Preprints: Opening Surgical Science to Greater Innovation and Transparency

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Citation

Keywords

Preprint

Copyright

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This is a preprint that has not yet been peer reviewed.

Think about the last time you submitted a paper. After meticulous editing, you uploaded your manuscript and hit the "submit" button. Then, you waited. And waited. The reviewers requested revisions, which you obliged. More waiting. Finally, the paper was accepted and sent for proofing. You were one of the lucky ones. Others had to repeat the process again, perhaps in a different journal with a different submission format. After more waiting still, your paper was published. Excited to share your findings, you posted your paper on social media. But many of your potential readers, off campus and without a virtual private network, could not get past the abstract. This commonplace experience highlights two pain points in current academic publishing. First, that it takes too long to share your data with the world, and second, that much of the world can't see your data anyway.

Open science offers potential solutions to both problems. Per the United States government, open science is "the principle and practice of making research products and processes available to all."[1] In practice, open science can be operationalized through preprints, the publication of reviewer comments, and open-sourcing of data or code. Recently, Pathak and colleagues studied the adoption of open science practices within academic surgery. Among 240 manuscripts in eight highly ranked journals, none were preprinted or published reviewer comments and only 22 (9%) shared methodology or code.[2] The authors hypothesized that a lack of time and incentives prevented surgeons from adopting these practices. We additionally posit that surgeons may not know that these practices exist or realize that they are feasible. Anecdotally, we found that several surgeons and trainees did not know what preprinting was or how to do it. Some were unsure whether it was even allowed. The benefits and risks of preprints have been previously reported in the literature.[3] In this paper, we expand on this work by introducing the topic of preprints to the surgical community. Moreover, we aim to share practical guidance on how to preprint and advocate for specific policies that would advance preprinting alongside traditional peer review.

A preprint is a non-peer-reviewed manuscript that the authors publish and share. If you post a copy of your manuscript on social media, that would be a preprint. However, there are a number of websites, known as "preprint servers", that host and organize preprints. These platforms screen papers for offensive content and article structure but do not conduct any peer review of their own. ArXiv (pronounced "archive") is a preprint server for research in quantitative sciences (e.g., mathematics, physics, engineering, and economics), BioRxiv ("bio-archive") is a complementary server for biology research, and MedRxiv ("med-archive") enables users to preprint original medical research. While preprints are only one manifestation of open science, we focus on them here because of their low barrier to entry and minimal dependence on institutional support or regulatory changes.

Preprints offer several advantages over traditional peer-review alone.[3] The first is speed; you can get your research to the world faster. Perhaps for this reason, preprints were increasingly used in the early days of the COVID pandemic, when doctors and researchers needed to share information faster than traditional review could support.[4] Or why today, research in fields like

artificial intelligence is published predominantly on preprint servers. For example, the famous paper which heralded the development of large language models was published on arXiv.[5] Second, preprints improve access to research. Preprints are free to read even without a subscription or university affiliation. A prior critique of preprints may have been lack of reach. However, this concern has been mitigated now that preprint servers assign digital object identifiers (DOIs) to preprints and increasingly index them on popular research databases. For instance, MedArXiv papers are indexed by PubMED as of 2020. Third, preprints improve collaboration and reproducibility. Preprint servers encourage researchers to make their methodology and code public, another open science practice that is uncommon in surgery today.[2] As a result, readers can immediately replicate findings to ensure accuracy and build on them to avoid duplication of work. Fourth, preprints reduce the non-scientific barriers to publication. Preprinted articles can be deposited to servers without onerous formatting requirements. Finally, preprinting may directly benefit researchers, with prior studies demonstrating that preprinted articles had more citations and higher altmetric scores compared to non-preprinted counterparts.[6,7]

Preprints may have potential drawbacks, the most important of which are ameliorated by the fact that preprints exist alongside, not in lieu of, peer review. First, some worry that removing the barriers to publication will lead to the dissemination of hazardous or erroneous findings, a concern ostensibly mitigated by peer review. While this is a reasonable concern, the peer review process is not flawless today, and its absence does not necessarily preclude high quality science. For example, the paper in which Watson and Crick described the structure of DNA was not peer reviewed. Nor was Einstein's paper on special relativity.[8] That most of us aren't Einstein is a fair rebuttal. Nevertheless, the open publication of data, methods, and code actually makes reproducibility easier, not harder. Furthermore, it makes the review process transparent and accessible to all. Second, most preprint servers only support original scientific research, not viewpoints, commentaries, and perspectives. Such article types are increasingly being utilized to discuss novel ideas in academic surgery for which formal data are not available. Third, preprint servers are largely based on the analog PDF format, thus not taking advantage of the enhanced interactivity and data visualization capabilities of the internet. Finally, preprints may lack the prestige of peer-reviewed publications, potentially impacting their value in academic advancement and career progression.

How does one preprint? If you are working on original health-related research, you can submit your completed manuscript to MedRxiv (https://www.medrxiv.org/submit-a-manuscript). If you want to preprint an editorial piece or commentary, you can use Zenodo (https://zenodo.org/). Both services will provide a DOI which enshrines your work within the scholarly record. Alternatively, you can preprint your work on your own blog. Getting a DOI on blog posts is more technically challenging, but still possible using services such as The Rogue Scholar (https://docs.rogue-scholar.org/). As individuals are able to more easily share their work directly, it is possible that we will see a proliferation of surgeon-scientist-bloggers. If you plan to submit your work to a traditional journal in parallel, it is best to confirm that the journal does not prohibit preprints from consideration, but most do not. Websites like Transpose and Sherpa

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Services can provide detailed information on preprint policies, and we have included the specific policies of high impact and common academic surgery journals (Table 1).[9]

Looking forward, existing journals and publishing companies can support preprints in many ways. Moreover, they can do so with minimal disruption to the current peer review process. First, journals that do not allow preprints to enter review should change this increasingly outdated policy. Some journals are even proactively integrating preprints into their submission processes. For example, some journals accept papers from MedRxiv into review while others allow authors to deposit papers into MedRxiv upon completing a standard submission.[10] Alternatively, journals can preprint any submitted papers on preprint servers of their own. Springer Nature offers this service with its preprint server called Research Square while Elsevier has a preprint server called the Social Science Research Network (SSRN). As more scholars embrace the principles of open science, policies that favor preprints and open science may serve as a competitive advantage that draws the highest quality research.

In this paper, we aimed to show that preprinting your manuscript is easy and beneficial. In doing so, we were reminded of that grade school adage: "show, don't tell". You can find a preprint of this paper, here.

More information on specific preprint policies for academic surgery journals can be found in the accompanying table here.

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