document persistent bias that continues to affect female physicists, as well as gender bias in *Science* reporting, *Nature News & Views*, although this gap is beginning to narrow. If one looks at publications in basic sciences, again you see bias in terms of citation, and the repercussions of that.

There is also a gender gap in NIH applications and funding. There was a 2020 *Journal of the American College of Surgeons* paper from Dr Showalter and colleagues at UVA, where they reported that female surgeons hold a greater than anticipated proportion of NIH funding with a high number of first‑time grants. So, that is good news.

The importance of the present study, in my view, is that it demonstrates gender bias in surgical publications. A better understanding of the root causes of gender bias in citations is needed to effectively address these problems that affect womens' career advancement in academic surgery. I ask the authors what their research plans are for addressing this. I also wonder whether the citation rate difference holds across surgery specialties.

**DR NANCY D PERRIER** (Houston, TX): I noticed in one of your slides about the limitations of the study, you acknowledged the self‑citation distinction. I think as we talk about the holistic root cause of this is, we may want to pay attention to that in our cultural acknowledgement. Dr Tuttle spoke about beginning with medical students and teaching them training and leadership skills, but I think the culture of how we raise our daughters and sons probably plays into that factor of humility, or that factor of being comfortable with boasting about your own work or acknowledging it.

I wonder if you would have the ability in your study to look at female vs male gender senior authors, and how many self‑citations are in those works? That probably escalates logarithmically through the years, but I know for many women, self‑citation of work seems a little unusual or boastful, and there is a tendency to possibly not do as much. And that is probably due to gender bias in upbringing.

I think it is important to look at the way we can change promotion criteria, viewing not only citations, age indexes, and number of publications, but also looking at the quality of service, education, clinical care, then making changes to those formulas a bit to be more reflective of the things we prioritize, not the things which historically have been available at a time in life, particularly for women who may have other value systems that are competing.

**DR JONATHAN LARYEA** (Little Rock, Arkansas): In looking at the bubble plots that you showed for both first authors and senior authors, you can see for the men, there was a long tail, which means there are outliers. Do you care to comment on that? Is that what is accounting for the differences that you are seeing in the data?

**DR WILLIAM J KANE** (Charlottesville, VA): To address the question regarding the impact of journal quality on our findings, we appreciate this important point and agree that journal prominence certainly affects article citation rate. To address this, in both our unadjusted and adjusted regression models, we controlled for the journal within which each article was published, thus correcting for potential confounder. In fact, it was after this adjustment, as opposed to simply comparing the raw number of citations between groups, when we began to detect a difference in citation rate between men and women last authors.

Regarding the question on what we can do at the local and even at the national level, we believe this starts, first and foremost, with authors being mindful of their citation habits. When choosing citations to include in a manuscript, we believe it is important for authors to be intentional in citing the most relevant and robust articles to support their claims, and not necessarily citing articles by prominent or well‑known authors.

Additionally, journal reviewers and editors should be similarly mindful of citation practices when reviewing papers and providing citation suggestions.

Finally, we believe promotion and tenure committees should keep in mind the potential impact of gender bias on women surgeons when evaluating publication productivity and making career advancement decisions.

With respect to how we can affect rapid change and the next steps with this study, this is an incredibly important point. We would certainly like to believe that publishing this work will be enough to prompt authors, reviewers, and editors to be thoughtful and correct any biases in their citation practices, but if the body of research on gender disparity and academia tells us anything, it is that change is glacially slow.

While we do not have evidence to support any specific recommendation, one way to immediately correct career advancement inequity as a result of citation disparity could be for promotion and tenure committees, editorial boards, and societal executive boards to remind themselves of the gender inequity in citation in author age indices. Even further, these bodies could consider implementing a numerical correction, perhaps a 10% increase in women surgeons' cumulative citations and age indices when being evaluated, at least until future literature demonstrates that these gender disparities have been eliminated.

With respect to the question about why we saw fewer or no differences among the top 25 journals, we believe this is primarily due to a lower sample size. The top 24 journals have significantly fewer publications; less than 50% of the publications presented in our primary findings, with substantially fewer publications. These comparisons had less power to detect differences between groups.

We, unfortunately, do not have any data to evaluate whether these trends have changed over time, but that is certainly an area of future research we would be interested in pursuing. With respect to why female authors are less cited, this is a very interesting question and one we thought a lot about. Previous work in the life sciences literature has demonstrated that male authors are more likely to present their work in a positive light, for example, by using the word "novel" than women authors. Perhaps this could be a source of why women authors tend to be less cited.

Regarding the fact that one‑fifth of journals are orthopaedic or neurosurgical journals, which tend to be more heavily male-dominated specialties, this is certainly an interesting point and an area we would consider studying in the future, breaking down our results by specific subspecialties. Unfortunately, we are unable to determine which authors are citing specific articles, but this would also be another very interesting area of research.

The limitation of self‑citation habits among authors is also very important. Some argue that self‑citation is a habit of very productive authors who demonstrate a long period of research in the same area, but I think that it is certainly an area that should be investigated further. And, finally, with respect to the long tail in citations, that is specifically why we chose to perform a negative binomial regression for comparing our outcomes, and so we hope that this was not the source of the differences we detected between groups.