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Paper Mills for research writing and publication: A threat to the integrity of science

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Abstract

The reliability of publication affects evidence-based science. In recent years, science has come under increasing scrutiny for its trustworthiness because of the misconduct of a few researchers, authors, and publishers involved in the unethical behaviour of research writing and publication. There has been an exponential increase in research output worldwide, and many publications are of questionable credibility due to "Paper Mills." These are profit-oriented, illegal, and unethical organisations working in the shadow to produce papers on demand, or sell readymade papers for a price. All stakeholders: researchers, authors, readers, journal publishers, and all of the academia need to be aware of "Paper Mills" to minimise scientific misconduct.

Key words: Accountability; Integrity of science; Paper mills; Research publication; Scientific misconduct.

INTRODUCTION

In the world of scientific research writing and publication, the Paper Mills (PMs) are known as profit-oriented, unofficial, illegal, and unethical organisations. A PM works in the shadow, as a company that produces scientific papers on-demand. They sell the articles, often to the authors who pay for a quick-fix to have papers published on their names to fulfil the criteria to complete their academic degrees and/or the requirements of academia/employer for recruitments and promotions. The PMs often have a system in place to handle the administrative work. They 'manufacture' the paper, submit it to the journals for review and see-through the publication process, or simply sell the authorships to researchers once the article is accepted for publication.[1-6]

This viewpoint aims to discuss relevant information available about "Paper Mills", its impact on the integrity of science, how and why, authors are attracted to PMs, and the measures for the control of this unethical business by increasing awareness of authors, journals, academia, and society.

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DISCUSSION

The "Paper Mills" in research writing and publication

The "Paper Mills" are known to manufacture research articles for a certain fee, functioning underground, potentially illegally and disregarding the ethical research and publication practices, to fulfil the requirement of authors who simply wish for a short-cut.[1,2] The PMs can manufacture customised articles to meet the requirement of authors and also the journals. They often use 'cooked-up data or images, often plagiarise from published articles. Committee on Publication Ethics (COPE) considers PMs as a significant ethical problem.[2] Demands from academia and research institutes, combined with the greed of authors to publish in so-called international and high impact factor (IF) journals

are some of the reasons for the mushrooming of PMs that functions in the 'underworld' making scientific research and publication a commodity that can be bought and sold.

Historically, PMs have been in the market for decades in many countries around the world. In the early 1980s, the New York Times published how the American colleges had to struggle to stop the purchase of term papers by students.[3] Recently a report on the unethical appropriation of others' research thesis, for a price, was found a thriving market in Nepal as well as the 'Xeroxed Knowledge'.[7]

Paper mills are a challenge for accountability of research and publication

The PMs are a challenge for journals and academia. Often it is difficult to verify the authenticity of the work because of the covert nature of this industry, without acknowledgement for their service, submission of papers with minor changes to several journals, which may lead to duplicate publication, salami slicing, or redundant publications.[8,9] The verification of data on articles from PMs may be time-consuming and challenging requiring software to open and analyse the files and compare with original sources. To add to the difficulties, the submitted paper may already be in the process of publication or already published before the investigation is complete. To strengthen the authors' accountability for the final work, all authors listed in the author byline of the manuscript are required to fulfil mandatory four-criteria and declare their individual contribution for the components of the paper as suggested by the International Committee of Medical Journal Editors (ICMJE).[8,10]

The PMs are highly adaptive and manipulative to adjust to the customised paper to meet the need of authors and requirements of journals. The reviewed ready-to-publish manuscripts for sale to the authors who are waiting to cut the corner, for example, pressure for academic promotion or graduation fuels the functioning of PMs.

The red flag signs of PMs articles may be similarity in layout, methodology, images, or figures that they submit to the same or different journals. Non-native English-speaking researchers seeking service from online companies operating in the name of 'language editing services, or medical writer' may be substantiated by reputable journals which charge a high article processing or publication charges (APC).[1,2,11] Though, such writing companies are registered and are often in the open and traceable, the shadowy PMs are not and provide services at a discounted rate to lure the authors. The requirement for an ORCID (open researcher and contributor IDentifier) is helpful to recognise the author and their affiliation as well as their contributions. However, creating the ID for submission is easy and it may not always be feasible and practical to demand a populated ORCID or an institutional email because it may restrict the researcher who switches jobs or retires from their institutes.[1,11, 12] Investigation for the increasing incidence of scientific misconducts is a difficult task for journals, and plagiarism (copy-pasting others' work), salami-slicing (publish multiple papers from same data source instead of incorporating into a single paper) are some 'tip of the iceberg' of scientific misconducts by authors, and of PMs.[13]

Authors attraction for "Paper Mills"

The "publish or perish" and the rewards (monetary or academic) of publications are the important drivers for seeking services from PMs and for scientific misconducts.[8,14]

The PMs often misuse the ICMJE guidelines for inappropriate attributions of authorship.[15] The shadowy publication, for example, ghostwriting is infamously prevalent in the pharmaceutical industry's research and publication. A healthy collaboration of the industry for research is important for funding and generating new evidence. But, academia and journals should be careful from manipulations by or from the industry collaboration. In such collaboration, industry often promotes the research as if it has come from academics and not from the industry itself by manipulation and funding to cover-up and pass on the accountability, responsibility, authority of intellectual contribution to the academics in disguise of ICMJE guideline. Here, the use of a ghostwriter (industry appointed) for the guest authorship (the academics) requires scrutiny. Complete disclosure of finance, planning, and full, permanent data access (not only during trial) to academic authors may help curb ghost authorship and guest authorship.[10] It may be helpful to list industry or company as authors, to bear the accountability.[15] For example the listing of the world health organisation (WHO) or professional society as an author in the scientific publications is a good example. The PMs simply do not follow the basic requirements for accountability and transparency.

It is often difficult for journals and reviewers to detect on-demand custom-made manuscripts, because of the manipulation and the dark side of the digital world.[9] The PMs may exist hidden in reputable organisations

like contract research, manuscript editing companies, or publishers which adds difficulty to detect.[16] All these add burden and responsibility to the journals to select and ensure the quality of knowledge and evidence that goes into publication.

The role of academia and government in controlling "Paper Mills"

With the ever-increasing volume and velocity of publications globally, and the traditional concepts of metrics used to measure academic success need a re-look. The decision-making in academia, the importance given to the number of publications, citations, and IFs are some of the issues that have fuelled the development of PMs. The analysis of >120 million papers and >20,000 journals over the last century shows a compromise, and doubt the usefulness of citation-based metrics, the h-index, and the IF.[17] These 'numbers' used for rankings, success, and incentives for researchers, and also grading for the journals have contributed to the commercialisation and unhealthy competition possibly compromising the trust in science.[18] The targets set by academia for publications should look beyond the numbers, and focus more on building a culture for research publication, because "when a measure becomes a target, it ceases to be a good measure".[17]

The government has responsibility and can play a crucial role to control the PMs and misconducts. For example, the government issued Official Responses to the Academic Integrity Crisis and directives: the Five Codes of Conduct for Authors Who Publish in International Journals (2015); the Six codes of guidelines on the prevention and punishment of academic misconduct for colleges and universities (2016); and self-disciplinary ethical standards for science and technology workers (2017). The directives and codes have resulted in investigations and actions on academics to ban them from research, or disqualified or grants revoked.[19]

Scientific misconduct is a worrying phenomenon globally. There is a risk of reaching a point of no return when a critical mass of scientists may become untrustworthy, corrupting the science and losing the public trust, endangering humanity as a whole because of fraud and misconduct becoming norms.

The role of a journal to maintain the integrity of research publication

The assessment of publication, its integrity, and making scientific information useful for the public good is a slow process. The integrity of a scientific paper may be assessed by the use of an 11-item REAPPRAISED checklist: **R**esearch Governance, **E**thics, **A**uthorship, **P**roductivity, **P**lagiarism, **R**esearch Conduct, **A**nalysis and Methods, **I**mage Manipulation, **S**tatistics and Data, **E**rrors, **D**ata Duplication and Reporting containing 58 components.[20] This checklist is also helpful for the researchers and authors to avoid falling prey to predatory journals.[20] The peer-review system despite its complexities continues to help maintain the integrity of the publication to some extent.

The administration and government plays important role in maintaining trust in science and scientific integrity. A recent survey of 63,000 federal scientists in the United States from 16 federal agencies on scientific integrity indicated that scientists perceived loss of scientific integrity under the Trump Administration. The survey points out the undue political interference in scientific work and the important role a government should play to maintain public awareness and trust to maintain scientific integrity.[21] Government involvement in the alleged manipulation of information for public understanding leads to a climate of denial and trust in science.

Scientific misconduct in research, writing, and publication is a global concern for all: the readers, editors, institutions, and society.[22] Once published, it requires a lengthy process and a long time to correct the misconduct, for example, the retraction of a fraudulent article. By the time of correction, the misinformation is spread and the damage is already done, including care for the patients by the questionable evidence. Only a fraction of articles gets retracted. Even after retraction, these articles continue to be cited further spreading the misinformation as per Retraction Watch which tracks retractions of published articles.[23] The retracted article should not be cited. Even if it is cited, the author should take responsibility to meticulously check for retractions, and explain why such article is cited (to convince the reviewers and editors), and mention clearly for the retraction in the text and also in the reference list.[24] This is interesting to note that among 10 highly cited articles (all in high IF Web of Science journals as of December 2020) received large numbers of citations after retraction. The damage control and process for tackling misconduct in research and publication is a complex process, for example, the number-two most cited paper (in Lancet) received 642 citations post-retraction (compared to 780 citations pre-retraction).[25]

The PMs by copy-pasting and aggregating the text, images from published sources adds to the list of fraudulent publications.

The "Paper Mills" vs. medical writing companies

In contrast to PMs, professional medical writers are usually competent and aware of the scientific guidelines for ethical conduct. The authors, be junior or senior academics, with or without experience in writing, may use the help from medical writers in a transparent way with acknowledgment and declaration for such help. Both the medical writers and authors have access to relevant data in line with ethical standards, unlike ghost writing. The utilisation of services from medical writers is more common for industry-sponsored research than non-industry-sponsored research. The PMs differ here from medical writers because they do not follow any ethics of research writing and publication.

Almost two-thirds of the researches go unpublished due to the lack of time or expertise of the researchers. Getting help from medical writers by the authors is a healthy practice. The Joint Position Statement by American Medical Writers Association (AMWA), European Medical Writers Association (EMWA), and International Society Medical Publication Professionals (ISMPP) have clear statements and checklists on publications and peer review to maintain public trust in science.[26] The Australasian Medical Writers Association (AMWA), Indian Medical Writers Association (IMWA), and Chinese Medical Writers Community (CMWC) all provide a forum for medical writers to share knowledge and experience, to promote professional development and standards of documentation, by offering medical writing training. The transparency and legally registered companies of medical writing differ from shadowy PMs which function in underground similar to illegal underworld markets.

The way forward for control of "Paper Mills"

The way forward to address the issues of PMs and ways to control them is the responsibility of all concerned: the authors, the journals, the publishers, and the society at large. Making money at all costs may directly or indirectly fuel the promotion of PMs. Predatory journals and mushrooming of journal publishers try to cash on the 'publish or perish' psychology and often for undue profit. They put the scientific content and ethics on the sideline. Journal publishing has emerged as a multi-billion business, for example, the Elsevier's[27] earning can be compared to Google and other flourishing businesses. Elsevier's grosses up to 36% profit margin which is higher than Apple, Google, Amazon, etc. It is no exaggeration that the highly profitable business of publishing medical research has fuelled unethical practices. A highly skilled scientist submits their paper to a journal agreeing not to submit it elsewhere, and also transfer the copyright to the journal and are required to pay a hefty fee for publication (unlike other writers who are paid for their work). On top of it, the expert scientists who peer-review the manuscript for the journal also provide the service for free as a contribution to the development of science. This business model seems to be the exploitation of scientist and their work.

Open access (OA) publishing has its merit for research findings to be available to the general public without a paywall. But again, in most of the medical studies, be drug development or vaccine, there are volunteer participants, there are article processing charges (APC) and yet the journals get free peer-reviews. The majority of research work and articles are not funded which creates a huge burden to the clinician-cum-researcher especially from low- and middle-income countries (LMIC, even if there may be an offer of peanuts of discounts!

Clinical research findings should be made free to publish and access, especially for the reporting of practice guidelines and checklists. This may also minimise replication and redundancy. Even after charging a hefty APC, the figures, tables, checklists (in a guideline) are not accessible due to various copyright jargons (alien to most readers and users). For example, the Creative Commons Attribution (CC BY) which allows to "distribute, remix, adapt, and build upon the work, as long as it is credited to the original creation", various terms are confusing, like 'CC BY – NC' (non-commercial) or 'CC BY – ND' (not allowing any derivative works) adds to the complexity (by shrewd commercial interest in the name of copyright).[28] The gold and green model of OA publishing collect a fee (from APC) which is diverted to publishers and repositories (e.g. PubMed).[29] This is interesting why scientific researchers/ authors are forced to pay APC in contrast to other writers who are paid for their writing and publication of their work.

The PMs and predatory journals somehow take benefit and lure authors with the attraction of flexible and lower fees. The fees are often hidden compared to the mainstream journals. A change is necessary to force the commercial interests of publishing houses to take a backseat. The scholarly publication should be re-established for a scholarly exchange as the main focus for the common good of mankind globally. Authors and academia from LMIC also need to strengthen their local/ national journals and get out of the colonial mentality to link publishing in international journals as prestige, and not fall prey to the PMs.

More effort is required to establish an ethics-based culture of research writing and publication, from the early stage of undergraduate schools to address the need of 'physician scientists'.[30] These physician-scientists, besides being good clinicians can engage in clinical research to generate the local evidence which may be more relevant for the population for the available resources and sociodemographic rather than blindly following the guidelines and evidence generated from resource-rich countries.

CONCLUSION

Science relies on trust, the reliable evidence which can be verified. The "Paper Mills" are profit-oriented, unethical organisations working underground in the shadow to produce papers on demand, or sell readymade papers for a price. All stakeholders, researchers, authors, academia, and journal publishers need to be aware of PMs. The PMs, like other underworlds, must not become the answer for the legitimate work of scientific research and publication.

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