Read, reflect, respond:
How to write a research paper and get it published

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Competing interests: GY works for PLoS, an international non-profit organization that believes that all research articles should be considered a freely available global public good.

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My reasons for writing this module

"Many of us have suffered the humiliation of receiving a rejection letter from a medical journal. The letter usually goes something like:

Dear Sir/Madam,
Your paper is good and original, but unfortunately we are not willing to publish it. The trouble is that the good bits were not original and the original bits were not good.

Why did the journal reject our brilliant, groundbreaking work? Sadly, the reason is often rather simple—our paper was so poorly written and structured that the editors couldn't fathom its meaning. Editors are human beings. They are impressed when they see papers that are short and easy to read and that have a clear message.

I wrote this module to give an insider's view, as a medical journal editor, of what makes a well-written research paper."

Read

Before you start writing

You've done your research, and now comes the hard part—writing it up in a short and structured way. Before putting pen to paper, there are a few things you can do that will make the task easier:

Choose a journal and write your paper specifically for that journal's audience
- Make sure the journal publishes the sort of study that you've done
- Ask yourself what your audience knows about this topic already and what they want to know now

Read the guidelines
▪ Read the journal's guidance to authors and its style guide
▪ Make sure you know about specific guidelines for writing up certain types of studies, such as the CONSORT guidelines for reporting a randomized controlled trial (www.consort-statement.org), and the QUORUM guidelines for reporting a systematic review.[1] (see table 1) Many of these guidelines have been recently collected together on the website of the EQUATOR network (http://www.equator-network.org/), a new initiative that "seeks to improve the quality of scientific publications by promoting transparent and accurate reporting of health research."

Many journals, including the PLoS family of journals, will only publish your clinical trial if it has been registered in a publicly accessible registry. All trials initiated after 1 July 2005 must be registered prospectively in a publicly accessible registry (i.e., before patient recruitment has begun), or they will not be considered for publication at PLoS. For trials initiated before 1 July 2005, all trials must be registered before submission to any of the PLoS journals.

Think about your message and its importance
▪ If the journal editors can't work out what your main message is, they will reject your paper
▪ They will also reject it if you haven't convinced them of your study's importance

Read a related learning module, *Tips on effective writing*
▪The module outlines the basic rules of good writing and the importance of using a clear, simple writing style

Table 1
Guidelines for writing up specific types of studies

Type of Study	Relevant guideline
Randomised controlled trial	CONSORT (www.consort-statement.org)
Systematic review	QUORUM [1]
Economic analysis	BMJ Economic Evaluation Working Group [2]
Study of diagnostic accuracy	STARD (www.consort-statement.org/stardstatement.htm)
Meta-analysis of observational studies	MOOSE (http://www.consort-statement.org/mod_product/uploads/MOOSE%20Statement%202000.pdf)
Observational epidemiology	STROBE (http://www.strobe-statement.org/)
Microarray experiment	MIAME (http://www.mged.org/Workgroups/MIAME/miame.html)

Selling yourself

In many ways, getting published is like a commercial transaction. You have a product (your paper) that you have to sell to a buyer (the journal editor). So you need to persuade the buyer of the value of your goods.

In particular, you have to get your paper through editorial triage. Many medical journals use the following sorts of questions to triage your paper:
▪ Does this article have a clear message? (if there isn't one, then we doubt that readers will find the paper valuable)
▪ Is it original?
▪ Is it important?
▪ Is it true?
▪ Is it relevant to our readers?
If we can't answer, "yes" to all five questions, the paper isn't for us. So in preparing your manuscript, make sure you can pass the triage test.

The first thing an editor looks at is….

....the title? No. The abstract? No. Often the first thing that an editor will read is your covering letter. So don't waste the opportunity to sell your work by writing something dull like, "Please consider this manuscript for publication in your esteemed journal."

Instead, tell the editors why they really must take your work seriously: "Many researchers have wondered whether drug x might help to reduce the frequency of relapses in multiple sclerosis. We have done the world's first ever randomised controlled trial to address this crucial research question."

The second thing an editor looks at is….

…....often the title. It should be concise and informative. Ideally, it should entice the reader without giving away the punch line. Be careful, though, not to make it overly cheesy or sensationalistic (which can be a real turn off to an editor).

Good title: "Can acupuncture help the chronic fatigue syndrome? A randomized controlled trial"
Bad title: "The amazing effect of acupuncture on the chronic fatigue syndrome!"

Many journals now insist that your title includes the study design (for example, "Sickness certification system in the United Kingdom: qualitative study of views of general practitioners in Scotland " [3]). This allows people who are reviewing the literature to identify particular types of studies from the titles alone (for example, they may just be searching for randomized controlled trials).

The third thing an editor looks at is…..

…....usually the abstract. Some journals, including PLoS Medicine, will make an initial decision to consider or reject your paper *based purely on the abstract*. Sadly, it is clear that many authors write the abstract in a great rush, almost as an afterthought, not realizing that their chances of publication depend on the strength of the abstract.

Your abstract should be a clear, concise, "stand alone" piece of writing. Readers should get the message of your study without having to read the whole paper. Spend time getting it right.

Almost all journals will ask for a structured abstract. So look at the journal's guidance to authors to find out which structure the journal wants you to use. Usually you need to state:

- Why did you do the study
- What you did (setting, design, subjects, main outcome measures)
- What you found (just the main results)
- What you concluded

The IMRaD structure

If you're writing a scientific research paper for a medical journal, the journal will probably ask you to follow the IMRaD structure (Introduction, Methods, Results, and Discussion).[4]

Introduction

This should grab the readers' attention, drawing them in immediately to the important issue that your paper addresses. The introduction must be short—usually two or three brief paragraphs is plenty.

Avoid the temptation of describing everything that is known already about the topic. Instead, set the scene and then briefly summarize the "state of the art." Ideally you would cite the current best evidence from any systematic reviews. The journal editor will notice if, for example, you forgot to mention a recent high profile Cochrane systematic review that was relevant to your paper.

You need to say why your research was needed. What was new and innovative about your work? Why did it matter to doctors, patients, or policymakers? Were there any controversies that your study was trying to address?

It is good practice to end your introduction with a single sentence that states a clear, crisp research question and how you set about answering it. For example, here is the last sentence in an introduction to a study published in the BMJ:

"To discover if this reported link between Down's syndrome and neural tube defects could be replicated in other conditions, we looked for it in a South American population."[5]

Avoid the temptation of giving away your findings or conclusions at this stage.

Below is an example of a well-written introduction that illustrates all these points. Note how the opening sentence takes you straight to the issue. This is followed by the most important details of the issue, and then a brief summary of the controversies and the best evidence. The introduction ends with a crisp, clear research question. Note also how the authors use the active tense ("We compared the cost effectiveness") rather than the passive tense ("the cost effectiveness was compared"), in keeping with the rules of good writing.[6]

"More than 35 000 new cases of colorectal cancer occur in the United Kingdom each year, representing a major disease burden on health services.[1,2] At initial presentation, around two thirds of patients undergo resection with curative intent, and most enter some type of long term follow up.[3] The rationale behind this is threefold: psychological support, facilitation of audit, and the early detection and treatment of recurrent disease, with potential improvement in survival.[4] The merits of early detection and treatment of recurrent disease have been vigorously debated. Recently, the present authors and a Cochrane review group independently reported two meta-analyses of all randomised trials of follow up strategies for patients treated for colorectal cancer and showed a significant improvement in all cause mortality in patients followed intensively.[5,6] A further randomised trial has since been published supporting these findings.[7] These data are the first direct evidence that intensive follow up improves survival.

Against the emerging evidence of the effectiveness of intensive follow up, follow up practice varies widely worldwide and, among these many different protocols, the costs to health services are considerable.[8-10] We compared the cost effectiveness of intensive follow up with conventional follow up in patients treated for colorectal cancer." [7]

Methods

In many ways, this is the most important section of your paper. PLoS Medicine rejects many papers because the authors used the wrong method for answering the research question. For example, in testing a new drug x, they did an uncontrolled study rather than a randomized controlled trial.

You need to give enough detail so that a qualified reader would know exactly how to repeat the study. If you haven't outlined your methods in sufficient detail, the editor may worry that you are hiding something.

For all studies that involved human participants, you must mention that your research ethics committee (also known as an institutional review board) approved your research and that the participants gave their written informed consent to be entered into a trial. PLoS Medicine will not send a paper for peer review without a clear statement of ethics committee approval and confirmation of written informed consent from the participants.

Some journals, including PLoS Medicine, may ask to see the study protocol along with the research article that is submitted to the journal.

Quantitative studies

For quantitative studies, the editor will focus on five main things in your methods section. You could walk the editor through these by dividing your methods section with five sub-headings.

Design
You need to outline how the study was designed (box 1).

Box 1 Study design

▪State clearly the design you used. Was it:
Observational or interventional?
Prospective or retrospective?
Controlled or uncontrolled?
A cohort study, cross sectional survey, or case control study?

▪For controlled studies was it randomized or not?

▪For randomized controlled studies, exactly how was the randomization done (for example, did you use randomly generated numbers in sealed envelopes)? What was the unit of randomization (for example, individual patients or GP practices)?

Sample
Explain how you chose your sample. In particular:

▪ How did you determine your sample size? (include the power calculation)
▪ How did you recruit participants?

▪ How did you ensure that your sample was representative of the population you wanted to study?
▪ What measures did you use to reduce bias in the way you chose your sample?
▪ What were your inclusion and exclusion criteria?

Intervention
▪ Describe the intervention you studied and what happened to the control group
▪ What measures did you take to blind participants to which group they were in (for example, did you make the placebo and active treatment indistinguishable)?
▪ Could contamination of the groups have occurred?

Outcome measures
▪ Which outcomes did you decide to measure when you designed your study? You should specify your primary and secondary outcomes
▪ Did you use a validated tool to measure these?
▪ What steps did you use to reduce bias in the recording of outcomes (for example, was your trial double blinded?)

Data analysis
What statistical methods did you use to analyse your data?

Qualitative studies

For qualitative studies, the editor will focus on five main things in your methods section:[8]

▪Was a qualitative approach appropriate? (for example, a quantitative approach is needed to answer the question, " What proportion of smokers have tried to give up?" but a qualitative approach is appropriate for answering, " What stops people giving up smoking?")
▪How were the setting and the subjects selected?
▪ Have the authors been explicit about their own views on the issue being studied (in other words, could observer bias have affected the results)?
▪What methods did the researcher use for collecting data—and are these described in enough detail?
▪What methods did the researcher use to analyse the data—and what quality control measures were implemented?

Results

Here you present just the facts, and nothing but the facts (don't, for example, discuss what your data might mean).

Ideally the results section should be ordered around the primary and secondary outcomes, in the same order as they are listed in the methods section.

State clearly and simply what you found, using words and numbers. Put the main numbers into tables and figures. Each figure or table should convey just one message. Don't repeat yourself—there is no need to duplicate information in the text and tables. A table or figure should be entirely understandable on its own, without looking at the whole paper or reading the text of the results section.

You need to persuade the editor that your sample was representative of the population you wanted to study. For example, what was the response rate? Were there any important

differences between the responders and non-responders? If your response rate was low (under 60%), most journals will still consider publishing it provided that:

a. There is no major reason why the responders should be different from the non-responders
b. The nature of the research question or population being studied means that a higher response rate would have been unfeasible

The statistics that you present should let the reader know:
▪ How likely your results are to be true (for example, p values)
▪ How confident the reader can be in your data (for example, 95% confidence intervals)
▪ How practical your findings will be to implement (for example, what is the number needed to treat)

Avoid using statistics to compare everything in sight.

Discussion

Unfortunately, many authors use the discussion section to write expansive essays that extrapolate wildly from what their study actually showed. Avoid doing this. Instead, guide the reader through the following:

What you found: start your discussion with a single sentence that states your principal finding. For example:

"While smokers of non-filter high tar cigarettes with tar ratings ≥ 22 mg experienced the highest risk of lung cancer, we detected no difference in risk among people who smoked medium tar cigarettes (15-21 mg), low tar cigarettes (8-14 mg), or very low tar cigarettes (≤ 7 mg)."[9]

Strengths and weaknesses: discuss them *both*. It is tempting to just discuss how great your study is, but editors (and readers) are usually more interested in the problems with your work. Every study has its weaknesses, and it is best if you can identify them yourself as an author, rather than letting editors and readers find them. Remember that, "if editors and readers identify weaknesses that are not discussed then their trust in the paper might be shaken: what other weaknesses might there be that neither they nor the authors have identified?" [10]

Relate your study to what has gone before: how do your results fit in with what is already known? What are the strengths and weaknesses of your study compared with previous studies? Why did you reach different conclusions?

What your study means: be careful not to overdo the importance of your findings, since readers will probably make up their own minds anyway. What do you think your study means to patients, doctors, or policymakers?

Unanswered questions: what did your research not address? Avoid using the cliché, "More research is needed."

If you're worried that you've written a long, rambling discussion section, start again and write a structured discussion (box 2).[10]

Box 2 Suggested structure for the discussion section [10]

- Statement of principal findings
- Strengths and weaknesses of the study

- Strengths and weaknesses in relation to other studies, discussing particularly any differences in results
- Meaning of the study: possible mechanisms and implications for clinicians or policymakers
- Unanswered questions and future research

Adding the extras

You will usually need to finish off your paper with:

▪ A list of references
  -cite them accurately
  -restrict yourself to the ones with a direct bearing on your work
  -follow the journal's house style
▪ Acknowledgements
▪ Contributorship (state which contributor did what)
▪ A statement of your competing interests (for example, PLoS Medicine asks authors to fill out the form at http://journals.plos.org/plosmedicine/competing.php)
▪ A statement of who funded the trial, and whether the funder played any role in the preparation of the article or the decision to submit it
▪ A statement about ethics committee approval (if you haven't already included this in your methods section)

The bottom line on getting published

You will get your paper published if:

▪ You picked an important research question
▪ You used the right method to answer it
▪ You wrote a short account of your study that followed a tight structure, using clear language to convey your message

Reflect

To which journal should I send my paper?

This question matters enormously, because you should write your paper with a particular journal in mind. There are all sorts of reasons why authors pick a certain journal to send their work to, including its "impact factor" (a measure of the average number of citations to a journal's articles) or its reputation. But ideally, you would choose a journal based on the audience that you would like to reach. This audience might be GPs, all doctors, primary care researchers, policymakers, or some other group. Ask yourself, "Who would benefit most from reading my work?" A crucially important issue is whether the journal is open access (i.e. anyone worldwide is free to read it) or whether it is only available to those who can afford a journal subscription. Some research funders now insist that you must make your final published work freely available to all, and so you'll need to choose a journal that can comply with this demand.

The decision on where you publish your paper (in an open access versus a restricted access journal) will affect how accessible, or inaccessible, the paper will be. Another issue to consider is whether the journal will allow you to keep the copyright (this means you will be free to post it on your website, make unlimited copies and derivative works, distribute it freely, translate it, etc.) or whether the journal will insist on owning the copyright (this means you cannot reuse the paper for the purposes mentioned above).

I have done a small study in a district general hospital. Would a high impact journal be interested in my study?

Editors are interested in studies that:
- are relevant to the journal's audience
- are well-designed and executed
- are clearly written
- show something new and important

So the size and setting of the trial matter less than the trial's quality, presentation, novelty, and importance. The topic must be one that the journal is clearly interested in. The results should be generalizable to other patients, so that the study has some value to readers. And make sure that the journal publishes the sort of study you've done (some medical journals, for example, don't publish economic analyses).

Remember, you need to "sell yourself" to the editor. If you're writing up a study, and there have been many similar studies before, you need to persuade the editor that your study is different. Perhaps, for example, yours is the first to be done in a district general hospital rather than a specialist setting.

You should always justify how you chose your sample, including the sample size (you need to include your power calculation). Some journals will reject a randomized controlled trial that has a negative result if it was too small (underpowered) to exclude a difference between the groups.

How much time should I set aside for writing up the study? Can I squeeze it in between other clinical work?

Unless you are in a research post with protected writing time, it can be a major challenge finding time to write. Tim Albert, a trainer in medical writing, says, "Almost everyone agrees with the statement: 'I do not have enough time to write.'"[11]

Most professional writers would say that it is important to write *regularly*—so it can be helpful to set aside, say, 20 minutes every single day. The most important thing you can do to make the writing process easier is to spend time planning before you write. You must, for example, be very clear about your audience and the single main message you want to get across to them.

Remember that writing is "not a test of personal worth but a tool for achieving a particular objective. When your writing achieves what you set out to do, then you can consider it a good piece of writing and get on with your life."[11]

I love research but am not keen on writing. Can I leave all the writing to the end?

You could, but it may be easier to start structuring and getting the bare bones of the paper down in writing before starting the research.

You may ask, "How can I write anything before doing the actual research?" Well, you should certainly have all the components you need for your introduction:
▪ You should have reviewed the literature (especially systematic reviews) on the subject you are studying
▪ You should have thought about why your study is actually needed
▪ You should have formulated a very clear research question that you aim to answer

Similarly, you should be able to write your methods section in advance of doing the study. In fact some journals may provisionally commit to publishing your research before you've even done it on the basis of your research protocol.

Remember that good writing takes time. You may have done a spectacular piece of research, but if you don't spend time writing it up in a structured way with a clear message, you may find it hard to get the research published at all.

What should I do if a journal rejects my paper?

If you genuinely think that your research was important, well done, well written, and deserves to reach that journal's audience, you should write an appeal letter to the editor.

Here are some of the dos and don'ts in writing a persuasive appeal letter:

Do:
▪ Be polite
▪ Point out why you think the journal may have missed an important study
▪ Challenge each of the reasons that the editor gave for rejecting your paper. Be firm and courteous.
▪ If necessary, re-write the paper in view of the criticisms you received and ask the editor to take another look. Perhaps, for example, you didn't give a detailed enough account of your methods the first time round.

Do not:
▪ Under any circumstances at all, abuse the editor ("What kind of second rate journal are you running? How could you be such an imbecile in failing to spot the enormous importance of my work?")
▪ Pull rank ("You must publish my paper because I am a professor")
▪ Come across as aggressive or threatening ("If you don't publish my paper, I will personally make sure that nobody from my university ever sends you any of their research ever again")

Will I ever get my damned paper published?

Yes, provided that the actual research was worthwhile. Almost all papers get published in the end. You may not get it published in the journal of your first choice, but it will eventually appear in print or online.

If you're trying a second journal, it is good practice to send them any peer review reports from the first journal you tried. You may need to re-write the paper to meet the second journal's guidelines.

I have a conflict of interest, but I don't think it's important. What should I do?

If you are in any doubt at all, the best thing to do is to declare it. We all have competing interests (mine are published on PLoS Medicine's website, alongside those of the other editors) and we should openly declare them.

Conflicts of interests can be defined as, "a set of conditions in which professional judgment concerning a primary interest (such as patients' welfare or the validity of research) tends to be unduly influenced by a secondary interest (such as financial gain)."[12] Richard Smith, the editor of the BMJ, notes that, "It is a condition not a behaviour, and there is nothing wrong with having a conflict of interest. It is common."[13]

If my research itself was important, does it really matter how well I write the paper?

Yes, it does. However important your study was, you won't get it published unless you can get a clear message across to the reader about why you did it, what you found, and what it means.

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Respond

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