Scientific Writing
Development Series

Anne Marie Weber-Main, PhD
Dept of Family Medicine & Community Health
Office 421
717 Delaware St. Building
weber005@umn.edu
612-624-5864
I have no financial relationships to disclose.

I will not discuss off label use and/or investigational use in my presentation.
Context: Why write well?

Science depends on it.

The goal of research is the creation of new knowledge. However, a study’s results are not part of the collective knowledge base until they are published.
Context: Why write well?

Your research career depends on it.

Publish or perish!
Does published = good writing?

“There seems to be no study too fragmented, no hypothesis too trivial, no literature citation too biased or too egotistical, no design too warped, no methodology too bungled, no presentation of results too inaccurate, no argument too circular, no conclusions too trifling or too unjustified, and no grammar and syntax too offensive for a paper to end up in print.”

Session 1 Objectives

1. Recognize the importance of crafting “reader-centered prose” in research articles.

2. Describe how reviewers assess the quality and credibility of published results.

3. Explain the essential qualities of effective written communication to scientific audiences.
The reader needs to be the center of your universe!

http://hubblesite.org/gallery/album/the_universe_collection/pr1999019a/
Reader-Centered Prose

What is it?

Prose that meets readers’ needs and expectations

Why strive for it?

Your research paper is more likely to

• be published at all
• be published more quickly
• have an impact after publication
Who are your readers?

- Scientists
- Busy human beings
- Competitors
- Skeptics
- Clinicians
- Patients
Who are your readers?

- **Scientists (like you)**
  
  Expect your message to be credible – valid, believable – and important.

- **Busy human beings (like you)**
  
  Expect your message to be clear, concise, logical, readily understandable.
As scientists, what do readers expect?

What criteria do readers use to assess the quality and credibility of a research manuscript?
Review Criteria - Resources


- Reviewer guidelines and author checklists for a particular journal (e.g., *Nursing Research*)


What do readers expect?

Overall, readers expect authors to have:

1. Investigated an important question.

2. Approached the question or problem with an appropriate study design and methods.

Your goal is to clearly demonstrate to readers that you have done this.
What do readers expect?

Readers expect authors to have:

3. Reported their methods in sufficient detail to allow the research to be replicated.

4. Provided a thoughtful interpretation of findings – what they mean, how they might be applied.
## Importance

<table>
<thead>
<tr>
<th>Rating</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate the paper’s originality, importance</td>
<td>(excellent, poor)</td>
</tr>
<tr>
<td>Rate to what extent the subject addressed in this article is worthy of investigation</td>
<td>(0-5 scale) fails by a large amount, succeeds by a large amount) <em>Lancet</em></td>
</tr>
</tbody>
</table>
Common criticisms about an article’s importance

- Rehash of established facts
- Insignificant research question
- Irrelevant or unimportant topic
- Little clinical relevance
- Lack of originality
- Repetitious data (already in literature or adding little)
- Insufficient new information
- Low reader interest

(Byrne DW. Publishing Your Medical Research Paper. Baltimore, MD: Williams & Wilkins; 1988, pgs 48-50)
What do journal editors expect?

1. Read the journal, understand its focus.

2. Understand who their readers are, what they want.

3. Follow the instructions to authors.

4. Whatever you write, shorten it by one fourth!
## Match with journal’s scope, readers

<table>
<thead>
<tr>
<th>Question</th>
<th>Rating System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suitable for publication in this journal?</td>
<td>(yes/no)</td>
</tr>
<tr>
<td><strong>Who would be interested in reading this paper?</strong></td>
<td>(fill in the blank)</td>
</tr>
<tr>
<td>Rate the interest of the topic to readers</td>
<td>(very high, very low)</td>
</tr>
<tr>
<td>Rate the appropriateness of topic for this journal</td>
<td>(highly relevant, fairly relevant, tangential, inappropriate)</td>
</tr>
</tbody>
</table>
Example - *Neuropharmacology*

- High quality, original research in neuroscience
- Encourages neuropharmacological content
- Publishes reviews
- Does not accept clinical research
- Publishes occasional Special Issues
- Broad scope, for example:

  - neurotransmitters and receptors, ion channels, psychopharmacology (animal models of psychiatric disorders), depression, epilepsy, ischaemia, neuroprotection, drugs of abuse
Example – *Ethnicity and Disease*

- **Focus:** Causal relationships in the etiology of common illnesses through the study of ethnic patterns of disease

- **Multidisciplinary journal:** epidemiology, genetics, health services, social biology, anthropology

- **Subscribers:** physicians, medical researchers, other healthcare providers who treat patients and conduct research in the U.S. and abroad.
In real estate, what matters most is *location, location, location*.

In scientific review, what matters most is *methods, methods, methods*.
# Design and Methods

<table>
<thead>
<tr>
<th>Explain why the study design and data analysis are/are not appropriate for the research question.</th>
<th>Comments for author and editor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate the methodology, including analyses</td>
<td>(excellent, very poor)</td>
</tr>
<tr>
<td>Rate the scientific validity</td>
<td>(high, low)</td>
</tr>
</tbody>
</table>
Common criticisms about an article’s design and methods

- Poor experimental design
- Biased data collection
- No control or improper control
- Small sample size
- Vague or inadequate description of methods

Byrne DW. *Publishing Your Medical Research Paper*. Baltimore, MD: Williams & Wilkins; 1988, pgs 48-50
Readers’ assessment of the quality and credibility of your research – that is, its overall value – is influenced not only by what you did, but also by how you report it.
Provide readers with lots of reasons to “rule in” (rather than “rule out”) your article
Good scientific reporting: The four C’s

1. Complete
2. Compelling
3. Centered (Focused)
4. Conclusive
1. Complete

Give readers all of the information they need to evaluate the science.

Methods, Results
1. Complete

Take advantage of standardized reporting guidelines, such as the CONSORT Statement

www.consort-statement.org
What is CONSORT?

- Consolidated standards of reporting clinical trials (RCTs, parallel groups)
- Checklist of information to include in each section of manuscript
- Different guidelines for different designs
- Evolving document
Why was CONSORT developed?

Response to underreporting of key details such as:

- How patients were assigned to treatment groups
- Which patients were included in data analysis
- Method of randomization
- Level of treatment difference the study can detect
Why was CONSORT developed?

“Inadequate reporting makes the interpretation of RCT results difficult if not impossible. Moreover, inadequate reporting borders on unethical practice when biased results receive false credibility.”

CONSORT says…

Methods:

Describe the settings and locations where the data were collected.

www.consort-statement.org
Example

“Volunteers were recruited in London from four general practices and the ear, nose, and throat outpatient department of Northwick Park Hospital. The prescribers were familiar with homoeopathic principles but were not experienced in homoeopathic immunotherapy.”

CONSORT says…

Results:

Report results for all planned primary and secondary end points, not just for analyses that were statistically significant.
CONSORT says…

Results:

Report departures from the protocol, including unplanned changes to interventions, examinations, data collection, and methods of analysis.
“CONSORT-Like” Guidelines

- **MOOSE** - For meta-analysis of observational studies
- **STARD** - For reporting studies of diagnostic accuracy
- **STROBE** - For reporting of observational studies
- **QUOROM** - For systematic reviews and meta-analyses
2. Compelling

Do not assume that readers know why your research is important.

YOU need to explain why your research question is interesting, exciting, relevant, controversial, makes a contribution.

Introduction, Discussion
2. Compelling

LIKA syndrome ("Little Is Known About…") does not justify a study!

“...legend suggests that a woman’s shoe size correlates with (and therefore can be used to predict) her newborn baby’s birth weight in pounds.

“...a focused review of the English-speaking literature reveals no prior studies specifically investigating a relationship between maternal shoe size and birth weight.”

2. Compelling

Ask yourself, then *tell readers:*

What gaps in the knowledge base must be filled?

How does my work fill this gap?

Address limitations of previous studies?
What is the health problem?

“What rates of relapse to smoking within 1 year after initiating a quit attempt are 70-90%.”

What don’t we know?

“What despite the presumed influence of withdrawal symptoms on relapse to smoking, only minimal direct evidence from clinical studies indicates that withdrawal severity is a good predictor of relapse.... A need exists for a more detailed understanding of both the time course of nicotine withdrawal symptoms and the relationship of such symptoms to the likelihood of smoking relapse.”

What did you do?

“The primary goal of this study was to identify temporal patterns of standardized symptom scores …”
And the reviewers said:

“There are several positive aspects to this study. As the authors point out, the literature indicates that the methods typically used to assess withdrawal have been somewhat problematic and may explain the inconsistent findings in terms of the relationship between withdrawal and relapse. This study addresses that issue by assessing symptomatology over time and in relation to the timing of relapses. The analytical approach also lends itself to easy interpretation of the findings.”
3. Centered

Explicitly state the central purpose of your study – what you specifically wanted to learn, or what specific question you aimed to answer, and how you specifically did this (design).

Introduction, Abstract
3. Centered

In this report, we examine conventional and low-air-loss bed therapies for patients with pressure ulcers.

We conducted a prospective randomized controlled trial to compare the rate of healing of pressure ulcers in nursing home patients who used low-air-loss beds with the rate of healing in those who used a conventional foam mattress.
4. Conclusive

Give readers the answer to the question you were investigating.

State the implications of your results.

Discussion, Abstract
4. Conclusive

You don’t want reviewers to say,

“Implications of the results are not described.”

Which means they think,

“What’s the point of all this?”
Main Message – What is it?

A short (1-3 sentence) statement of what you want the reader to understand as the most important point in your paper.
Main Message

Framers of the U.S. Constitution:

- All persons have inalienable rights and freedoms that should be protected.

- No one arm of government should hold all of the power.
Main Message – What is it?

- Answer to your research question
- Unexpected but important finding
- Conclusions
- Implications of results
- Key points, take-home messages

The reason people will read your paper, learn from it, and frequently cite it!

*Your main message* (Weber-Main, 2008).
Main Message

Watson and Crick:

“…the specific pairing we have postulated immediately suggests a possible copying mechanism for the genetic material.”

**What we found:**

“We observed a consistent pattern in which craving, withdrawal, and smoking urges increased leading up to the day of relapse and then subsided quickly.”

**What this means (for research, clinical practice):**

“These findings suggest an association between pattern of symptom intensity and relapse. They highlight the importance of adopting a detailed approach to the measurement and analysis of symptomatology when assessing the effects of a smoking intervention. Further, they suggest that frequent symptom monitoring might be clinically important for relapse prevention.”
## Good scientific reporting: The four C’s

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
</table>
| **1. Complete** | Readers have all of the information they need to properly evaluate the science.  *
**Methods, Results** |
| **2. Compelling** | Readers perceive a clear need or rationale for your study.  *
**Introduction, Abstract** |
| **3. Centered** | Readers know the specific purpose of your study – what you wanted to learn, what question you wanted to answer.  *
**Introduction, Abstract** |
| **4. Conclusive** | Readers have the answer to the question you asked and understand the implications of your results.  *
**Discussion, Abstract** |
One more “C” – Critical argument

You can appeal to the scientist by thinking about your research article as a critical argument.
Readers as Scientists

“Scientific papers are not just baskets carrying unconnected facts like the telephone directory; they are instruments of persuasion.”

Scientific papers, even if they are based on sound research, must argue you into believing what they conclude; they must be built on the principles of critical argument” (p. 60).

### Research paper as critical argument

<table>
<thead>
<tr>
<th>Section of research paper</th>
<th>Element of critical argument</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>Problem (question)</td>
</tr>
<tr>
<td>Results</td>
<td>Evidence (the data); initial answer</td>
</tr>
<tr>
<td>Materials and methods</td>
<td>Credibility of evidence</td>
</tr>
<tr>
<td>Discussion and Conclusion</td>
<td>Your valid evidence; supporting evidence from others; contradictory evidence; final assessment of all evidence. Answer!</td>
</tr>
</tbody>
</table>

Research paper as critical argument

It’s not just about putting the right information, in the right section (filling the baskets with content).

It’s about the whole package:

- How well you present all of the interconnected elements of a critical argument.
- How well you tell the full story of your research.
Who are your readers?

Scientists

Busy human beings

Expect your message to be clear, concise, logical, readily understandable.
Good scientific reporting and elegant, clear prose are not mutually exclusive!
They are co-dependent!

“Successful scientific experimentation is the result of a clear mind attacking a clearly stated problem and producing clearly stated conclusions. Ideally, clarity should be a characteristic of any type of communication; however, when something is being said for the first time [as in scientific writing], clarity is essential.” (p. 1)

Good writing = ???

It is well-written.
It is well-organized.
It flows well.
<table>
<thead>
<tr>
<th>Writing Problems*</th>
<th>Writing Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>It’s not clear.</td>
<td>CLARITY</td>
</tr>
<tr>
<td>It’s not logical.</td>
<td>COHERENCE</td>
</tr>
<tr>
<td>It’s too long.</td>
<td>BREVITY</td>
</tr>
<tr>
<td>It’s full of clutter.</td>
<td>ECONOMY</td>
</tr>
<tr>
<td>It’s pretentious</td>
<td>WORD CHOICE</td>
</tr>
<tr>
<td>It doesn’t lead readers out of the previous sentence.</td>
<td>FLUENCY</td>
</tr>
<tr>
<td>It could be read in several different ways.</td>
<td>UNAMBIGUITY</td>
</tr>
</tbody>
</table>

Clarity

Authors tend to:

- Obfuscate (i.e., darken) their message
  
  e.g., by using jargon, complex sentences, poor organization, empty phrases, etc.

Readers need:

- Simple, clear, readily understandable prose
In considering diseases that might be ameliorated by gene therapy, a setting in which a selective advantage is conferred by a transgene expression in association with long-lived transduced cells such as T-lymphocytes may prove critical.
Original

In considering diseases that might be ameliorated by gene therapy, a setting in which a selective advantage is conferred by a transgene expression in association with long-lived transduced cells such as T-lymphocytes may prove critical.

Revision

The selective advantage conferred by transgene expression and long-lived transduced cells may be critical to the success of gene therapy.

Fluency

Authors tend to:

- Interrupt flow

  e.g., by neglecting transitions, being repetitious, writing non-parallel sentences.

Readers need:

- Prose that flows smoothly, promotes forward movement of thought. No defects interrupt the line of thought.
Fluency – Use parallelism

Original (non-parallel) :

Women were excluded from the study for a history of stroke, if taking psychiatric medications, pregnant, or having a premenstrual symptom score of less than 10.

Revision:

Women were excluded from the study if they had a history of stroke, were taking psychiatric medications, were pregnant, or had a premenstrual symptom score of less than 10.
# Economy – Empty Words and Phrases

<table>
<thead>
<tr>
<th>Empty Phrase</th>
<th>Preferred Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>a number of</td>
<td>many</td>
</tr>
<tr>
<td>accounted for by the fact that</td>
<td>because</td>
</tr>
<tr>
<td>during the time that</td>
<td>while</td>
</tr>
<tr>
<td>in close proximity to</td>
<td>near</td>
</tr>
<tr>
<td>give rise to</td>
<td>cause</td>
</tr>
<tr>
<td>if conditions are such that</td>
<td>if</td>
</tr>
<tr>
<td>are of the same opinion</td>
<td>agree</td>
</tr>
<tr>
<td>ascertain the location of</td>
<td>find</td>
</tr>
<tr>
<td>give indication of</td>
<td>show, indicate, suggest</td>
</tr>
</tbody>
</table>
In Future Sessions, Expect More

C’s of good scientific reporting

- Complete
- Compelling
- Centered
- Conclusive
- Critical argument

Characteristics of good [scientific] writing

- Clarity
- Simplicity
- Economy
- Fluency
- Accuracy
A tree that falls in the forest makes no sound unless someone is there to hear it. Similarly, a published paper will “fall silently in the woods” unless its meaning is clearly understood and appreciated by readers. (pp. 1-2)

Recommended Reading

Evaluation!
The purpose of this exercise is to get you to think critically about the Introduction section of a research article. Read the Introduction provided below. Then, list up to three brief (one sentence) questions or suggestions you think the authors should consider when revising the Introduction for content, focus, or organization. In crafting your suggestions, be tactful and constructive. **Do not spend more than ½ hour on this exercise.**

**Remember**— you are not to edit the Introduction; just read it closely and evaluate it critically. Please send your 1-3 suggestions to me (weber005@umn.edu) no later than 3pm on April 11.

**INTRODUCTION**

Juvenile dermatomyositis, a multisystem inflammatory disorder of unknown etiology, is characterized by a non-suppurative myositis with symmetrical proximal muscle weakness and typical skin rash with predominant involvement of face and hands; elevated serum levels of muscle enzymes, electromyographic changes and histopathologic changes provide laboratory confirmation of the diagnosis (1).

Spencer et al, have reported that the course of JDM is heterogeneous. They observed three courses of JDM: monocyclic, polycyclic and chronic continuous (2). The main stay of pharmacological therapy is corticosteroid. Corticosteroids are generally used initially in a high dose followed by tapering doses for extended periods of time (3, 4). The disease is usually responsive to steroid, however the response of patients with different clinical courses is variable and may respond to different forms of treatment (2). Some patients may be resistant to steroid or remain dependent on high doses of steroids, while others may develop unacceptable complications of steroid therapy (8,9). Such patients are treated with immunosuppressive agents as alternative therapy, but these therapies are not always effective and their potential toxicity particularly in children remains of great concern (3,17).

Intravenous gammaglobuline (IVIg) has been used in the management of dermatomyositis as a steroid-sparing agent or as an alternative therapy to cytotoxic agents (5,6,8-16); and has showed a promising results in JDM (8).

We performed a retrospective analysis to establish the long term efficacy and safety of IVIg in children with JDM whose disease was not controlled adequately by corticosteroid therapy or who developed unacceptable side effects.