UNITED2ACT AGAINST PAPER MILLS

A joint project from COPE STM

United2Act

Working Group 1: Education and awareness

A group of international stakeholders working collaboratively to address the collective challenge of paper mills in scholarly publishing

Feedback

This draft slide deck is presented by **United2Act Working Group 1: Education and Awareness**, aiming to create new educational tools and resources to make authors, researchers, institutions, funders, publishers, editors, and the general public aware of the problem of paper mills, and how we can fight against it together.

Here we present the content that training material will be based on. Some concepts are repeated, tailored to different audiences.

We welcome feedback on this content. The next step will be to develop it into training material for the different stakeholder audiences.

Please email feedback to **contact@united2act.org**

Content

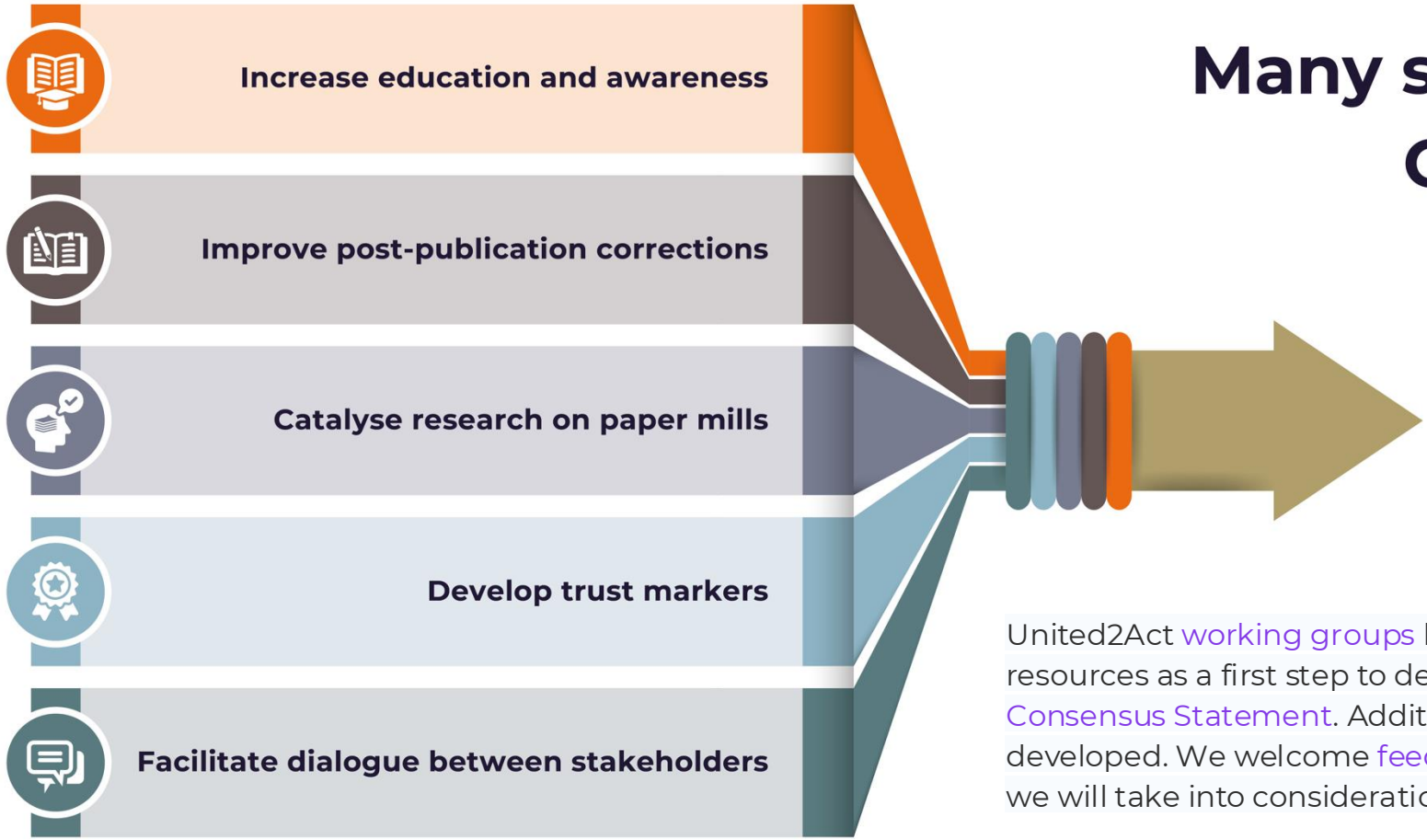
Background

United2Act is committed to addressing the collective challenge of paper mills in scholarly publishing.

Paper mills are a real threat to the integrity of the scholarly record. Collective effort is needed because no individual stakeholder can solve this problem alone.

This content combines knowledge and perspectives from the different stakeholders on the Working Group.

Background



Many stakeholders
One purpose

United2Act working groups have prepared a number of draft resources as a first step to delivering on the actions in the Consensus Statement. Additional resources are also being developed. We welcome feedback on these drafts, which we will take into consideration for final revised versions.

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Paper mills: the essentials

The following slides are intended to educate the community on the hallmarks of paper mills, how they operate, and paper mill detection as well as a multi-stakeholder view on the consequences of paper mills and overall risk to the scientific community at large.

The What, How, Who, Where and Why of paper mills

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What	What are paper mills and predatory publishing?
How	How do paper mills work?
Who	Who is responsible for operating paper mills?
Where	Where do paper mills operate?
Which	Which research fields are targeted by paper mills?

What are paper mills?

> **Paper mills are organisations or individuals that aim to profit from the creation, sale, peer review and/or citation of manuscripts at scale which contain low value or fraudulent content and/or authorship, with the aim of publication in scholarly journals.**

Definition by United2Act Working Group 5: Facilitate dialogue between stakeholders

Further reading: https://publicationethics.org/sites/default/files/paper-mills-cope-stm-research-report.pdf (2)

What is predatory publishing?

Predatory publishing

Predatory journals and publishers are entities that:

- Prioritise self-interest at the expense of scholarship
- Are characterized by:
  - false or misleading information on their websites
  - deviation from best editorial and publication practices
  - a lack of transparency about their processes and charges
  - the use of aggressive and indiscriminate solicitation practices

Predatory journals are distinct entities which may be created as part of paper mill related activity or in collaboration with paper mills.

They are part of a spectrum of behaviours that may be considered predatory practices *(3, 4, 5)*

How paper mills work

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Paper mills evolve to find new ways to attract and generate manuscripts and 'customers'

So that they

Guarantee publication

and

Collect payment

To achieve this they might

- Fabricate manuscripts (e.g., using generative AI tools)
- Call for papers for a special issue (which can be legitimate or fabricated)
- Call for papers for a fake conference (which can be legitimate or fabricated)
- Pretend to be an editing agency
- Blatantly or covertly advertise their services on social media.

To achieve this they might

- Recruit guest editors for special issues (who accept paid-for manuscripts) usually by direct unsolicited emails
- Bribe regular editors to accept paid-for manuscripts
- Bribe/coerce publishing staff to accept manuscripts
- Manipulate peer review e.g., by fabricating reviewer email addresses
- Creating networks of individuals who intercite/review/edit manuscripts and articles.

- For guaranteed publication in a legitimate journal
- For authorship
- May collect payment for other activities such as adding citations for other researchers.

How paper mills are identified: stakeholder perspectives

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Institutions/ROI's

It is not easy to detect if a researcher has used a paper mill for scholarly publishing, however assessments of potential research misconduct show common features such as "tortured phrases" and image manipulation

Researchers

Researchers might realise that paper mills are approaching them via advertisements on social media.

Or they might become aware of paper mill activity amongst their peers via word of mouth.

Innocent researchers may unwittingly become involved in paper mill activity.

Journals and publishers

Journals and publishers identify paper mills via:

- Readers or 'sleuths' who identify suspicious features in published content.
- Their own internal quality control mechanisms which detect suspicious features in submitted manuscripts.

This is increasingly being done via the use of automated AI and non-AI based tools.

Who is behind paper mills?

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Large global commercial entities dedicated entirely to paper mill activity that involve thousands of people

Agencies that openly seem legitimate but covertly paper mill services on a large scale.

Groups of researchers at institutions selling paper mill services on a small or large scale.

Individuals selling manuscripts or authorship on a small scale.

Where do paper mills operate?

- Paper mills operate in areas where there is a huge pressure to publish in order to obtain jobs, funding and promotions and also where there are cash incentives to produce publications *[13].*

- Researchers who buy authorship from paper mills appear to come from around the world *[2].*

Which research fields are particular targets of paper mills?

- Paper mills target a broad range of research fields including, genetics, oncology, pharmacology, *[8, 11, 12],* computer sciences, nanotechnology, law, economics and many more.

- Researchers key factors seem to be fields where images are easy to fabricate, such as Western blots and histological images, and fields where there is no quantitative data collection so the content can be easy to generate using generative artificial intelligence based tools.

- However, any field of research is at risk of becoming a target for paper mills.

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Paper mill consequences: stakeholder perspectives

The following slides are intended to demonstrate potential consequences of paper mill activity across different stakeholder groups. Fictional scenarios have been posed to illustrate the ways in which paper mills can affect people, organisations, and even nations throughout the scholarly publishing community.

Consequences of paper mills for society

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For research and society as a whole: paper mills undermine the principles of honesty, integrity, rigor, transparency, fairness, respect, accountability and promotion. They:

- **Contaminate the published literature with false and fabricated ‘research’**
- **Waste time and resources**
- **Can have real world dangerous consequences. For example, fabricated medical research which can inform medical practice may harm patients**

Ultimately, they lead to a general erosion of trust in academia and scholarly institutions.

Consequences of paper mills for stakeholders

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Funders

Unchecked, paper mills can lead to misallocation of research funding, faulty policy decisions based on incorrect data. Addressing this issue ensures that research funding is used effectively and that policy decisions are based on accurate and reliable evidence (also applies to govt, for publicly funded research).

Institutions/ROI's

Recognized as a serious breach of research integrity and codes which can jeopardise current and future funding and grants.

Reputational damage, affecting rankings, partnerships, collaborations with industry & government.

Publishers

Retractions/Mass retractions. Can slow down the review/ publication process for all submissions due to added checks/assessment/amount concerning material. Uses up editor/reviewer time on unreliable material. Increased scrutiny = increased workload. Reputational damage & Financial implications (company value).

Governments/policy makers

The spread of low-quality or fraudulent content wastes resources and misguides other researchers, policymakers, and the public. Academic fraud leads to financial loss and inefficiency, harms governmental efforts and public trust.

Researchers

Disciplinary actions, including loss of position and/or funding. A shortcut to perceived success will result in a lack of essential skills – critical thinking, research and writing abilities, which in turn will hinder future personal development. Output from paper mills cannot be relied upon, affecting the integrity of cited research and subsequent publications, likely to result in retractions. Impact on honest researchers likely to inadvertently fall victim to these consequences.

Consequences of paper mills for stakeholders

We present a fictionalised illustration of the ways in which paper mills can affect people, organisations and even nations throughout the scholarly publishing community.

A case is presented showing the consequences for:

Researchers

Publishers

Institutions/ ROI's

Funders

Government and policy makers

Consequences: the researcher

The researcher

An early career researcher entering the second year of their postdoctoral work is thinking about applying for their next role. With four papers published since their PhD, they do not feel that they will be a competitive candidate in their field of study. After speaking to a colleague about their concerns, they are told about a website which guarantees quick publications in reputable journals. Feeling as though they have no other option, they use the service and pay for an authorship slot on a paper. To the researcher's delight, the manuscript is quickly published in *Journal A*. Feeling positive about the experience and wanting to further improve their career opportunities, they buy authorship on a second paper.

Following a successful job application, the researcher is offered a new role. In advance of them starting, though, they are contacted by *Journal A* who have concerns about the published papers. Unable to provide the data for the articles during the journal's investigation, both of the researcher's papers are retracted in quick succession, with compromised peer review mentioned in the retraction notices amongst other issues. Soon after, an article appears in *Retraction Watch* about *Journal A* and it was clear the researcher was involved in paper mill activity.

The researcher is contacted by their new employer and told that unfortunately they didn't get the job, following reference checks. With the end of their current role now imminent, the researcher applies for anything that is available, but to no avail. The researcher wasn't aware that involvement in paper mill activity could affect their future opportunities.

Consequences: the publisher

The publisher

The publisher of *Journal A* first hears of the potential problem with the researcher's article when they are contacted by a reader. This reader has concerns that a number of unrelated articles published in this journal and several others, contain unexpected similarities and suspicious patterns. The publisher reviews the researcher's paper and all the other unrelated articles, as well as the peer review process for each as part of their initial investigation. Inconsistent authorship, untraceable data and violation of ethical standards within the papers and a pattern of irregular and concerning reviewer activity including citation manipulation were detected; the combination of these signals suggest paper mill involvement.

A number of seemingly compromised authors and reviewers are identified as a result. Further cross-checking by the publisher reveals that a number of these reviewers had also been reviewers and/or editors of other journals containing similar concerning features. The publisher launches a wider investigation across their portfolio and identifies systematic manipulation that led to the publication of hundreds of articles across several different journals. As a result the journal processes the retraction of hundreds of articles across multiple journals with more retractions anticipated as ongoing investigations generate more leads that require investigation.

The consequences of this are significant to both revenue and reputation. This incident attracts a lot of negative attention from many different scholarly and mainstream media organisations and the publisher has faced a significant amount of criticism from various parties. The publisher has had to close two journals, directly as a result of reputational damage caused by this paper mill activity. Additional journals faced scrutiny from various global indexation services and following re-evaluation, those that did not pass the quality criteria for indexing were delisted. Immediately after the retractions are announced, the publisher sees a drop in the number of submissions, and the submission numbers have still not recovered. Since this incident, the publisher has invested significant resources towards hiring additional ethics specialists, evaluating new detection and screening technologies, and implementing revised policies to further safeguard journal processes and published content. The publisher is also dedicating time and expertise and sharing technology and learnings with other publishers and stakeholders to better address the issue of paper mills at the industry level.

Consequences: the institution

The Research Integrity Office (ROI)

The Research Integrity Office (RIO) at the researcher's university is notified of the potential problem with the researcher's work by the publisher. The RIO starts a formal investigation into the allegations, undertaking a document review, conducting interviews, and engaging a forensic linguist to examine the writing style of the publications in question compared to the researcher's other work. After a substantial period of time the investigation concludes that the researcher had used a research paper mill to produce two publications. The key findings include inconsistent authorship, untraceable data and violation of ethical standards.

The RIO provides a summary of their findings to the publisher who uses them to inform their decision to retract these and many other papers. The university referred the researcher to a research misconduct investigation panel (made up of academics external to the university). At the conclusion of the investigation the panel determined that a serious research misconduct breach had occurred and the researcher was referred to the University's HR processes for disciplinary action. The publicity caused by the incident causes significant reputational damage to the university, who face scrutiny from the academic community for failing to detect the misconduct. In response to this case, the university implements several new policies to reduce likelihood of similar incidents in the future. This includes more rigorous oversight of research data collection and verification, mandatory ethics training for all staff, and stricter monitoring of publication practices.

Consequences: the funder

The funder

The medical research charity, who funded the research project the researcher was working on, is alerted by the university that an investigation had been launched and the article, citing their funding as a source, has been retracted.

The charity had previously featured the researcher in its communications, promoting the project as a testament to the charity's commitment to fostering early-career researchers. The retraction triggered shockwaves through the charity's network. Beyond the immediate embarrassment, the retractions raised questions about the charity's due diligence and oversight mechanisms. Other research funders, observing the charity's predicament, expressed concerns over the reliability of the charity's funded research outcomes. They feared that association with the charity and their projects might put their own reputations at risk. Some funders considered tightening their collaboration terms with the charity or refraining from future partnerships until the charity could demonstrate stronger vetting processes.

Donors, who had contributed with the understanding that their funds would support credible and impactful research, began voicing concerns. Many questioned how thoroughly the charity vetted their awardees and ensured research quality. The retraction left them worried about potential future misuse of donations. Large corporate sponsors and government partners raised inquiries about the charity's evaluation criteria and the rigour of their quality assurance measures.

The scandal surrounding the retracted articles quickly became public. News outlets picked up the story, sparking conversations on social media about the oversight of charity-funded research. The charity experienced a surge in inquiries from concerned citizens, some of whom were long-time supporters. Public trust, once a bedrock of the charity's operations, was under threat. The scandal began affecting not just the charity who funded the research but also the general public's confidence in research funded by charities, and in medical research more broadly.

Consequences: the government and policy makers

The government and policy makers

This was not an isolated incident - far from it. Although the full extent of the issue remains unclear, the government believes that many papers authored within the country have been as a result of this fraudulent practice. Unfortunately, before the issue came to light, several new government policies had already been introduced, based on falsified research.

The Ministry of Health adopted a treatment for a new respiratory disease based on fraudulent studies. After six months, the treatment was found to be both ineffective and dangerous, triggering a public health crisis. The government wasted resources on the ineffective treatment, delaying the proper response and causing misallocation of funds. The exposure of fraudulent research undermined trust in scientific recommendations. Public scepticism toward medical experts grew, and many ignored the guidance issued for vaccine campaigns.

The country's once-renowned universities also faced reputational damage, In response, the government introduced new policies to tighten research oversight, inadvertently slowing down legitimate research.

Further damage occurred when fraudulent studies on water filtration technology compromised public safety, allowing contaminated water to reach rural areas causing widespread disease. Similarly, fraudulent research on solar energy led to failed projects, causing economic losses and a decline in the country's competitive advantage in green technology.

Internationally, the nation's credibility was severely damaged, hindering collaboration on pressing issues including climate change and public health. Other countries began to question the reliability of the country's scientific data, undermining joint initiatives and global agreements.

Ultimately, the government's ability to make informed, evidence-based decisions was compromised – resulting in far-reaching consequences: public health crises, economic setbacks, loss of international standing and an erosion of public trust in science.

Paper mills: guidance for authors

The following slides are intended to help educate authors on the hallmarks of paper mills, potential consequences of engaging with paper mills (professionally and to the scientific community), and steps an author can take to protect themselves.

Ethical authorship

- Researchers publish their work in peer reviewed journals to establish provenance, share findings, advance careers and reputations
- Authorship order can be by contribution or alphabetical
- Journals require author contribution statements in the manuscript to check eligibility
- Any changes to authorship require written justification and approval from all co-authors; journal editors will review requests to ensure compliance with authorship policies
- Accepted manuscripts are published, and may impact decisions about, for example, qualifications, job opportunities, funding

While paper mills are commonly thought to exploit author-pays model, they also often target subscription journals as well. They exploit the pressure to publish and authors who need publications. They can damage all aspects of ethical authorship.

Why would authors use paper mills?

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Why would authors risk using these methods to obtain publications?

- Immense pressure to publish on researchers is found across many disciplines and countries
- Many institutions link qualifications, promotions, job opportunities, funding and even monetary bonuses to publications and their perceived impact (e.g. citations garnered or an author's h-index)
- Some individuals, especially those early in their career, may not recognise the problem, and use paper mills without realising the implications
- Others may choose to take the risk for the perceived gains

Why are paper mills a problem for the literature?

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There are a variety of serious problems with paper mills.

- Very poor quality or fraudulent manuscripts contaminate the scholarly literature
  - Fabricated or stolen data
  - Nonsense text
  - Violations of ethics and integrity
  - Has effects on meta-analyses and literature reviews

- The principles of authorship and accountability are undermined

- Fraudulent interference with the review process – fake identities, accounts, reviews
  - The integrity of an entire journal can be damaged

All of this undermines the trust in the scholarly record. There can be consequences for future research, wasted funding, safety and even human health and policy.

Why are paper mills a problem for authors?

In addition, there can be serious consequences for the publications arising from the use of paper mills:

- Manuscripts are unlikely to be published in good quality, reputable journals. Any that do reach publication are likely to be debunked by publishing teams, readers and data sleuths, resulting in:
  - Manuscript investigations
  - Corrections to the scholarly record post-publication, including retractions and expressions of concern
  - Rejection of manuscript pre-publication
  - Institutions and funding bodies being notified of potential misconduct for their own investigations

- Paper mills will often work with predatory journals as these will publish fabricated manuscripts more easily
  - Charges for paper mills and predatory journals can escalate the costs rapidly
  - Retraction less likely, but the publication may not be recognised as legitimate
  - Withdrawal often not possible meaning any legitimate results cannot be submitted elsewhere

Why are paper mills a problem for authors?

In turn, this can have serious consequences for the authors and their careers:

- Publication of poor quality or fabricated work will not build an author's reputation or career and is likely to have repercussions for the authors

- There are possible institutional consequences for any benefits obtained fraudulently:
  - qualifications can be revoked
  - promotions can be removed
  - monetary bonuses and grant funding can be recouped
  - a tarnished reputation can prevent future employment in the field

This can negatively impact an author's reputation, with potential consequences for their credibility, collaborations, career and funding.

Spotting paper mill offers

Ethical researchers will not want to take the risk of damaging their reputation and future career by seeking out paper mill companies. However, they should be aware of the signs of paper mill offers.

What are some of the hallmarks of a fraudulent offer?

- Advertise primarily online
- Guaranteed publication
- Guaranteed citations
- Offer of authorship or citations for a fee
- Choice of position in authorship list
- May offer a manuscript to the author as-is
- May offer to take manuscript through submission and publication process
- May offer authorship on a manuscript which is already accepted for publication

Spotting predatory publisher offers

Predatory publishers publish poor quality manuscripts with little or no peer review, and so are the perfect venue for paper mill output.

What are some of the hallmarks of a predatory publisher?

- High volume of unsolicited emails with poor spelling/grammar
- Very rapid publication offered
- Unclear costs of publication
- Websites may have claims of indexing and citation metrics without evidence
- Policies and processes not included or unclear
- Editorial board members may not be listed, or not known names in the field

What can authors do to protect themselves?

Most importantly, do not deliberately choose to use paper mills or predatory publishers

- Avoid advertisements which offer authorship or a manuscript in return for a fee
- Take care and be vigilant with emails which solicit content
- Use **the Think.Check.Submit. checklist** for the full list of warning signs of predatory publishers
- Check journal websites and author guidelines carefully, and research journals not previously used before submitting
- Check conferences carefully when considering where to submit abstracts, posters etc. Use the **Think.Check.Attend. checklist**
- Consult your institution if you are worried you may have used a predatory publisher by accident

Paper mills: guidance for editors and publishers

There is COPE guidance for editors and publishers on how to detect and manage paper mills. The following slide references those resources.

Paper mills: guidance for editors and publishers

COPE Position Statement	 Statement	https://publicationethics.org/cope-position-statements/paper-mills
Systematic manipulation of the publication process	 Discussion/flowchart	https://publicationethics.org/resources/flowcharts/systematic-manipulation-publication-process
Addressing concerns about systematic manipulation of the publication process	 Discussion/flowchart	https://publicationethics.org/resources/flowcharts/multi-article-paper-mill
Paper mills research	 Research report	https://publicationethics.org/resources/research/paper-mills-research
Practical steps for managing paper mills	 Webinar	https://publicationethics.org/resources/seminars-and-webinars/managing-paper-mills

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Paper mill investigations: a collaborative effort

The following slides are intended to provide guidance around paper mill investigations and the collaborative efforts required between Publishers, Institutions/Research Integrity Offices, and Funding Bodies to resolve investigations and take appropriate corrective - and preventative - measures.

A multi-stakeholder problem

Publication of content generated by paper mills can negatively affect the reputations of journals, publishers, researchers, institutions, and ultimately affects the public's trust in the scholarly record.

Institutions/ ROI's

Government and policy makers

Researchers

Publishers

Funding Bodies

Recent identification of large numbers of papers originating from paper mills highlights the pervasiveness of this problem and has been the impetus for all stakeholders to work together to mitigate – and proactively safeguard against – paper mill activity.

Publisher and Institution Collaboration is Critical

Investigations into paper mills have identified three primary areas in which collaboration between journals, publishers, and institutions is critical towards ensuring timely and efficient resolution and correction(s) to the scientific record.

IDENTITY VALIDATION

RESEARCH DATA VALIDATION

PEER REVIEW MANIPULATION

Identity Validation

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Investigative Hallmarks

- Paper mill services often coordinate manuscript submission through peer review at which point one or more positions within the author list are sold and added onto the paper.
- In some instances, affiliations are also deliberately misrepresented.
- In other scenarios, fictitious identities and/or stolen identities may be utilized (e.g. fake reviewer and/or Guest Editor profiles and accounts).

Collaborative Verification

- Confirm an individual's affiliation with a particular lab, department, institution, etc.
- Verify if research described was carried out at their institution
- Validate that the manuscript scope/content aligns with the individual's area of research
- Provide evidence of collaborations with co-authors (e.g. grant applications)
- Investigate email account creation (i.e. where institution emails have been potentially sold to or compromised by a paper mill)

Recommendations

- Requirement of use of ORCIDs and Institute/Researcher collaboration with ORCID to validate affiliation records
- Researcher declaration of all secondary affiliations with the Institution
- Regular review of Institution affiliated publications and authors to identify implausible publication and citation records
- Encourage use of preprints
- Development/enforcement of policies around accountability (e.g. misrepresenting institution)
- Review of manuscript retractions to determine if investigation/action is needed at institute level
- Reconsider reward schema that may encourage bought authorship

Research Data Validation

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Investigative Hallmarks

- Paper mills may fabricate entire articles to appear genuine, for example using stock images or plagiarizing genuine research, or they may utilize manipulated, falsified or entirely fabricated images and/or data in publications.

Collaborative Verification

- Equipment validation
- Raw data and/or image files
- Statement signed by institute representative which gave approval (e.g. IRB), in instances where data cannot be shared

Recommendations

- Encourage open science practices that support the provenance of the manuscript and underlying work (e.g. pre-registration, data sharing, sharing notebooks and previous manuscript versions).
- Provide education on appropriate image adjustments & transparent declaration thereof

Peer Review Manipulation

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Investigative Hallmarks

Paper mills may provide payment to (guest) editors in exchange for:

- manipulation of the peer review process (e.g. use of fake reviewer reports), or for the
- allowance of or participation in citation manipulation (eg citation prompting, coercive citation, citation stacking, etc.)

Collaborative Verification

- Publishers may contact institutions to inform them of apparent concerns with the behaviour of an individual affiliated at their institution.
- The concerns may relate to their behaviour in their capacity as author, editorial team member, and/or reviewer.
- It is unlikely that a publisher would require any information in return from the institution; although they should be informed if the individual in question is in fact not affiliated with the institution.

Recommendations

Citation Misconduct:

- Review publication profiles during career reviews (e.g. tenure), hiring, etc. to identify prolific citation profiles, especially excessive self-citation
- Reconsider reward schema that may encourage citation manipulation

General:

- Educational outreach, especially to Early Career Researchers (eg how to provide a good peer-review)

What's at stake?

In addition to the negative effects on the public's trust in the scholarly record, outcomes of paper mill investigations may result in different intended and unintended consequences:

IDENTITY VALIDATION

RESEARCH DATA VALIDATION

PEER REVIEW MANIPULATION

- Manuscript retraction, or rejection of in-progress manuscripts
- Ineligibility to serve on editorial board team or as a reviewer
- Consideration for inclusion on STMJ watch-list

- Reputational risk/impact on institution
- Possible impact on career progression

- Notification to funding bodies and potential for funding to be revoked

References & Further Reading

References and further reading

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