



Editorial



Tackling the Issue of Paper Mills in Scientific Publishing

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The services facilitate the acceptance and publishing of articles containing fabricated or manipulated data in journals and selling authorship roles, which are called paper mills.¹ In other words, all services offered by paper mills encompass selling fake manuscripts, selling authorships, data fabrication, facilitating fake peer-review, and citation manipulation.^{2,3}

The articles produced by paper mills represent a systematic assault on research integrity, disseminating fake and fraudulent publications that pose a grave threat to the reliability of science. This issue is not just a concern, but a crisis for research ethics, often leading to the mass retraction of articles once they are exposed.^{1,4}

Research integrity in medicine is critical, as published studies lay the groundwork for clinical approaches and directly impact individual and community health. Fabricated studies misuse crucial scientific and financial resources and hinder the advancement of effective treatments, ultimately threatening public health and societal welfare.^{5,6}

The COVID-19 pandemic illustrated the dangers of misinformation, showing how unverified or fraudulent studies can negatively influence both public behavior and health outcomes.⁴ A notorious example is the discredited study linking the MMR (Measles, Mumps, and Rubella) vaccine to autism, which contributed to decreased vaccination rates and increased child mortality.⁷ These examples underscore the urgent need to counteract the influence of paper mills.

The growing prevalence of paper mills presents a significant threat to the structural integrity of global research institutions and erodes public trust in scientific output. According to an unpublished report shared with Nature, over 400,000 research papers have been published over two decades, many exhibiting substantial textual similarity. This resemblance suggests that paper mills may have generated a portion of these studies. Notably, within one year alone, approximately 70,000 papers from this dataset were published, underscoring the severity and scale of this issue and its potential threat to research credibility. Data indicate that an estimated 1.5

to 2 percent of scientific papers published in 2022 are suspected of originating from paper mills. The prevalence varies among disciplines, with Medicine and Biology accounting for about 3 percent, Chemistry and Material Science around 2.5 percent, and Computer Science at approximately 1.4 percent. Analyzing trends in textual similarity with suspected paper mill outputs reveals a steady increase in this ratio from 2000 to 2022 - rising from roughly 0.5 percent in 2000 to 1.7 percent in 2022. This growing trend highlights the need for vigilance in protect research integrity.⁸ Furthermore, the amount of retraction is increased; for example, Hindawi has retracted 8,000 articles in 2023 due to issues linked to paper mills.⁹

Consequently, the emergence of this phenomenon within the scientific community and the imperative to confront it are fully justified to ensure the preservation of research integrity.

Effectively addressing this issue requires a multi-pronged response involving journals, indexing databases, publishers, and research ethics organizations. Leading journals and organizations have already begun raising awareness and implementing safeguards. For example, Science has published articles to reveal the existence of paper mills since 2013 and has demonstrated their prevalence in the scientific community.¹⁰ Moreover Retraction Watch has actively contributed to raising awareness by regularly publishing investigative articles and updates focused on exposing cases and patterns associated with research misconduct.¹¹ Since 2020, the issue of paper mills has been discussed within COPE's resources as a significant challenge impacting publishing ethics. In response to this concern, extensive collaboration among COPE, International Association of Scientific, Technical & Medical Publishers (STM), and publishers have taken place to investigate the problem and explore potential strategies for addressing it. In 2023, following COPE's endorsement and support for the United2Act consensus initiative, a structured and unified strategy appears to be actively pursued and implemented to tackle this challenge effectively.^{1,12-14}

Complementing these efforts, journals serve as a

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primary safeguard for maintaining research integrity, with editors playing a central role in identifying and preventing the publication of articles produced by paper mills. Editors have proposed specific criteria and procedures to detect such manuscripts and to promote rigorous ethical standards, which will be explored in the subsequent sections. Common measures include requiring authors and reviewers to use institutional email addresses and maintain active ORCID IDs as basic indicators of authenticity. Strengthening journal submission systems and plagiarism detection tools can further enhance the ability to identify invalid or manipulated manuscripts before they reach peer review process. In fact, plagiarism detection has become a fundamental component of editorial workflows that some journals have adopted new, specialized software designed explicitly to detect paper-mill-generated content.¹⁵⁻¹⁷ Recently developed software, such as Papermill Alarm, can now identify suspicious manuscripts. This software analyzes titles indexed in PubMed and flags approximately one percent of papers that show high textual similarity to known paper mill outputs.^{17,18} The Signal team in 2024 unveiled a free platform designed to evaluate research integrity submissions, aiming to rebuild and strengthen trust in research.¹⁹ Also, the journal system with the capability to detect and track the IP addresses of computers used for article submissions can serve as a valuable criterion for identifying cases where multiple articles are submitted to journals from the same IP address.¹⁶

Despite these technological advances, human oversight remains essential. Improving awareness, providing training, creating new roles of Data Sleuth within journals, and recruiting increasingly specialized team members are key steps toward optimizing human resources in tackling paper mills. Ensuring editors and staff responsible for reviewing submitted articles are fully aware of the existence of such problematic material is vital.^{16,17}

As mentioned, identifying this group of articles at the submission stage is a significant advantage. Identifying paper mills articles at the submission stage can prevent the entrance of misinformation into the scientific community and save editors and reviewer's time. Therefore, scholarly journals should have a rigorous workflow check for evaluating submitted manuscripts.²⁰ Furthermore, academic journals can refine the initial review process by assigning this task to journal editors to enhance the efficiency of evaluating submitted manuscripts. Specific journals entrust this phase of manuscript evaluation to their staff, focusing solely on ensuring that submissions adhere to the structural requirements outlined in the author's guidelines. While this approach may expedite preliminary checks, it potentially diminishes the likelihood of detecting fraudulent papers or those produced by paper mills at this stage, thereby increasing the probability of such submissions advancing to the peer review process.⁵

In addition to technological and editorial measures, journals should regularly update their policies and

processes²⁰ to address emerging threats. These include:

- Regularly update the editorial guidelines²¹ and clear guidelines on the use of artificial intelligence^{16,22}
- Clarify policies of archive²³ data sharing,²⁴ public data repository,²² and Preprint¹⁹
- Update best practices and guidelines for principles of images,^{16,17} image copyright and the policy on using third-party images¹⁵
- Transparent authorship criteria and contribution disclosures¹⁷
- Conflict of interest declarations¹⁷
- Clarify raw data policy^{2,16,17,20,23,24}
- Policies for handling paper mill cases and ensuring timely retraction notices¹⁶

In parallel with the measures implemented by journals, major research databases such as Scopus, Web of Science, and PubMed Central provide a secondary layer of defense in safeguarding research credibility. Researchers depend on these databases to retrieve credible research, conduct comprehensive searches, and manage citations, making their quality-control processes essential. These databases apply stringent criteria when selecting sources for indexing and conduct regular post-indexing reviews to ensure continued compliance. For example, Web of Science has recently delisted more than 50 journals that had published more retracted articles, and it has withheld the calculation and release of their impact factors. Such actions underscore the role of indexing databases in reinforcing academic standards and complementing the efforts undertaken by journals.^{25,26}

In conclusion, simply rejecting paper mill articles at one journal is insufficient.³ These submissions often resurface elsewhere. Therefore, A coordinated and sustained effort across the scientific publishing ecosystem is essential to protect research integrity and uphold trust and ethical standards in scientific journals.

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Competing Interests

None.

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