

Ten Principles to Improve the Likelihood of Publication of a Scientific Manuscript

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OBJECTIVE. The objective of this article is to discuss the reasons that manuscripts fail to be published and to establish some principles for increasing the likelihood of publication.

CONCLUSION. Many good manuscripts fail to be published because they violate a few simple rules for writing a superior journal article. This review presents 10 principles for increasing the likelihood of manuscript publication.

No foolproof rules exist for success in publishing a manuscript. However, a number of guidelines can be used to increase the likelihood that a manuscript will be accepted for publication. Many articles have outlined the most common reasons for unsuccessful attempts at publication [1–4]. This article provides principles designed to avoid common errors in scientific writing and increase the likelihood of publication. A number of excellent articles have been published on the topic of writing a manuscript that guide the author through the process of writing a manuscript in a stepwise fashion from start to finish [5–7]. Rather than elucidate all the steps in writing a manuscript, this article will instead emphasize principles for increasing the likelihood of publication.

Much of the most important work of composing a manuscript occurs during the period of study design, well before the writing process begins. The planning stages of the study are critical for determining the likelihood that the resultant manuscript will be published. A number of excellent treatises have been written on the topic of designing a study, and the reader is directed to them for further discussion of this important topic [8]. Also, articles that discuss reviewing a manuscript often provide valuable guidelines for successful manuscript writing and study design [2, 9].

The intent of this article is to provide readers with 10 fundamental principles that, in this author's experience, many unsuccessful manuscripts fail to implement. Use of these principles is not intended to allow bad research to be published but to prevent good research from appearing to be bad research. We

hope to provide the reader with a competitive advantage relative to other authors. This article is not designed to acquaint authors with all the details of writing a manuscript; for that, the reader is directed to an excellent explanation, from start to finish, of writing a manuscript, which includes a discussion of such important features as appropriate selection of tables, figures, graphs, and references [7]. Clearly, inadequate tables and figures can decrease the likelihood of publication; however, those details will not be included within the scope of this article.

In addition, guidance will not be provided on an important aspect of publishing a manuscript—that is, the choice of journals to which the manuscript is submitted, which is dependent on many factors such as the target audience, prestige of the journal, and impact factor. Advice on that topic can be found in a number of excellent references [10, 11]. Finally, the choice of the most appropriate journal for the manuscript is an important one. Therefore, authors are referred to an article that deals with this issue in some detail [5].

Principle 1: Properly Organize the Manuscript

Proper organization of the manuscript is one of the key components to increasing the likelihood of publication. In many ways, the methods and results are the most fundamental elements around which the manuscript must be centered. Therefore, particular attention must be given to designing the Materials and Methods and the Results sections so that they adequately convey the means by which the study was conducted and the study findings.

Keywords: education, publication, scientific writing, study design

DOI:10.2214/AJR.06.1003

Received July 31, 2006; accepted after revision November 21, 2006.

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AJR 2007; 188:1179–1182

0361–803X/07/1885–1179

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One reasonable approach is to first compose the Materials and Methods section followed by the Results section. In fact, some experts envision data collection and manuscript organization as two facets of the same process by emphasizing that the manuscript production process should be envisioned while the data are being collected [6]. There are three arguments in favor of developing the Materials and Methods section during data collection. First, the Materials and Methods section requires meticulous detail; attending to this detail while the level of enthusiasm is highest (usually during performance of the study) seems appropriate. Second, formulating the Materials and Methods section while the study is in progress allows one to record the steps in the study when they are freshest in one's mind [12]. Finally, formulating the Materials and Methods section during the performance of the study allows the structure of that section to serve as the basis for the organization of the Results section.

Principle 2: Clearly State the Study Question and Study Rationale

As one author has stated, the Introduction is the section of the manuscript in which one answers three questions [12]. First, what is the general question? Second, what is the specific question? Third, how will this study help?

The clear declaration of a research question (or hypothesis) in the Introduction is critical for reviewers to understand the intent of the research study. It is best to clearly state the study goal in plain language (for example, "We set out to determine whether condition x produces condition y."). An insufficient problem statement is one of the more common reasons for manuscript rejection [3, 4]. In reviews of rejected manuscripts, journal editors frequently see reference to a "fishing expedition" or a "look-and-see approach."

As a specific example of a topic in radiology, let us imagine a group of authors writing an article about MR perfusion imaging of hepatic adenomas. If the authors state that the intent of the study is to "describe the MR perfusion imaging features of hepatic adenomas," the reviewer and reader will naturally ask "why are the authors setting about to study these lesions? Are there important unanswered questions about liver tumors that can be answered using perfusion imaging?" A much clearer statement of the problem is presented if the authors first state that distinction of hepatic adenoma from focal nodular hyperplasia is difficult using standard imaging techniques and then provide a ra-

tionale for the use of MR perfusion imaging in distinguishing the two entities.

Another common reason for rejection is failure of the authors to choose a topic that reviewers deem to be important [3, 10]. In addition to clearly stating the research question, a rationale should be provided. Briefly explaining the importance of the particular study helps the reviewer to recognize why the manuscript should be published [7]. Continuing the example used earlier, the authors should explain why distinction of hepatic adenoma from focal nodular hyperplasia is important for patient care.

Reviewing published articles or abstracts of national meetings is often helpful in identification of a novel or important unanswered research question—that is, a gap in the literature [13, p. 103]. Thereafter, providing the study rationale should be relatively straightforward. One solely needs to enumerate the supporting reasons for the study that have been culled from the medical literature and cite those sources as references.

Continuing with the previous example, investigators interested in the study of liver lesions might do well to examine the abstracts on this topic at major radiology meetings. The discovery that an entire scientific session is devoted to the distinction of hepatic adenomas from focal nodular hyperplasia would be an indication that the topic is an important one. Then a review of recent articles on the topic would likely provide statements useful for supporting a trial designed to test an imaging study for these hepatic lesions.

Principle 3: Explain the Materials and Methods in a Systematic Manner

One of the more common reasons for rejection of a manuscript is that the reviewers cannot fully understand how the study was conducted. This problem usually results from the author's failure to clearly enumerate the steps in data acquisition and analysis. A good study should be reproducible [10]; other investigators should be able to perform the same steps as those performed by the original investigators, which is not possible if the Materials and Methods section is not clearly written [13, p. 105].

One successful strategy is to write the Materials and Methods section as if one were providing a recipe. Just as a good cookbook recipe does not provide only some of the ingredients and some of the steps needed to replicate cooking a meal, the Materials and Methods section should provide all the important steps, in the correct sequence, for performing the study.

Writing the Materials and Methods section successfully is quite difficult for a single author if that person has not performed all the steps of data acquisition and data analysis. Having each participant in the study write an account of the steps as they are being performed will usually greatly clarify the Materials and Methods section and shorten the writing process.

Allow the reviewer to digest the Materials and Methods section in small segments rather than one continuous flow of paragraphs. Break the section into subsections, each having a separate subheading [6, 7, 12]. Helpful subheadings for manuscripts on radiologic topics include Subject Population; Imaging Parameters (or Image Acquisition); Image Analysis; and, if appropriate, Statistical Analysis. In some cases, a schematic illustration of the experimental procedure or a diagram of the steps in the analysis may also be helpful [12].

Reviewers find it very helpful to see mention of reasons for the use of a particular imaging analysis package or statistical package if alternatives exist. If multiple techniques for the analysis of data are possible, it is appropriate to mention why a particular technique was used. This practice shows the reviewer that the investigator thought carefully about study design. Continuing the example of MR perfusion imaging of liver lesions, the authors should explain the rationale for the specific hemodynamic parameter, contrast material dose, imaging technique, and analysis methods chosen for their study if universal consensus does not exist for any of these variables.

Principle 4: Structure the Materials and Methods and Results Sections in a Similar Manner

The majority of deficiencies in the Results section fall into three categories. First, the section may be disorganized (for example, the results may be mentioned in a sequence that is confusing). Second, the Results section may be incomplete (for example, only some data acquisition details are mentioned in the Materials and Methods section). This happens with some frequency in complex manuscripts, especially if many authors are involved in the writing process. Third, the Results section may mention data for which no mention was made in the Materials and Methods section. In all three cases, the deficiency is either because the authors have not properly organized the Materials and Methods section (see principle 3) or the organization of the Results section does not adequately reflect that of the Materials and Methods section.

Publication of a Scientific Manuscript

Writing the Results section in a manner parallel to the Materials and Methods section, even down to including the same subheadings in both sections, is a particularly efficient technique [7, 11]. This process makes for a logical flow in the manuscript that allows the reviewer to then easily move back and forth between corresponding sections. Following this formula, if the Materials and Methods section has been well-organized, the Results section can typically be written relatively easily.

At some point in writing the manuscript, the author should take an overview of the data and decide on their priority of importance and the best order in which to present them. In some disciplines—for example, the descriptive biologic sciences—it may be appropriate to unfold the results in a series of steps in a manner similar to a logical argument supporting one's hypothesis. In this manner, the reviewer is able to follow the investigator's thought processes that underlie the study and the path by which the conclusions were reached.

An analogous technique is for the author to sort results that are clear and unambiguous in their meaning and importance from those results that are less clear and more subject to interpretation. The latter data can then be presented as being of uncertain significance, which helps the reviewer to better understand how the author has interpreted the data and how much emphasis should be placed on this data in evaluating the study findings.

Principle 5: Make the Discussion Section Concise

The Discussion section is the portion of the manuscript in which the author summarizes findings, explains their importance against the background of previous publications, and indicates the direction of future studies. One of the most frequent mistakes made by authors is writing an unnecessarily lengthy Discussion section [11]. This flaw is usually due to attempting to provide an encyclopedic history of the research question, unnecessarily repeating information presented in the Introduction, or reiterating findings that were previously listed in the Results section. Concise writing allows the main findings and importance of the study to be evident and not hidden within a camouflage of unnecessarily lengthy discussion. Reviewing the Discussion section after the initial writing (often with the aid of colleagues who will serve as internal reviewers) and making deliberate attempts to minimize its length is a useful strategy.

Principle 6: Explain If—and Why—Your Study Results Are Important

The Discussion section provides the opportunity for the authors to show why the study results are important and, implicitly, why the manuscript should be published. Clearly stating the clinical and scientific implications of the study will help reviewers see the importance of the study [13, p. 151]. One of the goals of the Discussion section is to push the reviewer from a neutral stance toward a manuscript to a positive stance. The author should clearly state to what extent the study question was answered and the degree to which the findings advance the state of knowledge.

This task can usually be accomplished in a paragraph of only a few sentences and is best placed early in the Discussion section. Continuing the previous example of imaging of liver lesions, the authors might provide early in the Discussion section a statement regarding whether, in their study, MR perfusion imaging adequately distinguished hepatic adenomas from focal nodular hyperplasia and, if so, how the use of MR perfusion imaging to distinguish the two entities might now be important in patient care.

Principle 7: Avoid Overinterpretation of the Results

A common mistake of novice authors is providing sweeping conclusions from a study that, in truth, has only modest implications [3, 4]. In the enthusiasm of writing the manuscript, one can easily accidentally overstate the study implications and provide an interpretation beyond what the data support [14]. Showing the manuscript to an objective reader before submission may help to avoid this problem [12]. In addition, using qualifiers such as “probably” and “is likely” to modify claims will often provide assurance to the reviewer that the author is appropriately cautious in interpreting the results [9].

In a successful manuscript, the author shows that careful thought has been given to alternate interpretations of the data and reasons why those interpretations are not the most likely [3]. Finally, the author should avoid speculation; if the exact significance of a finding is unclear, it is best to simply state so.

Principle 8: Explain the Limitations of the Study

Almost every study, no matter how good its design, has limitations. Noting them is not a sign of weakness; instead, it sends the message that the author has thought carefully about

study design and is open to alternative methods to answer the study question. In a good manuscript, the author notes the study limitations in order of importance, provides an indication of how those limitations may have affected the results, and offers suggestions about how the study might be performed differently in the future [11]. In the example of MR perfusion imaging of liver lesions, the investigators might point out that many different MR perfusion imaging techniques exist. The study findings might be heavily influenced by the choice of the hemodynamic parameter studied, contrast material dose, acquisition parameters, and analysis methods. Such features should be mentioned and suggestions made for controlling for these features in future studies.

Principle 9: Account for Unexpected Results

Just as even very good studies have limitations, they may also have unexpected results. When this occurs, it is best for the author to acknowledge such results and provide a reasonable explanation as to why they were obtained. Perhaps a slightly different approach or an alternative study design might not have led to such results. The author should consider whether the unexpected results provide new insights. In some cases, the unexpected findings may even be more important than the expected results [15].

Principle 10: Fully Incorporate Reviewers' Suggestions into a Revised Manuscript

Many authors inappropriately view a reviewer's request to revise a manuscript as a nuisance and solely a hurdle to overcome before acceptance of the manuscript. However, an author who holds such an attitude may lose an opportunity to improve the manuscript through clarification and simplification. In a sense, the reviewers represent a small subpopulation of the readership. Points that are confusing to the reviewers would almost certainly also be confusing to the larger population of readers. Many questions that the reviewers raise would also be issues for the readers. Thus, the reviewer's comments offer an opportunity to render the manuscript into a form that provides maximal clarity and a minimal chance for confusion for the readers and embarrassment for the author.

Regardless of one's attitude, the author should go to considerable lengths to show the reviewers that the comments are taken seriously, even if only because the fate of the

manuscript likely hinges on it. Every effort should be made to address both major and minor requests unless the author finds them exceptionally unreasonable. Failing to make changes because they would require considerable work is not an acceptable option.

On occasion, authors will present the revised manuscript in a way that does not make the changes clearly evident to reviewers; the revised manuscript appears only subtly different from the original. One editor has termed this lack of clarity “invisible meddling” [16]. Clearly presenting the manuscript changes reduces reviewer and editor frustration and enhances the chances of manuscript acceptance. The changes should be made very clear in an annotated manuscript and also in a rebuttal letter to the editor using a numbering system that refers to a reviewer’s comment and author’s reply by the same number.

Summary

Writing a publishable manuscript is typically a difficult task, requiring good planning, hard work, and persistence. However, following a few basic principles can place authors at a competitive advantage relative to other writers. The principles outlined in this article ad-

dress many of the most common deficiencies that reviewers and editors find in unsuccessful manuscripts. These principles, if followed, should help authors avoid the most common errors in manuscript preparation and increase the likelihood of manuscript publication.

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