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Turning Your Abstract into a Paper: Academic Writing Made Simpler

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Academic writing is a critical skill distinct from creative writing. While brevity is vital, clarity in writing reflects clarity of thought. This paper is a primer for novice academic writers.
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INTRODUCTION

Academic writing is distinct from creative writing. While the latter involves detailed description of feelings, situations and scenes, the former requires only facts without editorial comment or extraneous detail. That which we learned in primary school must be modified substantially for scientific communication. The purpose of this paper is to provide a primer for inexperienced academic writers, mentor this important academic skill, and minimize the potential for harsh critique that will crush the intellectual curiosity needed to pursue clinical research.

Choosing a target journal

There are 35 general and subspecialty journals related to emergency medicine (EM). Twelve of these publish general EM papers and are included in Index Medicus, supported by the National Library of Medicine. These can be found at ftp://ftp.ncbi.nih.gov/pubmed/J_Medline.txt by searching for the term “emergency.” These 12 are some of the most discriminating and most-desired by authors, and do not require the author to pay for publication. There are other journals where the author pays for publication, on the order of \$1600-1800 per article, while others exist in electronic form only. Also included in Index Medicus are subspecialty EM journals for pediatrics, pre-hospital care, emergency department (ED) management, and emergency nursing. Your paper may be appropriate for these journals as well.

When writing a scientific paper, it is critical to choose and then write for a target journal, following their instructions to authors carefully. Examine the “Aims and Scope” of the target journal from its website, and assure the topic of the paper fits

the journal’s focus. First-time authors or resident research projects may not be accepted to top tier journals. Be realistic about the importance and quality of your project and try to match it with an appropriate journal. This is a situation where the advice of a research mentor can be valuable.

Be aware of EM conventions of the target journal. In general, use the terms emergency physician (EP), emergency department (ED) and emergency medicine (EM). Do not use emergency room physician, emergency room, emergency medicine physician, ER physician, EM physician or even ED physician. The first time you use these and any other common terms, spell them out and abbreviate them in parentheses. Thereafter, to save space, use the abbreviation. Tables and figures are exceptions to this requirement. Most journals require these to stand alone, with all terms spelled out or defined, so these could be taken out of the paper and still be clear. Similarly, the abstract must stand alone, with all abbreviations defined first, and then again defined in the body of the paper. Readers will often perform literature searches and retrieve abstracts independent of the full text electronic version of the article.

Brevity Rules

The overriding principle of academic writing is brevity. The journal editor wants to include as much scientific content in each issue as possible, within constraints of publishing cost. This was said best by Strunk’s 1918 classic, *The Elements of Style*:¹

Vigorous writing is concise. A sentence should contain no unnecessary words, a paragraph no unnecessary

sentences, for the same reason that a drawing should have no unnecessary lines and a machine no unnecessary parts. This requires not that the writer make all his sentences short, or that he avoid all detail and treat his subjects only in outline, but that every word *tell*.”

A prime illustration of this principle is that the landmark paper, “Molecular Structure of Nucleic Acids” by Watson and Crick² was only a bit over one page. A paper need not be verbose to be important.

Scientific writing should be intelligible to educated non-scientists. Avoid complicated medical terms and jargon, using medical terminology only when the shorter lay term is not precise enough. For example, it is appropriate to use “myocardial infarction” rather than heart attack, as the latter has many meanings, but “intestinal” has little advantage over, “bowel” or even, “gut.” A few characters do make a difference to the reviewer and editor. The goal should be to communicate a concept in the fewest possible words. Frequently, submitted papers can be trimmed by more than 30% without sacrificing meaning.

Use active voice almost all the time, even if it means referring to authors as “we,” or “I,” to employ it. This is not only more direct, but also shorter. Consider: “Scientists conduct experiments to test hypotheses” vs. “Experiments are conducted by scientists to test hypotheses.” The former is 15% shorter (49 characters vs. 58). “The survey was administered by the research assistants” is longer and vaguer than, “Research assistants administered the survey.” (54 vs. 43, or 20% shorter).

The corollary to “brevity rules” is “avoid redundancy.” Unless hyperbole is absolutely required, modifiers like “close proximity,” “summarize briefly,” “very deep,” “overcrowded,” and “very precarious” add nothing to their parent terms. It is rarely necessary to use the same word twice in a sentence. For example, “Simpler sentences are preferred over more complex sentences,” should be shortened to “Simpler sentences are preferred over more complex ones,” or, better, “Simpler sentences are preferred.” For most brevity, just use active voice: “Use simple sentences.” (59 characters vs. 20).

CLARITY OF WRITING REFLECTS CLARITY OF THOUGHT

It is critical to outline a paper before beginning to write, using, for example, the template included here to include all vital elements (Appendix, online at www.westjem.org). Vary your sentence length to improve readability, alternating between short and long ones. If your concept is highly technical and requires a long explanation of a complicated process, with parenthetical phrases and multiple qualifiers, follow this with a short sentence. Your reader will appreciate it. The previous two sentences are an example of this concept. Conversely, avoid run-on sentences, or using more than one

parenthetical phrase, (separated by commas) per sentence. Instead, simply divide the sentence into two.

A paragraph should have at least three sentences and rarely more than six. These include at least a topic sentence, an explanation of the topic, and a concluding sentence. If there are only two sentences, incorporate these into the previous or following paragraph.

When you have finished your draft, have someone not in your field, or not even in medicine, review the paper before submission. A college graduate should be able to understand much of medical writing. If they are lost, the paper needs more work. Write in plain English, rather than a foreign language called “medicine.”

Avoid politicizing a research paper. If you consider a concept politically or socially provocative, it probably does not belong in a research paper. There is little room for opinion in scientific writing as the facts speak for themselves. Only the “Discussion” section should contain opinion, clearly prefaced by “we believe,” and limited to a few sentences or conjectures. Most authors inherently overstate the importance of their findings, as they are invested in the project after years of work. It is almost always appropriate to tone down conclusions, as the definitive paper which settles an issue is exceedingly rare.

To gain experience with academic writing, consider volunteering as a reviewer. This flips perspective from author to consumer, and provides insight into common problems in academic writing. This process is time-consuming and intellectually demanding. A good review easily takes 2-3 hours, but will pay off in spades with a smooth road to the promised land of accepted publications.

What is wrong with the previous sentence? It includes three colloquialisms that do not belong in academic writing: “pay off in spades,” “smoother road,” and, “promised land.” It is also passive voice. The sentence would read better as: “You will need to spend 2-3 hours on a good review, but this will enhance your papers’ chances for acceptance. (129 vs. 108 characters, or 16% shorter)

SITTING DOWN TO WRITE THE PAPER

You may choose to use the template from the University of California, San Diego Emergency Medicine Residency, included as an appendix on-line at <http://repositories.cdlib.org/uciem/westjem/>.

The **title** should answer the question posed by the paper. It should include the study design: retrospective vs. prospective, randomized controlled trial, cohort study, before and after study, case series or report. Truncate the title as needed, as some journals have an 80-character limit, striking the best balance between brevity and accuracy. Spell out all abbreviations.

A structured **abstract** is next, and must include all major findings. The “introduction” should be two sentences

maximum, framing the background of the investigation. The “objective” sentence follows, and then the “methods” can be listed in 2-3 sentences, including the setting. Results should begin with the most important finding, and then, at most 1-2 secondary outcomes. The “conclusion” should be one sentence, qualified to clarify the subject population you studied. Readers may read and act upon the abstract alone, and even more distressing, only the “conclusion” sentence. These therefore must be able to stand alone with complete and honest reporting of both positive and negative results. Adhere to word count limits for abstracts, which vary by journal from 250-400 words.

The abstract should parallel the body of the paper in content and order. It is common to write the abstract first as an outline, then the paper itself. However, some results and conclusions may change in the arduous and lengthy writing process. Therefore, it is critical to return to the abstract and assure consistency in methods, results and conclusions. Nothing brands a paper as sloppy more than this common problem. The reviewer and editor think, “If the authors don’t care enough to make the numbers match, then what confidence can I have in attention to detail in their research?” Such blatant inconsistency casts a pall on the entire peer-review.

The **introduction** is typically four paragraphs, and should not be a literature review. Rather, it should frame the problem or hypothesis, drawing from a few key papers whose conclusions lead to the question at hand. All other citations belong in the discussion (save “methods” published previously). The last sentence should be “we hypothesized,” or “our objective was...” or similar.

The **methods** section should describe the setting, the inclusiveness of the sample, specific inclusion/exclusion criteria and the intervention, if any. How were subjects identified? How did you gather, record and analyze the data? What safeguards were in place to protect data integrity and accuracy? What statistical tests and programs did you use? It is important to have a statistician or senior researcher write or review this portion of the methods section. If equipment or computer programs were used, list the manufacturer, model or version number, which would enable a reader to replicate the study. If the study is a retrospective chart review, describe compliance with the 7-12 elements outlined in one of two methodology papers by Gilbert and Lowenstein³ or Worster and Bledsoe.⁴

Within the **results** section, present the primary outcome measure first, followed by secondary ones. If there are more than four or five related results, report them in a graph or table. Text in the results section should not repeat graphic or tabular results, but rather provide a synopsis of results. Design graphs in black and white, with different patterns, as most print journals are not color and the resultant shades of gray are difficult to discriminate.

Describe results in absolute, not relative, terms. For

example, “The absolute risk reduction in mortality was 2% (4% to 2%)” rather than, “The relative risk reduction was 50%.” This is intellectually honest, and avoids artificially inflating the relative benefit of an intervention. To compare groups, use p values with 95% confidence intervals, and report the number-needed-to-treat and to harm from the absolute difference in outcomes. This gives information to gauge clinical import of the intervention.

For diagnostic tests, use likelihood ratios in addition to sensitivity, specificity, and positive/negative predictive values. This allows the reader to change the pre-test probability of a condition to a post-test one after the diagnostic test, using the Fagan nomogram.⁵

Even if key findings in a picture or figure seem obvious, annotate them with arrows to provide greater clarity. Pictures must be high resolution, as low resolution images show pixels in print. Because tables and figures may be removed from the body of the paper and must therefore stand alone, define abbreviations, even if done elsewhere. The legends for both tables and figures are usually submitted on separate pages.

In the **discussion**, highlight the most important findings first, following the order of the methods and results sections. Discussion of secondary outcomes should follow. Limit and clearly label opinion, and identify how, and if, the study could or should change practice. Limit this section to 5-6 items, each with 1-2 paragraphs. Avoid submitting a comprehensive literature review, rather confining it to the outcomes of the paper.

Authors commonly overstate their **conclusions**, and offer them despite not having studied the issue. These should be quite narrow, and focused only on the sample studied. The definitive study is near impossible, so qualifiers such as “it appears,” or “from these data” are appropriately included. Further investigation is always warranted. Remember that retrospective studies cannot, by definition, show causation, only association, so use this word when indicated. Make the conclusion specific enough to stand alone. Include for example, “in adults,” or “in emergency department patients with a chief complaint of chest pain...” For case reports the conclusion should state the learning objective. Avoid statements such as, “The emergency physician must know about this rare condition...” and instead use phrases such as, “We present this case to increase awareness among emergency physicians of this condition...”

The **limitations** section should be 1-2 paragraphs and acknowledge major flaws, such as small sample size/underpowered study, incomplete patient enrollment, patients lost to follow up, obvious sources of bias, retrospective design, lack of blinding, controls, or generalizability. It is better to be honest up front about shortcomings, rather than be guaranteed additional criticism in the peer-review process.

The **references** of course must be complete and correct, and conform to a journal’s required format. The placement of

citations within the body of the paper must also conform to a journal's convention. It is important to do another literature review before submission, as new publications may have bearing on the paper, and failure to do so risks embarrassment if the reviewer finds pertinent references not included.

RESPONDING TO THE FIRST CRITIQUE

A very small minority of papers are accepted without revision, so expect a harsh critique. Whether resubmitting to the same journal, or to another, follow the reviewer's suggestions assiduously. If the review asks for information you did not collect, or cannot produce, acknowledge this in the limitations section. With repeated submissions, this section tends to grow sometimes longer than the discussion section itself.

Take a critical look at the clarity of the paper. If the first reviewers did not understand the paper, neither will subsequent ones. Show the paper to a colleague unfamiliar with the project, and respond to their confusion by clarifying seemingly obvious points.

If resubmitting to the same journal, avoid defensiveness in your response. Outline the changes you make in a point-by-point cover letter, so the reviewer can easily see compliance with suggested changes, and complete this within one month. Swift resubmission will increase chances of acceptance, as the reviewer will retain familiarity with the paper.

CONCLUSION

Academic writing is at worst maddening and at best painstaking. Attention to detail in reporting should parallel the same in execution of the project. With adherence to this advice, the severity of the critique will be manageable, and desire to replicate the research process will remain unscathed. The Editors of *WestJEM* wish you the best of luck in your

academic writing.

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Appendix.**Manuscript Publication Template****TITLE SECTION**

- Descriptive title
- Authors
- List of author selected key-words
- Source of financial support for study (if applicable)
- Acknowledgments
- Address for reprints

ABSTRACT SECTION (use structured format)

- Purpose of study or study objective
- Methods including
 - ◊ Study design
 - ◊ Setting
 - ◊ Participants – identify study/control groups if applicable
 - ◊ Interventions
 - ◊ Measurements – clearly specify primary outcome measure
 - ◊ Statistical tests applied
- Results
- Conclusions

INTRODUCTION SECTION

- Historical background
- Significance of study
- Review of prior pertinent literature
- Identify gaps in knowledge and state rationale for current study
- Clearly state in final paragraph study hypothesis or objective

METHODS SECTION

- Note human subjects/IRB approval, consent procedures
- State study design - method of randomization, blinding if appropriate
- Setting
- Participants – specify in detail inclusion and exclusion criteria
- Interventions – describe in sufficient detail to permit replication

- Measurements - identify clearly primary and secondary outcome measures
- Consider use of a flowchart to describe patient flow
- Data collection and analysis – specify statistical tests, sample size calculation

RESULTS SECTION

- Note number of total eligible patients during study period
- State number of patients excluded and why
- Number of patients enrolled by group
- Indicate completeness of follow up by group. What happened to every patient? Use flow chart.
- Include basic patient demographics and comparison of groups in “Table 1”
- Report results for primary outcome measure followed by secondary outcomes
- Include a power analysis for sample size.

DISCUSSION SECTION

- Discuss how current findings relate to prior studies
- Cite relevant prior literature
- Note specifically how current findings are new or different from prior reports
- Discuss implications of current findings
- Discuss limitations of current study
- Note future questions or areas needing further research

CONCLUSIONS

- State important conclusions – must be supported by specific data
- Don't overstate conclusions
- Limits on applicability (ability to generalize) conclusions

REFERENCE SECTION

- List in order they appear in text – use required journal format

APPENDIX SECTION

- Description of special procedures too detailed for body of paper
- List of definitions, codes, diagnostic criteria, etc.
- Sample data forms, questionnaires, etc.