

## **EFFECTIVE MEDICAL WRITING**

Michelle Biros, MS, MD

Editor-in -Chief

*Academic Emergency Medicine*

### ***Why We Write***

- To disseminate information
- To share ideas, discoveries, and perspectives to a broader audience
- Job security, requirements
- Personal satisfaction, prestige
- Research completion
- To develop a fundable track record

### ***How to begin***

- Do compulsive pre-study preparation
- Critically read successful papers on the same topic
- Develop the study question and hypothesis concisely
- Write your results first; these are the heart of your message and drive everything else
  - Introduction* must include the study question your results have answered
  - Methods* must indicate how you derived your results
  - Discussion* must argue the reasonable-ness of your results
  - Conclusions* must answer the study question in light of the results obtained

### ***General tips***

- Adhere to scientific and writing ethics
  - Indicate that the study had proper approvals
  - Be a responsible coauthor
  - Let the editor know about other similar submissions
- Follow the instructions for authors
- Apply research analytical principles to writing; if-then
  - The Abstract may be all that the reader looks at; make sure it is correct
  - The Introduction should justify why you did the study; make it intriguing
- Be patient - centered and not numbers centered
  - Avoid emphasis of statistical significance at the expense of clinical significance
- Write with vigor
  - Consider the active voice and be brief but complete
- Write vividly
  - Describe exactly what you mean in specific and concise terms
- Write for readers and not to please peer reviewers
  - Write as if you are talking to an informed colleague
  - Write as if you are explaining a new technique to an experienced research technician
- Avoid self plagiarism
  - Avoid writing templates from paper to paper
- Update the literature review before you submit the manuscript
  - Be comprehensive in your evaluation of the literature to date
  - Quote primary resources ( not text books)
  - Be compulsive about and cite the literature of emergency medicine
- Don't provoke the reviewers with misspelling, incorrect formatting ,typos
  - Proof read the final version for logic ,accuracy, flow, syntax, spelling etc.
- Don't ignore requests
  - Comply or justify why not

## ***Why Manuscripts Fail***

### 1. Technical reasons

- The focus of the article is not within the scope of the journal
- The authors did not follow the instructions for authors
- Unclear purpose, poor syntax, extremely verbose, flight of ideas
- Ethical concerns about the study or even the study question
- Lowest denominator paper, with a backlog of higher priority works
- Author unwilling to revise the manuscript to address reviewer's concerns

### 2. Cognitive reasons

- The concept is not unique
- The question is trivial
- There are obvious serious uncorrectable scientific flaws in the study itself
- Selection bias is detected; the study is underpowered
- The wrong groups are studied
- The methods are inadequate to answer the study question
- The results are statistically significant but not clinically significant
- The conclusions are overstated or cannot be supported
- The conclusions simply restate the results and do not answer the study question

### 3. "Degrees" of Manuscript Failures

#### "Fatal Flaws"

Serious errors that cannot be corrected with the data at hand or given the limitations of the methods: the question, methods and data collection were wrong from the start.

#### "Rejection threshold"

The cumulative weight of many smaller flaws tips the reviewers towards rejection.

#### Rejection = not seriously considered

- The submitted manuscript is not in the scope of the journal
- The submission is deemed unethical
- The science is fatally flawed

#### Not accepted= considered, but

- Peer review raises seemingly insurmountable concerns
- There is a backlog of similar manuscripts
- The submission will not enhance the literature
- The relevance is unclear

## ***Common errors in manuscripts***

### 1. In the Title

- The title is misleading
- The title does not set limits

### 2. In the Abstract

- The abstract results are not the same as the reported results
- The abstract reports different measures than the study itself
- The conclusions of the manuscript are not the same as the conclusions of the paper

### 3. In the Introduction

- The study question, hypothesis, study objectives are not specified

The study question, study purpose, objectives, hypothesis and goals are confused  
The importance, novelty, originality of the study is not shown  
The presentation is not intriguing (ie, the introduction is boring)

#### 4. In the Methods

Methods are reported that were not used (ie template methods from other papers)  
Details of the methods are missing  
Methods are omitted (ie some results do not relate to the described methods)

#### 5. In the Discussion

The logic is loose – a flight of ideas  
The content is too expansive and wanders from the results  
The presentation is biased, and omits key findings from other investigators  
Key results are not eluded to or are poorly explained  
The references are outdated or misrepresented  
Speculation is not identified as such  
Possible implications/ the study's importance are overstated  
The study's limitations are not described

#### 6. In the Conclusions

The conclusions simply restate the results  
The conclusions do not answer the study question  
The conclusions do not set limits for application  
The conclusions call for more study

### ***Common errors when reporting RESULTS***

#### 1. Errors of Omission: Something is left out, either intentionally without justification, or unintentionally

##### *A) Not accounting for all study subjects*

The table Ns don't add up  
Numbers in the paper are not consistent  
Categories equal more than 100 %

*Suggestion:* Include a schematic summary of the study population. This will account for all patients at each stage of the study, efficiently summarize the study design, and indicate the probable denominators for proportions, percentages, and rates. Double check all tables, the text and the abstract for consistency.

##### *B) Not naming which statistical tests were used for specific analyses*

Multiple tests are described in the methods : which is used where is not identified

*Suggestion:* Indicate the test used after each type of result. If the editor thinks this is redundant, it will be removed in the final edit.

##### *C) Not presenting the results in a clinically relevant units*

Try to answer “ How will medicine be different as a result of this research?

*Suggestions:*

##### 1) When applicable, make the patient the unit of reporting.

Report the group response, but if appropriate, provide the number of patients who got better or worse after the interventions.

##### 2) When applicable, include “ efforts to yield” measures

This allows treatments to be compared in similar terms by determining how many units of a resource are needed to produce one unit of an outcome.

3) When applicable, describe the quality of life after treatment

This acknowledges that patients have a say in what types of treatment they desire, and is therefore important in decision analysis or the development of clinical guidelines. It also may make a statistically nonsignificant finding clinically significant.

4) When possible, use a positive frame of reference.

Report a success rate instead of the failure rate: survival instead of mortality.

5) Report confidence intervals ( CI) for primary outcomes

Confidence intervals report the precision of the estimates of the responses of the entire population, and indicates the size of the treatment effect and therefore if it clinically important.

2. Errors in the Analysis

A) Lack of power

Statistical power indicates the ability of a test to detect a difference if one truly exists. If no difference is found between two groups, it can mean that there is no difference, or there is not enough data to determine if there is a difference ( the sample size is too small)

*Suggestions:* Early statistical consultation with power calculations before the study to determine how many subjects are needed; report power calculations in the methods section of the paper.

B) Failure to adjust for multiple comparisons

The more tests done, the greater the chances of false positives; the likelihood of false positives increases each time comparisons are made.

*Suggestions;* Early statistical consultation to apply a corrective measure (ie Bonferoni's correction ) or readjusting the p to accommodate for multiple tests in the same data set. Report your attention to this in the methods.

C) Analysis by treatment received and not by intention to treat

The success of an intervention is related to the efficacy of the therapy and the ability to deliver it within the designated clinical setting. Therefore, to accurately estimate its effectiveness, you must account for those patients for whom the treatment is initiated but cannot be completed.

*Suggestions:* Early statistical consultation. Indicate that the analysis used intention to treat; if data is reported otherwise, this must be explained and justified.

D) Providing no assurance that the data conform to the assumptions of the analysis

Parametric tests ( t-test, ANOVA) assume normally distributed data but most biological data are not normally distributed

*Suggestions:* Early statistical consultation. The assumptions of the data must be declared or easily implied. For biological data ,reporting the median and range ( or intraquadrile range) is usually better than the mean and the standard deviation.

E) Mixing up incidence vs prevalence

Prevalence =the proportion of the population that has a disease at a particular time  
Incidence = the rate at which new disease occurs in a population

*Suggestion:* Re-visit your study question to be sure you are reporting what you intended.

3) Errors in Interpretation

A) Not recognizing the limits/meaning of p

If  $p < .05$ , the difference between two groups is statistically different from zero. This does not indicate the size of the difference or how precisely the trial was able to estimate a true treatment difference.

*Suggestion:* Consider reporting confidence intervals as well as p values.

#### B) Pragmatic vs explanatory studies

Explanatory studies attempt to understand a disease or therapeutic process and are conducted under tightly controlled conditions.

Pragmatic studies or effectiveness studies are designed to make clinical decisions, and are conducted under clinical conditions.; these may be confounded by uncontrollable factors .

*Suggestion ;* Do not imply that the results of a pragmatic study suggests a disease or therapeutic mechanism.

#### **Guidelines for Writing Results- The Study as it was Conducted (Adapted from Lang and Seric)**

1. Specify the dates of the data collection period, and state why these dates were picked.
  - Places the study in time
  - Allows for the consideration of technologic advances in care or differences between what is reported then and what is standard now
2. Provide a schematic summary of the study, showing the number and disposition of participants at each stage.
  - Accounts for all patients at each stage of the study
  - Efficiently summarizes the study design
  - Indicates the probable denominators for proportions, percentages, and rates
3. Describe the characteristics of each group to ensure that no one subcategory includes atypical subjects.
  - Eligible but not approached for participation
  - Evaluated for participation but did not meet the study inclusion criteria
  - Evaluated and met criteria but declined participation
  - Did not complete treatment
  - Completed treatment but were lost to follow up
  - Completed entire protocol
4. Indicate how the sample group represents the population as a whole and similarities or differences between the control groups and experimental groups at baseline.
5. Indicate if allocation (randomization) of patients or masking was successful.
6. Describe duration and nature of the follow up.
7. For observations based on judgment, provide an assessment of consistency of agreement between observers.

#### **Guidelines for Writing Results: The Study Outcomes**

1. Present the results and absolute changes or differences for all primary endpoints.

2. Report 95% CI for changes or differences in endpoints.
3. Report actual p values for all primary analyses.
4. Whenever possible, report the main findings of the study in figures or tables.
5. When possible, report statistical findings in enough detail to allow reanalysis or metaanalysis.
6. Report any potential confounding or interactive effects.
7. Indicate the degree to which the participants adhered to the study protocol and explain any exceptions or deviations from the protocol.
8. Report all potential treatment related side effects and adverse events.
9. Describe the treatment of outlying values.
10. Account for all observations and explain any missing data.
11. Report any anecdotal evidence or observations that might contribute to a more accurate or complete understanding of the study or its results.

### **Suggested readings**

Hall GM. How to write a paper. BMJ Publishing Group, London 1994.

*Very basic guide to pulling together ideas, results and analysis of research. Defines what should be in each paper subsection.*

Hulley SB ,Cummings SR . Designing clinical research. Williams and Wilkens, Baltimore, 1988.

*A research classic, this is an excellent, easy read , which discusses the research process from developing the question to publishing the data.*

Lang TA, Secic M . How to report statistics in medicine. BMJ Publishing Group, ACP, Philadelphia, 1997.

*The title is misleading- this excellent book describes not only the meaning of statistical tests but also how to write research, how to interpret it, and how to clinically apply it.*