

Writing for Impact: How to Prepare a Journal Article

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Abstract:

Why are we so serious about writing? Because we believe writing is as important as the science showcased in a research paper. You could have a great idea, execute the study design perfectly and discover findings that would transform how your profession is practiced around the world. But if you cannot write a clear and compelling narrative, it is not going to have great impact. And, science is all about impact. Or, as Steve Jobs said, “To put a dent in the universe.” At the core of effective scientific writing is a disciplined approach, a lot of practice, and a commitment to improvement. We outline here our approach to structure the content of a manuscript as well as practical advice to improve your writing process.

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“I would not give a fig for the simplicity this side of complexity, but I would give my life for the simplicity on the other side of complexity.”

- Oliver Wendell Holmes, Jr., *United State Supreme Court Justice, 1902-1932*

WHY YOU SHOULD GET SERIOUS ABOUT YOUR WRITING

Consider a few of our highest impact scientific journals, such as *New England Journal of Medicine* (NEJM) and the *Journal of the American Medical Association* (JAMA). Publishing in these journals, or other high impact factor journals, can lead to significant changes in clinical practice and policy. What do these high impact publications have in common? Besides having a great idea and a well-executed study, they also have a clear and compelling narrative that makes the research accessible to their audience. There are a countless number of important scientific discoveries that never realize their potential impact because they are buried within poorly written manuscripts.

“The impact of your research is limited by your ability to effectively communicate the findings and implications of the work.”

The importance of writing a clear and compelling manuscript applies beyond the top tier publications. Even if you are a seasoned writer and researcher, most of your work will not be in these journals. But you should still write with the same clarity and focus as this will increase the impact of your work no matter where it is published. The impact of your research is limited by your ability to effectively communicate the findings and implications of the work.

Perhaps the most valuable reason to get serious about writing goes beyond manuscripts. Becoming a more effective writer will teach you how to communicate complex ideas into a logical and clear narrative.

Such a skill is necessary to other responsibilities often encounter by academic researchers: public speaking, grant writing, or institutional leadership positions. We point out the transferable nature of writing skills to overall professional development to help you justify putting in the time necessary to become an effective communicator.

The remainder of this chapter is organized into two sections. First, we outline how to structure the key content that should be included in a scientific manuscript. It draws on seminal work from Gil Welch —“Preparing Manuscripts for Submission to Medical Journals: The Paper Trail”¹—that we have adopted and tailored on over time. Second, we offer some practical advice on how to improve your writing process. These lessons come directly from our own learning curve as authors, our observations as peer-reviewers, and experience working with mentees.

THE CONTENT OF A SCIENTIFIC MANUSCRIPT

Scientific manuscripts submitted to academic journals are generally organized in the following order:

- Abstract
- Introduction
- Methods
- Results
- Discussion
- Tables and Figures

There is some variation from journal to journal on the details that should be included within each section. On the website of each journal you will find “Instructions for the Authors” that will detail any deviation from this format.

We discuss below each section separately.

Abstract

What is in an Abstract?

The *abstract* section of a manuscript is a summary (often 300 words or less) of the research article. It typically follows the same format as the article (i.e. introduction, methods, results, conclusion) but in an abbreviated form.

Although your main manuscript may include multiple findings, the abstract only has space to focus on one or two key findings. As such, you should spend time thinking about which is the most important. Take time to ensure your introduction, methods, results and conclusion are consistent *within* your abstract. For example, your paper may examine multiple outcomes (e.g. complications, mortality, costs) but you only plan to focus on mortality and costs in the abstract. Your introduction, methods, results and conclusion should all be tailored to those two outcomes. Readers will be very confused if state in your abstract that studied three outcomes, but then only report on two in the results of the abstract.

The Three Roles of an Abstract Across the Manuscript Timeline

An abstract takes on three different roles from the time you start writing, once it's submitted and after it is published (Figure 1).

1. When Writing: Improve Your Research Question.

We recommend that you write the abstract first because it helps you refine the narrative of the project. We even encourage doing so before you even have data with placeholder results (e.g. “XX%”, “YY%”) assuming a number of possibilities. This exercise will help you focus the research question, clarify which outcomes you want to evaluate and assess if your study design and data are appropriate. If you cannot trouble shoot these issues and write a compelling abstract with placeholder results, you should stop. This is a sign you need to refine or change your research question before wasting time executing the work plan.

2. Once Submitted: Convince Editors It’s Worth of Peer-Reviewed.

The abstract is where journal editors will look first to decide if the manuscript should be sent out for peer review. At high-impact journals, more than half of the submissions will be rejected based primarily on the abstract. A common mistake here is to overstate the importance of your findings with a “conclusion” that is not supported by the results. Editors have a sharp radar for this type of “overreach” and it gives them an easy reason to quickly reject your work. Remember, this last section of the abstract is labeled “conclusions” not “editorial overreaching”.

3. After Publication: Getting the Rest of the Article Read.

The abstract is the first section that readers encounter to decide whether or not they want to read the entire article. Many readers may never read past the abstract, so it is important to make sure you’ve communicated your key message. A poorly written abstract will not entice readers to spend time on more poorly written prose.

Introduction

The purpose of the introduction is to give context to the question, create a knowledge gap and preview your study plan. We feel this is done more effectively with three distinct paragraphs (Figure 2).

Paragraph 1: Give Context to the Problem

The first paragraph of the introduction should get the reader to care about the topic. It needs to bring the reader up to speed on the why the topic is important. For example, if your paper is evaluating a federal payment policy, you’ll need to help the reader quickly understand why the policy was created and what is important about it now.

Common mistakes here are to give context that is too broad or too narrow for your audience. Most people start too broad and tell their audience things they already know. For example, let’s consider a manuscript about colorectal cancer. Starting off with, “Colorectal cancer is the biggest killer in America” is not good. Almost all papers start that way, but you lose a huge opportunity because you are telling people things they already know. The only time it is okay to

start a manuscript with a sentence like, “Every year in the United States there are 100,000 cases of XXX” is when you are writing about epidemiology and you are going to say that number is wrong – it is actually 200,000.

You have to establish the right entry point for your topic. If you start too broad you (A) put everyone to sleep and (B) are will take up too much writing space getting people all the way up to your knowledge gaps.

Paragraph 2: Create a Knowledge Gap

The second paragraph needs to get the reader curious by creating a knowledge gap between what is known and unknown. You should not summarize all the literature on the topic here, but highlight the areas that have tension or uncertainty related to your study question. The knowledge gaps you introduce in this paragraph should directly correlate with the outcomes that your study will address.

“The knowledge gaps you introduce in this paragraph should directly correlate with the outcomes that your study will address.”

This is the hardest paragraph of the introduction to write for a few reasons. First, you actually have to know *exactly* what is known and unknown. Second, that knowledge gap needs to be exactly what *your* study is designed to do. Third, you need to put those both together in a compelling narrative that convinces the reader it is an important gap in the literature that needs to be addressed. For example, if your paper is about the long-term outcomes of colorectal cancer patients after surgery, you need to set up related knowledge gaps. Did previous studies not follow patients long enough? Are most of the studies focused on narrow subpopulations? Whatever gaps you choose to highlight here should play right into the strengths of your study (e.g. longer follow-up, more representative study participants, etc). Ideally, by the end of this paragraph, the reader should be thinking, “*If only there was a study with longer follow up and a more representative sample, we would understand this topic so much better.*” Bingo – then you tell them (Paragraph 3) that’s exactly what your study will do!

Paragraph 3: Preview Your Work Plan

The third paragraph of the introduction should preview your work plan, i.e., briefly explain how you will close the knowledge gap discussed in the prior paragraph. Save the details for the methods section, but simply state the database and the outcomes you’re going to use. Again, the outcomes should directly line up with the knowledge gaps you just created. If you wrote the first two paragraphs correctly – motivated why the topic is important, highlighted areas where there are knowledge gaps – then this should be an easy paragraph to write.

If you’re having trouble with paragraph 3, go back and look at paragraph 2 again. A common mistake is to highlight too many knowledge gaps. You get the reader curious about so many

controversial areas in the topic, then provide a huge let down in paragraph 3 when they realize your study is only going to fill one of them.

Methods

The methods sections should explain how the study was conducted. There are different conventions on what needs to be reported here for different study designs (e.g. randomized control trials, survey data, qualitative interviews, etc). We recommend looking at previous articles from the journal your targeting and/or your mentor to see how this section was organized.

For many papers, the methods sections will include these sub-sections:

- Data Source – what data did you use? (e.g. Medicare Claims)
- Patient Population – who did you study? (e.g. all patients undergoing surgery for colorectal cancer)
- Outcomes – what did you measure? (e.g. 30-day complications, readmissions)
- Statistical Analysis – What methods did you use? (e.g. multivariable logistic regression)

“A detailed reading of your mentor’s prior work will likely yield most of the methods that you will need...Rewrite them in your own voice, with an eye towards creating a clear linear narrative.”

Each of those headings, on average, will be two paragraphs. Again, we recommend following precedent from previous papers with similar methodological approach to guide you here. Chances are your mentor would have used most of these same methods before. A detailed reading of your mentor’s prior work will likely yield most of the methods that you will need. However, you do not want to simply plagiarize prior work. Rewrite them in your own voice, with an eye towards creating a clear linear narrative, emphasizing those methods most relevant to your current study. There may be a few areas that are entirely new, and those are the ones you should spend the most time crafting with your mentor.

Results

The results section details the findings from the analysis. This should be reported in multiple paragraphs starting with one that describes the patient characteristics. If applicable, the next paragraph should describe the hospital characteristics of the groups being compared.

The next 2-3 paragraphs should describe the outcomes of the study. These should be stated objectively. Avoid phrases like, “Surprisingly, we found...” or “Contrary to what we expected...” This section should simply present the information without any editorializing or interpretation.

You should present the outcomes in the same order that you introduced them in the methods. Start with your primary outcome, then your secondary outcomes as appropriate.

Each of the tables and references in the article should be references in the results section. In fact, this is a good strategy to avoid repeating lines and lines of results that are already clearly presented in the tables and figures.

Discussion

The discussion section is your opportunity to connect the previous three sections—introductions, methods, results—together and put them into the broader context of the topic. We typically use a 5 paragraph approach for this section that includes four components (Figure 3).

Paragraph 1: Summarize the Findings

The first paragraph of the discussion should be used to summarize the 1 or 2 key findings from the study. You've taken the reader on a long journey so far, so this is a good time to "refresh" in plain language what this study was about and what the key findings were.

Paragraphs 2-3: Put Your Findings Into Context

The next two paragraphs are used to place your main findings into context. You may have referenced some of this information in the introduction, but this is your chance to take a deeper dive. In addition to summarizing previous similar studies, end each paragraph with an additional sentence about how your research builds or adds to this prior work. It may challenge previous findings, or extended a deeper understanding of them. If you can't write that sentence because your research demonstrates the exact same findings as eight prior studies on this topic, don't write the paper.

An important style point here: authors who have written on the same topic will likely be a reviewer of your paper. So make sure you reference them appropriately and describe their study accurately.

Paragraph 4: Recognize Limitations

No study is perfect, including yours. The easiest way to annoy an editor or a reviewer is to ignore the limitations of your study.

Limitations are design features of your study that threaten the validity of the findings. You want to discuss three to five main limitations, which fall into the three main categories of threats to validity: Chance, bias, and confounding.

- Chance is random error. Addressing random error means making sure the statistical comparisons are adequately powered and analyzed with appropriate tests.
- Bias is systematic error. Addressing systematic error means discussing which strategies you used to ensure that these biases did not make your study results invalid, e.g., making sure you have a strategy for addressing selection bias.
- Confounding is when there are variables that are associated with the exposure and outcome that are actually driving your results, rather than a true relationship between exposure and outcome. Addressing confounding includes a thorough discussion of how you were able to address confounding with study design and/or methodologically.

To really take advantage of this section, you will want to provide a counter point about how you tried to mitigate that limitation or why it may not threaten your entire study. You can think of it as prophylactically addressing concerns you think will come up from reviewers. It will demonstrate you were thoughtful about the study design, and are not overreaching your conclusion.

Paragraphs 5: Implications Moving Forward

The last paragraph of the manuscript should discuss the implications of your findings. An extremely common mistake here is to simply conclude “more research is needed.” Do not do that. It makes everyone mad and cheapens your value as an author. Take a more sophisticated and detailed perspective with your recommendations. Demonstrate you have really thought about the subject matter and genuinely want to see your field advance based on the findings.

<p><i>The 4 P's of the Discussion: How Will this Study Impact- Patients? Providers? Payers? Policy Makers?</i></p>
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To help brainstorm the implications of your study, we often think about “the 4 P’s”: patients, providers, payers, policy makers. How will your study affect each of them? Does this change how patients choose treatments? How providers practice? How payers should reimburse? How policy makers regulate? This is your chance (within reason) to make a call for action based on your work. Having a co-author with deep experience in the topic area can be particularly valuable for help in writing this section.

Tables and Figures

Although tables and figures in final print are included within the manuscript, during submission they should all be placed at the end after the references. All data and figures should be referenced within the results section of the manuscript.

A clear table or figure takes a long time to create. It is worth looking at other manuscripts who have done this effectively and learn what made them useful to the reader. The most effective tables have: clear headings, identical spacing and logical organization of information.

IMPROVING YOUR WRITING PROCESS

This next section offers some practical tips and advice we have acquired over time to improve your writing process.

Learn What Is Tried and True

“You are unlikely to discover something new without a lot of practice on old stuff.”

- Richard Feynman Ph.D., Winner of the Nobel Prize in Physics in 1965

If you are new to writing scientific manuscripts, you will want to start with a lot of reading. Ask your mentor for a handful of important articles in your field and read them closely, sentence for sentence. Learn the style, tone and conventions that are used within your field. After a few articles, then re-read the articles alongside the guide above and identify key paragraphs within each section. Soon the template above will become second nature, and you'll quickly hone in exactly what each paragraph of a manuscript is designed to achieve.

Write in 20 Minute Bursts & 2 Hour Blocks

For many people, sitting in front of a blank page can be intimidating. It still is for us. That is why a template like the one we've given you above is helpful. When you have writer's block, what can you do? You can write *one* paragraph. Chip away at the paragraphs where you know what the content is supposed to be like the methods paragraph about the data source. If you sit down and write a paragraph every morning for twenty minutes for two weeks, guess what you have? You have an entire paper that took you twenty minutes a day to write. It is not very good because you have not edited it, but you do have a paper.

The 20 minute bursts can be effective for some writing, but not sufficient. We also recommend setting aside significant blocks of time in your schedule (e.g. 2 hours) for writing. This should be uninterrupted time to deeply focus on a single paper. The abstract, introduction and discussion sections particularly benefit from these longer writing periods.

Stick to a Parallel Writing Structure

As you read more and more scientific articles, you will observe that they follow a very clear style and pattern. You will want to develop that same habit in your own writing. The easiest place to start here is making sure that you introduce content within each section of your manuscript in the same order. For example, if the title of your paper is the “Complications and Costs of Rural Surgery” then your introduction should first introduce complications, then costs. Similarly, your methods should first define complications then costs. The results should then be reported in that order too, complications then costs. And finally, the discussion should first discuss the findings about complications, then about costs. Being diligent about keep the same order throughout ever section will make your manuscript easier to read and follow.

Be Consistent with Terminology

Use the same terminology throughout the manuscript. Scientific manuscripts are different than other forms of writing where you want to use variety to keep it interesting. This is the opposite. If you're calling something, for example, "Decline in Applicants", don't call it "Diminution in Med Students Interested in Applying to Urology" later on. Call it the same thing everywhere. It is too hard to read a paper when you are inconsistent. Switching the terminology or topic around is something that editors dislike because it makes the paper seem unfocused or confusing. The goal here is for the reader to understand the content of your research—not dazzle the editors with rhetorical flourishes.

Getting the Most From Feedback

A good mentor wants to see your writing early-on and help you iterate. It is your mentor's job to help improve the way you think, and to do that, they need to see what you are doing. Frequent short meetings are best. And, record everything! If you sit down with your mentor for twenty minutes to look over your paper, bring your audio recorder (or your smart phone) because they will say twenty things in that meeting and you will walk out remembering only two. If you try and write it down, you may walk out with five of the twenty. If you record the conversation (with their permission, of course), you walk out with all twenty. Your mentor might even say things like, "Why don't you try something like this?" and it will be the perfect sentence that pulls it all together. Put it into your own words if you like, but that is the best use of your time with your mentor. We can recall countless times we've gone back to audio and rediscovered optimal phrasing or ideas to put into a revision. We also can recall asking mentees who didn't record the conversation, "Didn't we talk about changing this when we met last time? Why is it still the same?"

Write As You Go

When can you start writing these various sections? You can write an abstract without data. You can write an introduction anytime, because it helps you understand if your research question is good. Particularly, the second paragraph of the introduction where you identify knowledge gaps. If you are thinking about a research question, try to write your introduction. If it is not compelling, then you may want to shift your research question.

Write the methods as you're doing the project so you do not forget details, especially if you do a lot of complicated analysis or make a lot of assumptions.

You have to wait for your results to finish your tables and figures, but you can mock up tables and figures. In this way you can think about the table, free of any data. You can develop a good structure for presenting your data.

Diversity Your Writing Portfolio

As you write a manuscript, you may find it not going as planned. The data you had was more limited than you initially thought to make a compelling argument. Or, after thinking through your knowledge gaps, you realized your research question is more appropriate for a specialty audience. Rather than hit these road blocks and scrap the manuscript, we suggest using that as an opportunity to refocus the manuscript to a different submission target.

We use the quality of the data (compelling versus limited) and scope of the narrative (broad versus specialty) to help determine where the manuscript should be submitted (Figure 4.) When there is compelling data and a narrative with broad appeal (e.g. Medicare claims evaluating a national payment policy), we recommend targeting a general medicine journal as an original contribution. Similar quality data, but with a more focused topic (e.g. evaluating readmissions in oncologic surgery) should be submitted to a specialty journal. When there is not great data to evaluate the question—perhaps it not available yet because the policy or new procedure was just announced—we still encourage developing the idea into a thought piece. Building a narrative in the form of a viewpoint, commentary or opinion-editorial can help you think through knowledge gaps in that area and establish your name in that space. Several journals, newspapers and online forums support this type of publication.

Every author serious about improving their writing should intentionally target to hit all four quadrants of articles regularly. Writing for difference audiences will sharpen your ability to communicate complex ideas in a clear narrative. Moreover, it takes advantage of effort spent on early drafts that do not all end up where initially planned.

Eat Some Humble Pie

What most determines whether or not you will be a good writer? It has to do with how often you seek feedback and how you respond to that feedback. The people who are the best writers and who produce the best manuscripts are those who are the most open to feedback. If you think your writing is great and that your mentor's criticisms of it are unfounded, then you will probably not become a great writer. Put your best foot forward in listening to what they say.

We try to write iteratively, and let a paper unfold over a long time horizon. If you write over a long period of time, you can see your flaws more clearly because you can set them aside and come back to them. We also try to bring in someone who has a different perspective than us, just to get their feedback. Often, the best ideas emerge from these conversations, instead of written feedback. Try not to be defensive, - just focus on understanding the problem. And, you do not need to take every suggestion. You want to make it your own. So, eliminate your defensiveness, hear the problem, and come up with a solution. The more iteration you invest in your paper, the better it will be.

References

1. Welch HG. Preparing manuscripts for submission to medical journals: the paper trail. *Effective clinical practice : ECP*. May-Jun 1999;2(3):131-137.

Figures and Tables

Figure 1. The Three Roles of an Abstract Across the Manuscript Timeline

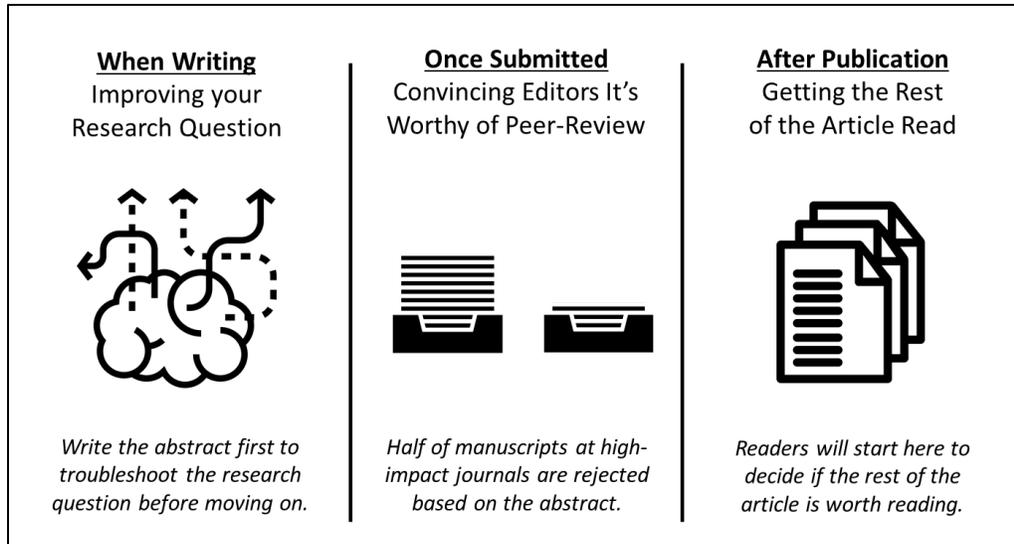


Figure 2. The Three Paragraphs of an Effective Introduction

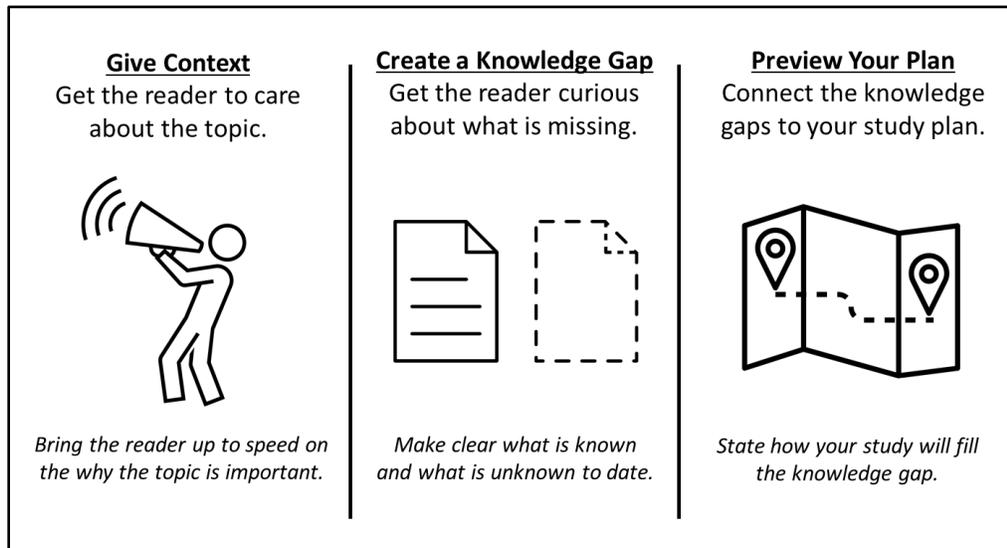


Figure 3. Four Components of a Compelling Discussion

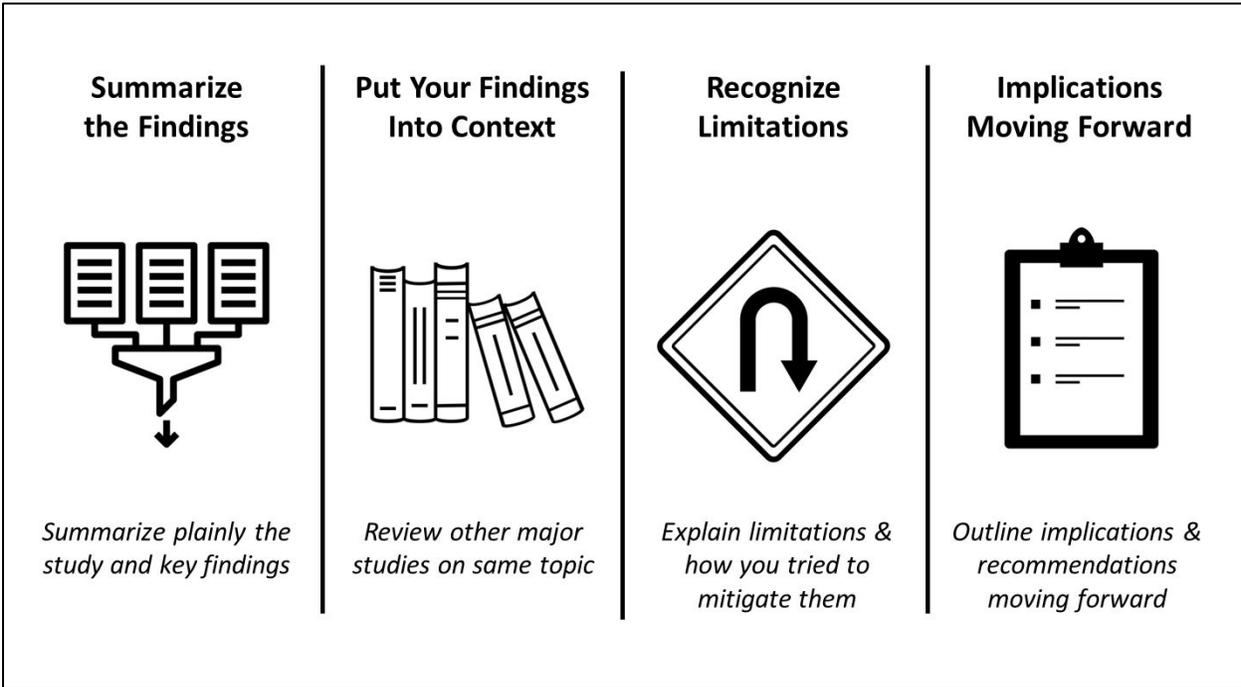


Figure 4. Where Should You Submit Your Manuscript?

