Recommendations from the RISRS Report: Reducing the Inadvertent Spread of Retracted Science

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Research

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Recommendations from the RISRS Report: Reducing the Inadvertent Spread of Retracted Science

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Abstract

Background: Retraction is a mechanism for alerting readers to unreliable material, effectively removing from the published scientific and scholarly record articles that are deemed to be seriously flawed. Research over the past decade has identified a number of factors contributing to the unintentional spread of retracted research. The goal of the Reducing the Inadvertent Spread of Retracted Science: Shaping a Research and Implementation Agenda (RISRS) project is to develop an actionable agenda for reducing the inadvertent spread of retracted science. This includes identifying how the gatekeepers of scientific publications can monitor and disseminate retraction status and determining what other actions are feasible and relevant.

Methods: These recommendations were developed as part of a year-long process that included an exploratory environment scan, a scoping review of empirical literature, and successive

rounds of stakeholder consultation, culminating in a three-part online workshop that brought together a diverse body of 70 stakeholders in October-November 2020 to engage in collaborative problem solving and dialogue. Workshop discussions were seeded by materials derived from stakeholder interviews (N=47) and short original discussion pieces contributed by stakeholders. The online workshop resulted in a set of recommendations to address the complexities of retracted research throughout the scholarly communications ecosystem.

Results: The RISRS recommendations are:

1. Develop a systematic cross-industry approach to ensure the public availability of consistent, standardized, interoperable, and timely information about retractions.
2. Recommend a taxonomy of retraction categories/classifications and corresponding retraction metadata that can be adopted by all stakeholders.
3. Develop best practices for coordinating the retraction process to enable timely, fair, unbiased outcomes.
4. Educate stakeholders about publication correction processes including retraction and about pre- and post-publication stewardship of the scholarly record.

Conclusions:

The continued circulation of retracted research is an ecosystem problem. These recommendations focus on areas where stakeholders can collaborate to address the continued citation of retracted research. We have suggested particular actions for standards organizations, publishers, researchers, and research integrity organizations.

47 **Keywords:** retraction, publication ethics, citation, spread of retracted research, citation of
48 retracted research

Background

Retraction is a mechanism for alerting readers to unreliable material, effectively removing from the published scientific and scholarly record articles that are deemed to be seriously flawed whether due to misconduct or honest error. As noted in the Committee on Publication Ethics (COPE) Retraction Guidelines, retractions may also be used to address, “redundant publication, plagiarism, peer review manipulation, reuse of material or data without authorisation, copyright infringement or some other legal issue (e.g., libel, privacy, illegality), unethical research, and/or a failure to disclose a major competing interest that would have unduly influenced interpretations or recommendations” (1).

Research over the past decade has identified a number of factors contributing to the unintentional spread of retracted research. Many retracted papers are not marked as retracted on publisher and aggregator sites (2,3), and retracted articles may still be found in readers’ electronic libraries, including in reference management systems such as Zotero, EndNote, and Mendeley (4). Most publishers do not systematically surveil bibliographies of submitted manuscripts, and most editors do not query whether a citation to a retracted paper is justified. When citing retracted papers, authors frequently do not indicate retraction status in bibliographies or in-text citations.

A study of citations to retracted papers in PubMed found that only 5.4% of post-retraction citations acknowledged that the paper they were citing was retracted (5). A smaller study, focused on two retracted COVID-19 articles, found that 52.5% of citations did not acknowledge the fact that they were retracted despite the widespread media attention that these retractions received (6). In addition to spreading information without notifying readers that the source was

retracted, the citation of retracted papers can also impact the validity of the paper that is citing it, including meta-analyses that include retracted papers (7).

The goal of the Reducing the Inadvertent Spread of Retracted Science: Shaping a Research and Implementation Agenda (RISRS) project is to develop an actionable agenda for reducing the inadvertent spread of retracted science. This includes identifying how the gatekeepers of scientific publications can monitor and disseminate retraction status and determining what other actions are feasible and relevant.

Methods

The RISRS project has derived recommendations through a cross-sectoral consultation process. This year-long process included an exploratory environment scan, a scoping review of empirical literature¹, and successive rounds of stakeholder consultation², culminating in a three-part online workshop (October 26, November 9, and November 16, 2020) that brought together a diverse body of 70 stakeholders to engage in collaborative problem solving and dialogue. Workshop discussions were seeded by materials derived from stakeholder interviews (N=47) and short original discussion pieces contributed by stakeholders. The online workshop resulted in a set of recommendations to address the complexities of retracted research throughout the scholarly communications ecosystem. The team iteratively updated and developed recommendations through a series of surveys and drafts.

¹ See Appendix C: Literature Scoping Review Methods and Intermediate Results in (8) and the online bibliography <https://infoqualitylab.org/projects/risrs2020/bibliography/>

² See Appendix D: Stakeholder Consultation Process in (8). Workshop attendees are also listed on the project website: <https://infoqualitylab.org/projects/risrs2020/attendees>

94 RISRS Project Assumptions

95 Given the repeated attention to citation of retracted papers since the 1990's, (4,9–16), we knew
96 that the inadvertent spread of retracted science was a complicated and long-standing issue. We
97 started from the assumption that this was a “stuck” problem that would require collaboration
98 across diverse stakeholders and, possibly, systemic changes to the way people work across
99 scholarly communication.

100

101 We conceptualize scholarly communications as an ecosystem comprising the individuals,
102 institutions, and processes through which research is produced, packaged, managed,
103 disseminated, promoted, consumed, and preserved into something deemed the scholarly
104 record. Examples of individuals include publishers, editors, researchers, librarians, standards
105 developers, funding program officers, and technologists. Examples of institutions include
106 universities, government labs, funding bodies, publishing houses, libraries, technology
107 companies, standards organizations, infrastructure providers, and vendors. Examples of
108 processes include: submitting, peer reviewing, or accepting a manuscript; quality assurance;
109 typesetting; creating metadata; depositing data; curating research products; selling, licensing,
110 and acquiring books, journals, etc. These are embedded in material, social, and technical
111 processes, which we conceptualized as points of intervention. By working with stakeholders
112 from across the ecosystem, we endeavored to understand how people interact with retracted
113 research, and encouraged stakeholders to reflect on how these interactions could be
114 redesigned to interrupt the continued citation of retracted research in these chains of research
115 communications.

116 Scope

117 This report focuses on the continued citation and use of retracted research, where our scope is
118 primarily, but not exclusively, the continued citation and use of retracted research. Our
119 investigation at times strayed beyond *citation* and *use* alone. That is because, for many of the
120 sources and people we consulted, citation and use are intertwined with a much broader frame of
121 reference, including the goals, purpose, and meaning of retraction, and expectations regarding
122 its implementation, and other aspects.

123

124 Part of the work of this project has been to move from the widespread view of retraction as a
125 social problem to a common stakeholder agenda specifying the range of problems associated
126 with retracted research and its continued citation. Collaboration across major stakeholder
127 groups is challenged by lack of common agreement about the scope of the problem, or the
128 efficacy of strategies to address the issue. For example, retracted research is sometimes
129 framed as an issue of individual misconduct or accountability. Likewise the continued citation of
130 retracted research may be framed in terms of breakdowns in editing and publishing processes.
131 Such differences in aim and perspective lead to some tension about what is needed, and what
132 is possible. On the one hand, many interviewees called for substantive reform of the scientific
133 publishing ecosystem itself and its role in scientific careers. On the other hand, other
134 interviewees called for fine-tuning of current practices and processes in effect to optimize the
135 retraction process, and clarify the role of retraction in stewarding the scientific record. This
136 unresolved tension has limited efforts to build the will and capacity to address the continued
137 spread of retracted research.

138

139 Mitigating the effects of the continued spread of retracted research will require multiple types of
140 coordinated interventions. Multiple stakeholder communities and multiple areas of the scholarly

communications ecosystem are involved, and stakeholder groups are impacted by retracted research in differing ways. As many interviewees suggested, disseminating and adopting existing best practices will go a long way. Our review of the literature and interviews with stakeholders also identified some innovation problems that will require the development of new standards, policies, or norms. However, incentivizing change and building the will to address recognized issues is a persistent system-level issue in scholarly communication.

Results

These recommendations refer to cross-sectoral areas where action can be taken to address retracted research and its continued citation. Rather than target a particular sector, or problem, the recommendations below speak to multiple points in the scholarly communications ecosystem. We prioritize recommendations for which there exists momentum to address the issue, known examples that can be used to model standards or best practices, current technologies that can be adopted, and proposals for which there is existing or strong agreement.

1. Develop a Systematic Cross-industry Approach to Ensure the Public Availability of Consistent, Standardized, Interoperable, and Timely Information about Retractions.

Over 94% of post-retraction citations in biomedicine do not demonstrate awareness that the cited item was retracted (5). Users' typical citation workflows may involve citing preprints, reusing downloaded copies, citing older works contained in their reference managers, and copying citations from their own or others' previous bibliographies (4,17). Among citation styles, only the American Medical Association (18), National Library of Medicine (19), and American Psychological Association (20) styles provide explicit standards for citing retracted papers³

³ See Appendix E: Existing Citation Standards for Retracted Publications (8).

Among commonly used systems, only a handful of databases (such as PubMed and RetractionWatch) and tools built on them (such as Zotero and scite) ensure that users know that a paper they are citing is retracted.

Information about retraction needs to move across different industry information providers (publishers, abstracting and indexing services, scholarly search engines, etc.). However, currently this need is challenged by non-robust dissemination, inconsistent information, and inconsistent presentation of retraction status information (21–24).

Shared standards amongst publishers are necessary, but currently there are no industry-wide standards for retraction information or its visibility. The most widely accepted guidelines, from the Committee on Publication Ethics (COPE) (1) and the International Committee of Medical Journal Editors (ICMJE) (25), recommend how to make retraction information easy to use and find. However, they are not uniformly adopted. Although both are widely accepted by many publishing groups, particularly in medicine (26,27), previous research has found that publishers do not uniformly adhere to COPE and ICMJE recommendations (28–30) and that more consistent display standards are needed, particularly regarding uniformity in landing pages (22). In 2015, Retraction Watch also published its own standard for what a retraction notice should include, with more details than those of COPE and ICMJE (31).

Supporting and motivating stakeholders to consistently adopt and follow COPE and ICMJE recommendations for managing retracted articles and retraction notices is a baseline for further improvements. Beyond COPE and ICMJE recommendations, publishers should update procedures to add ‘Retracted’ to the titles of retracted articles.

A standards group should develop best practices for databases that facilitate the public and unrestricted access to and dissemination of retraction statuses and retraction notices. Processes, model license agreements, and standards for retraction data interchange are needed to facilitate information flow between publishers, aggregators, and database providers. Model license agreements could expand on established agreements such as the National Library of Medicine's participation agreement for deposit (32).

Sustainable funding sources are urgently needed for databases to facilitate the public and unrestricted access to and dissemination of retraction notices.⁴ At minimum, such databases should feature automated electronic means of data retrieval (e.g., Application Programming Interfaces (APIs)) to track and disseminate retraction statuses. Currently, the Retraction Watch Database is a licensable source of good quality, domain-independent data about retracted papers.

A standards group should convene a working group composed of reference and citation industry groups along with members from COPE, the National Information Standards Organization (NISO) etc. The working group should be charged with defining best practices addressing retraction and post publication amendments in citation styles and citation software; developing additional citation styles and standards for indicating the retraction or correction status of a paper in text and in a bibliography.

⁴ The difference between restricted access and unrestricted access, facilitated by funding, can be seen by comparing the Retraction Watch Database to PubMed. Retraction Watch is a public database with restricted access. Free public results are limited to 600 and license agreements are required for bulk use. Its funding has included grants, private donations, and licensing agreements. PubMed is a public database, free to users (completely funded by the United States government), with unrestricted access to and dissemination of retraction notices, but only in biomedicine. PubMed has an API but as of July 2021 the Retraction Watch Database does not.

Multiple stakeholders can play a part in adoption. Citation software developers should add features to flag retracted papers in their tools (e.g., EndNote, Mendeley, Paperpile, RefWorks, etc.); Zotero, which flags retracted papers based on DOIs in Retraction Watch Database data can be used as a model. Researchers should use citation software that flags retracted papers. Submission management platforms should integrate tools that enable systematic identification of retracted articles. Publishers should adopt software solutions that enable systematic identification of retracted articles in bibliographies prior to publication and check bibliographies for retracted paper as part of manuscript review and publishing workflows. Publishers should also invest in maintaining metadata, including promptly registering post-publication amendments with Crossmark (33), which became free to Crossref members in March 2020 (34).

2. Recommend a Taxonomy of Retraction Categories/Classifications and Corresponding Retraction Metadata that can be Adopted by All Stakeholders.

Retraction notices often provide vague or limited information about the reasons for retraction (28,35,36). People using retracted science and evaluating authors of retracted science demand additional context about retraction to both clean up the literature and disincentivize misconduct (37). Concerns about possible reputational damage and the risk of litigation can disincentivize the use of more fine-grained distinctions about reasons for retraction (38).

A working group composed of standards organizations, publishers, and metadata development organizations should work to develop a taxonomy of retraction categories and corresponding metadata standards in tandem. In order to ensure the taxonomy is viable over the long-term, it should be curated and maintained on a discoverable website with a formal home and be based in an industry standards organization such as the NISO or the International Association of Scientific, Technical and Medical Publishers (STM). The taxonomy should be integrated with existing versioning systems and include recommendations for how database records for

retraction should include the taxonomy term for when a retraction reason is implemented and adopted by journals. Finally, to ensure adoption, we recommend that highly visible organizations build support and influence through endorsement and adoption of the taxonomy and metadata standards, in order to support and motivate other stakeholders to adopt them.

Publishers, standards organizations, platforms, and infrastructure providers should collaborate to develop and support the use of persistent identifiers throughout the publishing ecosystem to enable audit-like functions to track amendments (39). To do this we suggest building off of the F1000 model, in which: “All versions of an article are accessible, each with their own DOI (digital object identifier) and may be cited individually. The most recent article version is displayed as the default, and older article versions display a clear notification that newer versions are available” (40).

3. Develop Best Practices for Coordinating the Retraction Process to Enable Timely, Fair, and Unbiased Outcomes.

The time between the publication of papers and their potential amendment or retraction is a period in which papers may be adopted, used, and woven into the tapestry of scholarship. This time has been as long as 45 years (PMID:1233443), but papers retracted quickly may also receive fewer post-retraction citations (5). Reducing the time to retraction is desirable to ensure the clear and timely communication of amendments to publications. Another danger is that compromised research is identified but fails to be retracted because of logistical complexity amongst all stakeholders involved in the retraction process. In these cases, failure to retract enables the continued citation of research that should have been retracted.

Existing guidelines acknowledge the problems related to time to retraction. For example, the COPE 2019 guidelines say: “Publications should be retracted as soon as possible after the

editor is convinced that the publication is seriously flawed, misleading, or falls into any of the categories described above.” However, stakeholders suggest that coordination amongst authors, co-authors, editors, and in some cases institutions may present complex logistical problems or conflicts of interest. For example, review of compromised figures, data sets, and data represented in images can be costly and time consuming. For editors and publishers, the COPE flowchart library is in common use, and could be a model for developing workflow models and suggestions aimed at a variety of additional stakeholders. Some interviewees and workshop participants suggested that efforts to innovate retraction processes in this nexus—between institutions, publishers/editors, funders and researchers/editors—are often hampered by perceptions of risk and liability. Early adopters of reforms potentially face increased risks (e.g., liability) on top of the cost of developing policies and procedures; potential costs include referral boards or independent investigative bodies.

Here, we recommend the use of the Cooperation & Liaison between Universities & Editors (CLUE) report (41) recommendations to develop best practice guidelines to streamline the retraction process with respect to institutions and sponsoring agencies by improving coordination between institutions, publishers, funders and researchers. Additionally, COPE and the research integrity groups such as the Association of Research Integrity Officers (ARIO) and the European Network of Research Integrity Offices (ENRIO), should work to clarify best practices and guidelines for journals, authors, and institutions to efficiently coordinate and address concerns about published work. This should include offering fast-tracks for retraction notices to move through the process more quickly, if the authors agree with or request retraction, or if a retraction is requested following an institutional misconduct investigation. Here, publishers should reserve the right to retract in legal agreements with authors. Publishers should also make sure that all journal websites provide clear instructions on how to submit an inquiry or concern about possible research misconduct or serious error. For instance, websites

may not have updated contact information or email addresses. Finally we suggest creating a workflow template for starting a retraction inquiry and adopt a checklist of requisite information for a retraction notice. Publishers and editorial societies should encourage journal editors and institutions to develop systematic processes, including templates and checklists to coordinate and communicate about the retraction inquiry.

4. Educate Stakeholders About Publication Correction Processes including Retraction and about Pre- and Post-Publication Stewardship of the Scholarly Record.

Stakeholder education can help researchers and editors understand the range of post-publication corrections. Retraction is a publishing mechanism for cleaning up the literature, and not does not signify misconduct. Currently stakeholders report a tension between the need to correct the literature and the need to preserve their reputations, either as researchers or as editors. Fear of stigma or career impacts can make researchers reluctant to participate in retraction processes, even to correct honest mistakes or errors. Fear of litigation makes editors reluctant to initiate retraction inquiries (1,42). Awareness of retraction and the reasons for retracting research may vary by field; this contributes to a confusion about the severity and impacts of retraction. Professional, disciplinary and scholarly societies, publishing associations and editorial groups, government agencies, and local institutional programming should develop education aimed at researchers, authors and editors.

Researcher Education

Researcher education should focus on the value of amending the published literature, including through retraction. Suggested topics for Responsible Conduct of Research education should include publication ethics, including peer review and retraction. Disciplinary and scholarly societies should develop discipline-specific materials as well. These education initiatives should

emphasize the need to correct publications as part of responsible data management and work to destigmatize the act of retracting articles.

One strategy for doing this would be to develop an anthology of stories of honest retraction aimed at destigmatizing retraction amongst senior scientists, following the examples of *The Winnower* (43,44) and Retraction Watch's *Doing the Right Thing* series (45). Additionally, stories can give researchers a platform to express concerns they have with their own work, whether the issues might warrant retraction or other types of post-publication amendment, following the example of the Loss-of-Confidence Project in psychology (46). In general, we recommend moving away from inflammatory language associated with misconduct by naturalizing a more neutral tone for retraction inquiry and reportage. To broaden reach, we suggest developing pedagogical materials for use in broader ethics and professionalization training. Materials should be made available in open education platforms under licenses suitable for translation and reuse, to encourage multilingual availability. This should include materials on different reasons for post-publication changes to publications.

Author Education

Publishers, librarians, and disciplinary, professional, and scholarly societies should work to educate authors about their responsibilities related to retraction and other post-publication amendments (e.g., letters to the editor, corrections, and expressions of concern). Authors have a responsibility to evaluate and assess the references in their bibliographies. In particular, before publication, authors are expected to cite and reference reliable papers in good standing. In cases where it is relevant to discuss retracted work, both the article/text and bibliography should clearly indicate the retracted status of the cited work. Before publication, authors are expected to provide correct and complete reference details, and, in the pre-press stage, to respond to questions about errors/omissions in manuscript bibliographies. After publication,

authors of evidence synthesis products are expected to notify the journal if they notice that an article they cited has been retracted, because as COPE notes, “Articles that relied on subsequently retracted articles in reaching their own conclusions, such as systematic reviews or meta-analyses, may themselves need to be corrected or retracted” (1). Amendments provided by previous authors (e.g., 47–49) can be used as examples. Authors should take action to amend or retract their own research if compromised. If issues with an article come to light post-publication, an author should notify the publisher, their own institution, and all co-authors’ institutions.

Editor Education

General editorial education should build awareness of existing COPE resources and retraction best practices among editors, peer reviewers, and publishers. Publication ethics training modules and case studies should particularly target under-resourced groups, such as small museum and library-based scholarly publishers, by developing modules for education platforms, including Educopia’s Library Publishing Curriculum (50).

Editorial societies should develop and disseminate best practice educational modules that address the stigma associated with retraction. Editors, peer reviewers, and publishers should encounter examples of honest inadvertent serious errors that have required retraction. Editors should be incentivized to destigmatize the decision to retract articles. Education modules should provide support for editors developing or updating policies. Best practices for publicity and knowledge maintenance should also be developed; for example, *Anesthesiology*’s “what do we still know” series provides a model (51,52) for topic editors, journal editors and others responsible for stewarding research on a topic to commission review articles to revisit the

entirety of research on a topic, in the wake of a series of retractions or other post-publication amendments.

Standards groups should form working groups to develop best practices for emerging concerns.

A working group on preprint publication ethics should be charged to update and build momentum on recommendations for preprint servers (including withdrawal and removal of preprints) (53), developed at the January 2020 ASAPbio, EMBL-EBI, and Ithaka S+R meeting.

A working group on authoritative sources of retraction information should be charged with supporting authors in identifying authoritative sources for checking citations beyond Retraction Watch and PubMed.⁵

Discussion

Prioritization

We suggest stakeholders prioritize the first two recommendations, #1 Develop a systematic cross-industry approach to ensure the public availability of consistent, standardized, interoperable, and timely information about retractions, and #2 Develop taxonomy of retraction categories/classification and corresponding retraction metadata that can be adopted by all stakeholders. First, the remaining recommendations will have more traction once some agreement around Recommendations #1 and #2 has developed. Second, some progress on these recommendations has already been made.

⁵ Outside of medicine, we are not aware of statements about authoritative sources of retractions, analogous to that given in the ICMJE guidelines: “For articles published in journals indexed in MEDLINE, the ICMJE considers PubMed the authoritative source for information about retractions” (25).

377 NISO has convened meetings to consider developing a recommended practice or a standard for
378 how retractions/withdrawals should be handled by publishers, as a follow up from a RISRS
379 cross-industry panel at NISO Plus 2021. We expect NISO standardization work, if taken up, to
380 follow up on Recommendations #1 and/or #2.

381

382 There was broad stakeholder agreement during the workshop that a taxonomy and metadata
383 (Recommendation #2) was a necessary first step, and a COPE working group has already
384 produced an initial draft of the taxonomy, described by Deborah Poff at the Society for Scholarly
385 Publishing 2021 conference (54). The next step will be for multiple stakeholders to assess the
386 taxonomy, document what works, iterate as necessary, and encourage adoption. NISO or
387 another standards body may be an appropriate long-term steward for this taxonomy.

388

389 The goal of the RISRS project has been to clarify the scope and dimensions of the problem of
390 continued citation of retracted research, and to develop a research and implementation agenda
391 for reducing its spread. In this conclusion, we briefly cover some aspects of our implementation
392 strategy, and describe ways for you to contribute to the collaborative development of this
393 agenda.

394

395 Our general approach to this problem has been to co-develop a set of actionable
396 recommendations with a diverse group of stakeholders associated with scholarly
397 communications. To do this, we initiated a scoping literature review and created multiple
398 opportunities for sustained stakeholder consultation. Both enabled a process of problem
399 definition and refinement where we actively worked with stakeholders to identify viable areas on
400 which to focus our attention, and to anchor recommendations in the terrain of the scholarly
401 communications ecosystem.

402 Implementation Strategy

403 We have outlined possible cross-sectoral strategies for introducing change throughout the
404 scholarly communications ecosystem, and hope that this encourages collaboration amongst
405 stakeholders from different industries to address the continued citation and use of retracted
406 research.

407

408 Our aim is for stakeholders to take up our recommendations as elements of an implementation
409 agenda that targets reducing the continued citation and use of retracted research. We have
410 prioritized recommendations that are immediately and practically actionable, and which will
411 support robust collaboration between stakeholders utilizing existing practices, policies,
412 standards and technologies.

413 Conclusion

414

415 Addressing the inadvertent, continued citation of retracted science will require iterative work
416 from many parts of the scholarly communications ecosystem. Early implementation activity
417 coming out of the RISRS process has resulted in some promising initiatives that look at how to
418 develop these recommendations in ways that will meaningfully address long-standing issues in
419 the scholarly communications ecosystem that contribute to the continued citation of retracted
420 materials. The COPE taxonomy working group and the proposed NISO work item are helping to
421 address this issue by advocating for stakeholders to address the interlinked issues, but also
422 innovating practical solutions to be further co-developed in specific sectors of the scholarly
423 communications enterprise.

424

Yet there is still more work to be done, and we hope that by synthesizing this material we not only further the conversation about how to best address the problems presented by the continued circulation of retracted research, but as well support stakeholders in developing practical and actionable strategies within their zone of influence. It is our hope that further working groups take up the recommendations outlined above, as well as some of the targeted implementation priorities that we highlight.

A Call to Implement and Collaborate

We encourage you to disseminate these recommendations and to envision how you, in your role, and in collaborative partnerships, can make a difference. Additionally, the full RISRS report (8) details several other implementation actions, related to the general recommendations, as well as a corresponding research agenda.

Feel free to involve RISRS participants and the authors of this document in implementation actions to enact this vision! We welcome suggestions for ongoing research and collaboration, via the project website <https://infoqualitylab.org/projects/risrs2020/> or by email to jodi@illinois.edu.

List of abbreviations

ARIO: Association of Research Integrity Officers

COPE: Committee on Publication Ethics

ENRIO: European Network of Research Integrity Offices

ICMJE: International Committee of Medical Journal Editors

NISO: National Information Standards Organization
RISRS: Reducing the Inadvertent Spread of Retracted Science
STM: International Association of Scientific, Technical and Medical Publishers

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Declarations

622 Ethics approval and consent to participate

623 The project was approved by the Institutional Review Board at the University of Illinois, Urbana-
624 Champaign. All participants provided consent for participation.

625 Consent for publication

626 Participants provided consent for participation, for use and publication of anonymized direct
627 quotes, and for dissemination of the findings from this project. For this publication, participant
628 input was provided in the development of the recommendations, but direct quotes from
629 participants were not used.

630 Availability of data and materials

631 The full RISRS report informing this publication is available on MetaArXiv Preprints (CITE).
632 Many project outcomes are in IDEALS, the UIUC institutional repository, in the the RISRS
633 Collection <https://www.ideals.illinois.edu/handle/2142/108359> and on the RISRS project
634 website <https://infoqualitylab.org/projects/risrs2020/>

635

636 **Data:** We have deposited the qualitative analysis of materials used in the RISRS report in the
637 UIUC Databank (Woods, 2021). Given the risk of identification, we are unable to share full
638 transcripts of the interview data.

639

640 Competing interests

641 Jodi Schneider has been an invited speaker for the publisher organization CrossRef and has
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652 **Mary Terese Campbell:** Project administration; **Yuanxi Fu:** Investigation; **Katherine Howell:**
653 Investigation; **Tzu-Kun (Esther) Hsiao:** Investigation; **Randi Proescholdt:** Conceptualization,
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655 original draft, Writing – review & editing; **Jodi Schneider:** Conceptualization, Data curation,
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