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Best Practices for Conducting Research and Reporting Results

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Content

“A scientific research is not complete until the results have been published.”

Day R. How to Write and Publish a Scientific Paper. Philadelphia: ISI Press, 1983

Introduction

This document describes the best practices when conducting research or reporting research findings from the Lifestyle and Health Research Center (LHRC). Every researcher, scientist, technician, resident, intern, graduate student or collaborator working in the LHRC has the responsibility to ensure that the best practices in research are carried out and followed to the best of his or her ability.

It is well recognized that the research process involves several steps, including planning, conducting research, interpreting and disseminating the findings. Researchers and authors have the full responsibilities at all these stages and throughout the research process.

As they participate in planning and conducting research, scientists and researchers in the LHRC are anticipated to maintain high standards of research integrity and professional conduct throughout the research development. They should keep clear and accurate physical records of the laboratory and field experimentations as well as the electronic security of stored data. Also, it is essential that they adhere to safety procedures and regulations when conducting research. Further, they must follow the rules and research policies of the LHRC (as well as those of Health Science Research Center (HSRC) and Princess Nourah bint Abdulrahman University (PNU)).

Publishing research entails great responsibilities. Researchers in the LHRC should give due credit to colleagues for their assistance in completing research work, whether in an oral presentation or a published manuscript. They should reveal all methods, procedures and corresponding experimental findings that support their research conclusions. They should also disclose any unexplained outlying data that do not fit with the research assumptions and conclusion, allowing other researchers to decide whether the conclusions are still valid despite such outliers. Authoring credits must be given based on actual contribution of the participating researchers. Guiding principles from the scientific community such as those of the International Committee for Medical Journal Editors (ICMJE) guidelines should be followed.

Similarly, it is expected that the researchers, scientists and staff working in or collaborating with the LHRC to adhere and follow these best practice guidelines, which are adapted from several resources shown at the end of this document.

Research Integrity

Research integrity means that a researcher/scientist must observe all shared values in scientific research such as honesty, accuracy, transparency and objectivity, and does not engage in any activity that is considered to be academic fraud, including plagiarism, fabrication of data, or manipulating of research materials. Researchers are anticipated to be honest and ethical when conducting research as well as stating in their work which ideas and information were developed by themselves and which were taken from others. Researchers in the LHRC should strive to promote research integrity in fulfillment of the Center's mission and objectives. In addition, it is expected that researchers, scientists, trainees or technicians working in the LHRC to:

- Maintain high work standards and moral values when planning, conducting and disseminating research work at the LHRC.
- Understand and follow research rules, policies and guidelines of the LHRC, HSRC and PNU.
- Promptly and professionally raise questions on any problem or misconduct. Falsification, fabrication, plagiarism or misuse of research data is forbidden and condemned at the LHRC and an appropriate disciplinary action is expected to be taken by the HSRC.
- Strive to be open and courteous to colleagues. Researchers should be fair and considerate when critiquing the work of others. Criticisms should focus on errors in the work and disagreements about interpretation, but not on the individual who committed those errors.
- Support team work and encourage other researchers to contribute ideas and get involved in decision making.
- The following acts are considered as violations of the principle of academic integrity:
    - **Fabrication**: The unauthorized alteration or invention (making up) of any data, information or citation and reporting them in a research or an academic context.
    - **Falsification**: The manipulation of research materials or forging (faking) information for use in a research or an academic application.
    - **Multiple Submissions**: The submission of substantial portions of the same research publication (same intellectual material) more than once without approval from the publishing channel. It can be in the form of duplicate submission or major redundancy. There is no agreement on how much percent of such work that can be considered

substantial, however, the Committee on Publication Ethics (COPE) states that it is based on the same data with identical or very similar findings, even if authors tried to hide such redundancy by changing title or author order or not citing previous papers. Multiple submissions are not considered plagiarism, but it is often viewed as academic misbehavior. The reason is that it can skew meta-analyses and review articles and can ultimately distort citation indexes and citation impact. However, in certain instances, some guidelines of medical and scientific societies may be simultaneously published in multiple journals.

- **Plagiarism:** Plagiarism is considered a serious violation of academic integrity. It is intentionally or knowingly presenting the work of another as one's own without proper acknowledgment of the original source. It is a type of stealing of ideas or a work from other people. An exception to this is when the ideas, information, or materials are considered common knowledge.
- **Complicity in academic dishonesty**: Intentionally helping or attempting to help another person to commit an act of academic dishonesty or violate the academic integrity.

Data Handling

- Data handling ethics are concerned with how to obtain, store, manage, use, and dispose of data in ways that are consistent with ethical principles. Ethical principles often involve fairness, respect, responsibility, integrity, quality, reliability, transparency, and trust. Handling data in an ethical way is necessary to the long-term success of any academic institution. On the other hand, unethical data handling is not just illegal research practice, but can result in the loss of reputation.
- Develop data management and sharing plan at the beginning of a project and be aware of potential sources of personal bias in designing, conducting, evaluating, and reporting their own work. It is well understood that knowledge advances over time and that errors and mistaken interpretations can occur along the way. However, researchers who acknowledge and correct their own errors or misinterpretations with assurance and self-confidence contribute to the progress of science.
- Incorporate appropriate data management expertise including effective record keeping when conducting research project.

- Understand and follow data collection and management procedures as related to lifestyle research and human health and well-being. Also, adhere to regulations and policies of the L&HRC, HSRC and PNU, funding agencies, journals, and relevant government institutions such as King Abdulaziz City for Science and Technology (KACST).

Mentoring and Supervision

- A mentor is a person directly responsible for the professional development of a research trainee. Supervisors as well as other more senior researchers who are in a position to contribute to the professional development of trainees and junior researchers are also considered mentors.
- Mentors should make sure that trainees are aware of the risks of misrepresenting data. Trainees may sometimes experience intensified stress or a period of over concern to meet expectations which may impair the trainee's judgment. Therefore, ensuring that trainees understand and follow best practices in research is an important aspect of mentorship. This includes receiving high-quality instructions and checking the work of trainees, particularly work that is prepared to be submitted for publication. Frequent meetings with the trainee to discuss issues of research integrity and harmful practices are also essential. Constructive skepticism serves a valuable function in research and is always a legitimate request by a mentor.
- The research investigator leading the research group must show leadership and supervisory responsibilities. A lead investigator or a supervisor offers guidance and advice to individual members of the research group and checks the details of research procedures as well as the validity of the data. Also, sporadic reviews of primary resources should be one of his or her responsibilities. In addition, he/she has a major responsibility for the scientific integrity of the whole research team.
- Without jeopardizing authorship criteria (see the section on authorship criteria), an important best practice is to have early conversations with junior members of the research team, such as *trainees* and *technicians*, so to offer them opportunities to fulfill the authorship criteria.
- Trainees (graduate students, postdoctoral fellows, interns and a like) can be an important part of a project team. However, having trainees on a project team may lead to authorship

misuse, as they are at an early stage in their career and are sometimes working for a limited period of time. In addition, they usually have less experience in research writing. The likelihood of authorship can be a strong motivation that enhances the trainee's engagement in his/her work. Again, they are, nonetheless, subject to the same authorship criteria that are applied to all members of a project team.

- Similarly, a technician should be listed as an author if the technician fulfilled all of the authorship criteria described in the authorship criteria section. However, merely performing routine tasks or just collecting data does not qualify a technician for authorship. In the former case, if a technician and their research leader/supervisor agree that the technician is a candidate for authorship on a work product, the supervisor should encourage the technician early in the project to engage in the full spectrum of intellectual activities that result in meeting all authorship criteria.

Authorship and Communication

- Publications are an important measure of research productivity for scientists across all disciplines. The pursuit for authorship status, however, may sometimes become competitive and inviting in ways detrimental to both scientists and the research enterprise. Therefore, ensure that general standards and guidelines are followed for research publications.
- Decisions about authorship of research publications are an important aspect of the responsible conduct of research. Although many individuals other than those who conceive of and implement a research project typically contribute to the production of successful research, it is well accepted that authors are those who made a significant and substantial intellectual contribution to the production and presentation of the new knowledge being published.
- According to the International Committee of Medical Journals Editors (ICMJE), authorship credit should be based only on substantial intellectual contribution to:
  - **Conception and design, or acquisition of data or analysis and interpretation of data;**
  - **Drafting the article or revising it critically for important intellectual content; and**
  - **Final approval of the version to be published.**

  All these conditions must be met. Participation solely in the obtaining of funding or the collection of data alone does not justify authorship. Also, the guidelines of the National

Institute of Health, USA, state clearly that individuals who have assisted the research by just providing reagents should not be considered as authors.

- **Harmful authorship practices**

The below descriptions of some harmful authorship practices that are deemed ethically unacceptable and must be avoided.

- **Guest/gift/honorary authorship**

Individuals given authorship credit, but have not substantially contributed to the research. They are included in the author list just because of their status in the organization. Such an authorship status is sometimes given to a senior figure who expects or demands it because of his/her status as director of the laboratory or department head, or due to the controls the project's funding. In other instances, authorship is improperly given to senior figures to augment the perceived credibility of the research work and thus improves the odds of getting the research work published in a top journal. Guest, gift or courtesy authorship may happen when a legitimate author adds another person to the authorship list with the understanding that this individual will do the same for him in the future publication (or had already done so previously) in order to inflate the number of publications of both persons.

- **Ghost authorship**

Ghost authors are individuals who have contributed to the research work but are not listed as authors in a publication. Such authors have met the criteria for authorship, however, it is sometimes used to purposefully hide a conflict of interest from editors, reviewers, and readers (it is usually to obscure the involvement of an individual or institution in a work product).

- **Orphan authorship**

Orphan author is someone who has significantly contributed to the research work but is omitted from the authorship list unfairly by the drafting team or principal authors. Sometimes this may happen to a student working in a lab.

- **Forged authorship**

  Unknowing authors who had not taken part in the research work but whose names are added to the paper without their knowledge in order to increase the probability of such a work to be published in a good journal. Such practice has been greatly reduced since most of the journals now send an email to all the authors of the submitted manuscript altering them to such submission.

Authorship disagreements

Disagreements about authorship can happened. They are generally classified into two types: misconduct and disputes. The former does break the ICMJE guidelines and the later do not break the guidelines. Missus

- **Research misconduct**
  - This include misusing with authorship list, such as trying to omit a qualified author or adding unqualified author. This is of course unethical issue and represents a research misconduct. In addition, anyone who remains neutral about this situation and take no action is considered a complicit.
  - In case this occurs, you should explain the fact to the principal investigators or research group leader and state the fact that such action contradicts ICMJE guidelines and can be considered a misconduct. Also, indicate that this could lead an editor of a journal to decline publishing such manuscript provided he/she finds out. If the issue is not resolved, discuss this with the other contributors and then with the department head. You could also contact the journal and present your facts. However, an editor is unlikely to add your name without the agreement of the other authors. If they do not agree, the editor, based on your facts, may ask the corresponding author to withdraw the manuscript.
  - If your name is included on a publication against your desires you should inform the other authors as soon as possible. If you knew this after publication, you may contact the journal editor and ask for a correction. Journals are not usually in a position to investigate misconduct claims themselves, but journals' editors have a responsibility to alert appropriate organizations such as the institution where the research was conducted or the research funders and encourage them to investigate.

- Publication bias, selective reporting, and poor reporting are serious problems that damage the research record and should be avoided. Researchers are responsible for ensuring that previous work is appropriately and accurately cited. Needless to say, responsible authorship should avoid detrimental practices such as honorary authorship, ghost authorship and duplicate publication. Ensure that all sources of funding for research or publication are disclosed.
- Authors of a research article (or preliminary results of ongoing research) stemming from research work at the LHRC have a responsibility to ensure that press releases describing that work are accurate and unexaggerated. Researchers at the LHRC should avoid unfounded claims and reveal both the positive and the negative aspects of research results.

- **Research disputes**

  - As collaborative and interdisciplinary research work is becoming more of a norm in academia, a researcher needs to be open to collaborative research work with other investigators having diverse but complementary skills. However, it is imperative that early understandings should be reached in any collaboration, especially about authorship credit and accountability as well as sharing of research resources and materials.
  - Research disputes are likely related to interpretations and the extent of the contribution in the research project and whether it is substantial or not? These need to be negotiated first with the principal investigators or group leader as well as with the other researchers involved in the research project or the manuscript writing.
  - If such disputes are not resolved, then you may consider an appeal to the department head or someone in more senior position. Try to present evidence supporting your claims, such as laboratory note books, manuscript, email correspondence, ICMJE guidelines, etc. Make sure that the principle investigator or group leader aware of what you intend to do.

- **Authorship disputes**

  - Disagreements regarding authorship status can happen. Complaints regarding authorship order, however, do not constitute research misconduct. It is rather a matter of authorship dispute. Such difficulties/disputes arise because of misplaced expectations and poor

communication. Therefore, it is important that authors confirm in writing who is going to do what and by when before writing the research proposal.

- Authorship disputes are best dealt with internally between the members of the team and arbitrated by the principle investigator. The decision of the listing of authors and their order on a manuscript is made by the principle investigator upon consultation with collaborators. It is advised that such discussion takes place as early as possible while the research is in the beginning stage and revisited as research work progresses.
- In case authorship disputes happens, the policy of the University of Washington, St. Louis, for example, suggests that the authors request mediation from the head of the department involved or to the school dean or the research center director. If the dispute is still unresolved, then the lead author or principle investigator, in consultations with the department head or the school dean can have the final authority to determine author order. If there are multiple researchers from different institutions and that the authorship order cannot be resolved locally among the authors, then according to the ICMJE guidelines, the institution where the research was conducted (and not the funding agency) should try to resolve the dispute and make the final decision.
- Some other institutions may form a committee and follow established procedures for solving the dispute (arbitration of authorship disputes), but first, faculty members and researchers at the university or research center are advised to make every reasonable effort to resolve authorship issues internally by communication within the research team. If this attempt fails, complainants will seek to resolve the dispute through their department chair and/or school dean. If the issues are still not satisfactory resolved at this point, the case can be raised to the provost in writing and must be substantiated with supporting evidence. The following procedures are usually followed:

  1- Raising a formal authorship claim.

  2- Convening an authorship dispute committee.

  3- The committee conducts an Inquiry.

  4- The committee raises a fact-finding report to the provost.

  5- Decision and action are taken regarding the case.

- Taking the below measures and precautions should reduce the chances of disputes arising at a late stage of research work, when all the real work has actually been done.

  - ❖ Be transparent with your research and when communicating with all coauthors.
  - ❖ Acknowledge the roles and contributions of authors and ensure that all who deserve credit on a paper receive it.
  - ❖ It is recommended that authors start discussing authorship issues when they plan their research.
  - ❖ You should also have some idea of the type and number of publications and conference abstracts that might emerge from the research project. Discuss such issues as who is going to be the first authors, senior author or corresponding authors based on clear authors' contribution status. Keep a written record of your decisions.
  - ❖ The decision of the listing of authors and their order on a manuscript is usually made by the principle investigator upon consultation with collaborators. It is advised that such discussion takes place as early as possible while the research is in the beginning stage and revisited as research work progresses.
  - ❖ Research teams should estimate the number and type of publications and conference abstracts that might emerge from the research project. Discuss such issues as who is going to be the first authors, senior author or corresponding authors based on clear authors' contribution status.
  - ❖ Keep a written record of your decisions. Many authorship difficulties/disputes arise because of misplaced expectations and poor communication. Therefore, it is important that authors confirm in writing who is going to do what and by when before writing the research proposal.
  - ❖ Authors' contribution statement is very important, which intends to reduce the chance of any further authorship dispute and encourages transparency and accountability for the research product. It is a way of confirming each author's responsibility for the published content.

- **The corresponding author**

This is the author who places his/her contact details on the submitted manuscript, so the journal can make correspondence with him/her on decision related to the submitted work. He also

receives the reviewers' comments, the article proofs and the readers can request reprints from him/her. Journal editors consider this as a purely administrative role, but some authors associate it with seniority. It is better to decide who is going to be a corresponding author. Preferably, select somebody whose contact details are not likely to change in the near future. Some practices choose the senior author or the research coordinator, who knows a lot about the undertaken research, as the corresponding author.

- **The first and last authors**

  The first named author is generally the most sought-after position in a research paper. This is due to the fact that other studies refer when referring to an article they do by citing the first named author. The first named author is generally assumed to have made the greatest contribution to the research. The last named author is usually given to the senior member of the team who contributed expertize, guidance and leadership with critical review of the publication. Further, some conventional practices give significance to the last named authors, but this view is not universally acknowledged. In fact, skeptics may sometimes suspect that the final author is often included as a guest or honorary author. However, a person's name should not be listed as author without his or her knowledge, permission, and review of the final version of the manuscript. Indeed, many journals ask authors to sign a statement confirming having read and approved the final manuscript and having made a substantial contribution to the manuscript.

- **The order of authors**

  The current practices of the journals (through their instructions to authors) require that submitted manuscript should clearly state the contributions of all authors to the submitted work. However, the ICMJE guidelines recommend that such contribution and the order of the authorship should be decided by the manuscript coauthors. In some published papers, authors state that all authors have equally contributed to the research work. Also, in group research with many authors, authors are listed alphabetically.

Peer Review

- Peer review is still dominant when evaluating submitted manuscripts. Traditionally, some journals use single blinded reviews and others use double blinded reviews. However, we are

seeing more and more use of no blinding, especially in some of Open Access Journals. Single or double blind reviews are more likely to reject the submission. No blinding may lead some reviewers to decline reviewing the submitted manuscripts.

- Unfortunately, some reviewers, especially in the traditional Journals, still try to control the fate of the submitted papers. I quote a statement from Peter Lawrence, the past Editor of Nature, saying "*It should always be remembered that the proper role of the reviewer is to advise the editor, not to gain control over the author's paper*". (Lawrence, Nature, 2003)
- Researchers working in the L&HRC, who serve as reviewers, are expected to be honest, objective, and accountable during their review process. They should also strive to maintain confidentiality of the presented data and protect the ideas of others during the review process. Sharing materials or ideas from grants or manuscripts under review is considered a form of plagiarism.
- During grant review, peer reviewers are responsible for judging whether a research direction is worth funding based on originality and significance of the submitted research, and whether the proposed methodologies are appropriate for such an investigation.
- In the context of journal submissions, the reviewer's responsibility is to carefully evaluate the research hypothesis, experimental design, analysis procedures, research findings and interpretation and whether the conclusions are supported by the research findings.
- It is expected that potential reviewers completely disclose conflicts of interest when evaluating a grant proposal or a journal submission. High ethical values and good professional conduct necessitates that reviewers be aware of their own biases towards the submitted work under review and try to avoid critiques that are driven by a desire to defend their own research work.
- One particularly serious form of plagiarism is the misuse of privileged information taken from a manuscript sent from a journal for peer review or from a grant application received from a funding agency. In such an instance, this form of plagiarism is considered a stolen intellectual property. Such illegal act deprives the original author an appropriate credit and the entitlement of the original idea.

- In some instances, journals send a research manuscript for review, but you may not have the time to do the review or the topic of such a manuscript is not exactly related to your expertize. In such case it is not ethical to hand over the manuscript for your co-worker to do the review without asking first the editor of the journal.

Research Compliance

- Research on humans often involves risks to the participants, to those in the lab, or to those conducting field research. Therefore, researchers, technicians and collaborators should comply with appropriate institutional and national regulations and guidelines (see section on human participants) including those stipulated by the Institutional Review Board. Compliance failures undermine public confidence in the researcher, the institution, the field, and the broader research enterprise.
- Researchers should follow environmental and other safety regulations. They also must ensure that they do not engage in misuse. Further, they should disclose and manage personal conflicts of interest.
- In order to communicate and promote research integrity, HSRC should address allegations or concerns in an appropriate and timely manner.
- Strengthening education and training in the responsible conduct of research, should improve the center's research climates. Proactive approaches such as placing infographic or concise posters on bulletin boards of the HSRC laboratories or other potential places near researches offices to encourage best practices may improve compliance.

Research with Human Participants

- The conduct of research with human participants is highly regulated and is guided by ethical guidelines.
- It is acknowledged that research with human participants is a privilege, not a right.
- Researchers are obliged to conduct research involving human participants in a way as to minimize any risks or harm to the participants.
- When conducting research on humans, the Institutional Review Board (IRB) review and approve such research and sure that the participant's rights and safety are protected based

on international guidelines which stress on minimizing risks and ensuring the safety and privacy of all participants.

- It is also customary that an informed consent is obtained from the participant prior to the conduct of the research. Further, it is the responsibility of the IRB to safeguard when vulnerable populations are involved in such research. The next paragraph details this.

Participant's consent form

- The consent form provides the potential participant with written information about the proposed research and enables him/her to decide whether to take part in such research or not.

- It informs the participant with a detailed explanation of the goal, nature and procedures of the research and any potential risks or benefits to the participating subject. It also grants the prospective participant the right to withdraw from the research without any harmful consequence.

- Typically, the information written in the consent form should be in the form of a plain language statement. Once the research is approved by the IRB and the consent form is signed by the participant, he/she must be given a copy.

- Generally, the consent form should contain the following:

  1- The consent form should be on the Lifestyle and Health Research Center (L&HRC) OR the Health Science Research Center (HSRC) letterhead.

  2- Clearly identify the title of the research project, the name(s) and contact details of the principal researcher(s) including phone number.

  3- Explains the purpose of the research and brief description of the involvement of the participant in the research (what the participant will be expected to do and what procedures will be applied and how much time this will take from the participant).

  4- Indicate that the participation in the study is voluntary and that the participant is free to withdraw any time from the study without any penalty.

5- State the anticipated risks, inconvenience and benefits (for the participant or for the society) from participating in this research and how these risks will be minimized or avoided.

6- Indicate the arrangements taking place to protect the confidentiality of participant's data.

7- If applicable, describe any provided monetary compensation, medical treatments or fitness consultation provided if the participants take part in the study.

8- When conducting research with **children**, consider whether only the child, or both the child and the parent, will take place in the study (for example, in addition to testing the child, some information may be sought from the parent, such as demographic, socioeconomic information or lifestyle habits). In this case you need to obtain the parent's consent for participation in the research, the parent's permission for the child to participate, and (if applicable) the child's acceptance to participate in the research (assent form).

9- Note that the verbal explanation of the study objectives and procedures to the child and the request to participate must be tailored to the age and developmental stage of the child who is sought to participate in the research. However, an adolescent may be capable of participating in a meaningful written assent process (besides the parent consent).

10- A copy of the consent form MUST be given to the participant (or representative).

Publishing in a traditional versus open access journal?

Publication accomplishes two things: 1) it makes the new knowledge available to others, 2) it allows for replication and reproduction of the study findings. Traditionally, subscription-based journals had dominated the academic publishing business for a long time. These types of journals are mostly funded through subscriptions or advertising. Further, in the subscription model, copyrights for the published content of the journal are usually transferred to the journal. This mean that the author must seek permission from the publisher in case he decided to use or reprint any part of his/her own published paper. Some traditional journals charge the authors a page charges, while others do not charge any things from the authors. Also, libraries must purchase these journals and make available for readers, however, this can cost large institutions (most often universities) hundreds of thousands of US$ annually, especially for hard copy prescription.

In open access publication model, on the other hand, scholarly journals make their content freely available online to all readers without needing a subscription. However, authors usually have to pay the article-processing charges (APCs) once their paper has been accepted for publication (or the APCs can be paid by the author's institution or funding body). Some open access journals, however, are subsidized by either the government or the professional society and do not require any APCs from the part of the authors. Authors in open access journal generally retain the copyright of the published article. In addition, open access journals often use Creative Commons licenses, which make the author shares, uses, and builds upon the original research publication. In recent years, the open access model has become a broad international academic movement that seeks free and open online access to academic information, such as publications and data. It advocates unrestricted online access to research outputs such as journal articles and books. Open access content is open to all readers, with no access fees. Lately, even some traditional journals are becoming "hybrid" open access publication, by starting to offer authors a choice whether to publish traditionally without a charge or to pay a hefty price and have an open access for his/her article and owns the copy right.

There are four factors to consider when deciding between an open access or a traditional journal. These factors are visibility, prestige, cost and speed of publication.

1- Visibility

Publishing an article in an open access journal means that more people are likely to see it (and hopefully to read the title and the abstract). This is simply because more people will be able to access the article.

In addition, several surveys indicated that authors think that open access publications are read more widely. However, it is still uncertain whether such an increase in downloads and visitors would translate into increased citation rate. The number of citations though has become increasingly important as a measure of a scientist's scholarly output. More citations of someone's published works lead to an increase in H-index, a measure of scientific productivity and the research impact. Undeniably, articles that are published in open access journals will be readily available to scholars, educators and the general public, many of whom may not have access to subscription journals, especially in low economy countries.

2. Prestige

Some researchers are more reluctant to publish in open access, owing to the fact that journals in the traditional format still tend to have a higher level of prestige as measured by impact factors. However, this thinking is somewhat changing due to the increasing quality of some of the open access journals. Indeed, high impact open access journal are available in a variety of scientific fields. In biology, for example, the open access PLoS Biology and BMC Biology ranked among top tier journal in their field. Additionally, that same year, PLoS Computational Biology, BMC Systems Biology, BMC Bioinformatics and Frontier Neurosciences and Frontiers psychology ranked among high impact journals in their respective field. Despite that, many academics still place more importance on well-established traditional journals.

3. Cost

Many traditional journals may charge a small fee at the time of submission to cover editorial and peer review-related costs. However, the difference arises in the post-acceptance fees. Some traditional journals generally charge per page (often US$100-250 each) and/or per color figure (US$150-1000 each). However, an open access journals normally charge a flat article processing charge that can range from US$300 in newly published journals to as much as US$5000 in well-established and highly ranked journals. Most often, open access journals can provide either a partial or a full waiver of article processing charges to authors in low income countries.

4. Speed

Publishing in any peer-reviewed journal will always involve some degree of delay from submission to acceptance and finally to publication. However, the traditional method of paper publication generates significant delays owing to the need to group articles into issues and backlogging the accepted articles due to space limitations in the printed issues of the journal. Indeed, the waiting time from the submission to publication can sometimes be unreasonably very long.

Authors would prefer a short waiting time for their papers to be published. A Nature's survey revealed that about two-third of the science authors consider the speed of handling (from submission to final decision to publishing) their submission to a journal to be very important or quite important when deciding which journal to send their research to. Open Access journal, as an electronic periodical, can publish articles faster than the traditional journal. Indeed, a recent study

that was published in Journal of Informetrics, has examined 135 journals listed in the Scopus citation index and found that the review and publication times tend to be significantly shorter for open access journals. Thus, if speed of publication is an important factor in your decision regarding where to publish, then an open access journal may be the best choice.

In summary, when choosing between open access and traditional journals, it is important to consider the above mentioned factors. In addition, you should consider the publication format for your particular article at a particular time. No doubt that open access journals provide numerous benefits for both authors and readers. However, like any type of business, there are open access journals that operate for the right reasons while others are simply trying to make money without any scholarship involved. If you decided to seek an open access periodical, it is important to look for legitimate open access journal, as there are thousands of what are called “predatory open access journals” (see next section). Examples of legitimate open access journals are BioMed Central (BMC) group of journals and Public Library of Science journals (PLoS) journals. BMC is one of the largest and well established open access publisher that was started in 2000 from London, United Kingdom. BMC is for-profit scientific open access publisher and publishes over 250 journals. Its parent organization is Springer Nature publisher. Many of the journals of BMC have a high impact factors in their respective fields. PLoS is another major open access organization, which is a non-profit open access science, technology and medicine publisher and was founded in 2000 and it’s headquarter is in San Francisco, California, United States. It publishes 7 peer-reviewed open access journals. One of its flagship journal, PLoS One, was able to publish over 30,000 articles in 2013, before this number declines to just over 20,000 published articles in 2017. Many of their journals have high impact factors.

Predatory open access journals

Predatory open access journals is publications that charge authors publication’s fees to publish their research papers without providing the standard editorial and publishing services associated with legitimate journals such as peer reviews, or that make misleading claims about their journals on issues such as impact factors or indexing. The term ‘predatory journal’ was coined less than a decade ago by Jeffrey Beall, a librarian at the University of Colorado Denver. Predatory journals have since become a hot subject in the scholarly publishing scene. Jeffrey Beall had compiled lists of "potential, possible, or probable predatory" journals and publishers. As of January 2017 the list

is no longer updated. However, an anonymous individual has taken on the responsibility of preserving Beall's list and updating it when potentially new predatory journals and publishers are identified (https://predatoryjournals.com/publishers/).

Publishing in predatory journals can carry some possible consequences, including the following ones:

- The submitted manuscript may receive poor or no peer review.
- It is likely that the published work is not protected.
- The journal has no permanent repository system or its archiving system can disappear.
- It is likely you will have less citation of your published work.
- If you have published your research in a predatory journal, it can be very difficult, if not impossible, to have that work removed and published elsewhere in a reputable academic journal.

In a study published recently in F1000Research, an open access publishing platform that operates by formally inviting peer review after publication, predatory journals were characterized as mostly displaying low levels of transparency, integrity, poor quality practice when operating the journal, absence of or not easily verified contact details and published predominantly by authors from specific countries.

How to avoid predatory journals?

Start by visiting the journal's website, then read and check the scope, the instructions to authors, the type and quality of the published paper, the editorial board specialties. Also, check if the journal is a member of Committee on Publications Ethics (COPE), Directory of Open Access Journals (DOAJ) or Open Access Scholarly Publisher's Association (OASPA). If you still have doubt about the journal's reputation consult with your colleagues, mentor or a senior researcher. The following suggestions can help to guide you through the process of evaluating a possible predatory journal before submission:

- Predatory journals often have an outrageously high acceptance rate with little to no peer-review.
- There are many spelling and grammatical errors in the publication, missing key information, chronic misspellings, and presenting clear signs of poor editing.

- If the journal asks you to pay for them to "review" your paper (at the submission stage), this may indicate that the journal is predatory.
- Check if the journal is indexed in popular indexing platform. Any reputable journal will be indexed by at least one of the major indexing and abstracting services such as PubMed, MedLine, Scopus, Thomson Reuters' services, or INSPEC.
- If the open access journals send you unsolicited invitations (from an "editorial support team" or "editorial office") asking you to submit a paper, a brief report, a case study or an editorial for the about to be published issue, then think twice about the journal. It may be a predatory one.
- The journal may be a predatory journal if the editorial board is very small; or it say “coming soon”; there are major errors in the titles and abstracts; the content of the journal differs from the title and stated scope; or the website is not professional in quality.

Desert Prisoners and the Negative Results

In a desert prison, an older prisoner befriends a new arrival. The young prisoner talks constantly about escape, spinning plan after plan. After a few months, he makes a break. He’s gone a week; then the guards drag him back. He’s half dead, crazy with hunger and thirst. He wails how awful it was to the old prisoner: endless stretches of sand, no oasis, failure at every turn. The old prisoner listens for a while, then says, “Yep. I know. I tried those escape plans myself, 20 years ago.” The young prisoner says, “You did? Why didn’t you tell me?” The old prisoner shrugs: “So who publishes negative results?”

From: Crichton M. A case of need. New York: Signet, Penguin Books, 1968: 217-8.

Note: The above joke was often said when most traditional journals did not publish studies with negative results. However, nowadays things have changed and there are several journals that are dedicated to publishing studies with negative results, such as Journal of Negative Results, Journal of Negative Results in Ecology and Evolutionary Biology, Journal of Negative Results in Biomedicine, Journal of Universal Computer Sciences for negative results, PLoS ONE, Peer Journal, and Journal of Pharmaceutical Negative Results.

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