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PROPER MEDICAL WRITING

A SHORT TEXT-BOOK ON SCIENCE WRITTEN COMMUNICATION

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Connaître, découvrir, communiquer—telle est la destinée d'un savant.

François Arago

Les Savants Illustres de la France (1865), 456

Preface

Dear Colleagues and Readers,

Research is not only to discover something. Equally important is to communicate obtained data. Since the beginning of the science and research, writing scientific paper was an art. As an author and frequent reviewer I often deal with problematic construction, messy grammar and unthought constructions of scientific manuscripts. Most of these errors are very easy to predict, avoid and correct. But in our very competitive world papers are frequently rejected based not on the scientific merit, but on very poor language. Communication skills are important not only in the verbal world. This short text-book is entirely devoted to scientific writing. Although, we review the writing process in great details, one might summarize the process in just few lines:

- Get to know what you are writing about
- Be concise and precise to an extreme
- Use only so many sentences if are needed, no more, no less
- Keep up the flow
- Re-read the manuscript several times and think about it as a reviewer
- If you can make it shorten and simpler - do it!

We all hope, that you enjoy reading this book and that it will be helpful in writing your manuscripts and the PhD thesis.

Rafał Pawliczak MD, PhD

Brevity in writing is the best insurance for its perusal.

Rudolf Virchow

An Introduction to the History of Medicine (1929), 16.

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INTRODUCITON

Clinical practice and public health policy decisions depend on high-quality information about research findings. Publication of articles seems to prepare favorable grounds for knowledge transfer, especially because academia is used to it and publications are considered as the criteria for their promotion. Authors are responsible for how medical research is interpreted and communicated. Often their work is the product of collaborations with other individuals (such as clinical investigators, biostatisticians, and professional medical writers) from around the world. In this script the types of scientific communications are described as follows:

- Letter to the Editor
- Abstract and conference report
- Review article
- Original research article
- Case study
- Meta-analysis

LETTER TO THE EDITOR

A letter to the Editor is a short form of communication. It might be written on any subject of interest to the journal reader. It provides a means of communication between the author of an article and the reader of a journal, allowing continued dialog about journal content to take place [1, 2].

Comments on previously published articles are probably the most common reason for writing a letter. Although not original research *per se*, such letters may provide new insight, make corrections, offer alternate theories, or request clarification about content printed in the journal. By providing additional information, the evidence may be strengthened.

Letters to the Editor should be objective, constructive and purposeful. Letters should be short and concise, with clear and specific points [3]. A letter to the Editor is published at the Editor's discretion. A variety of other types of letters exist, depending on individual journal policy.

In most indexing systems, letters to the Editor are indexed and linked to the original article. This allows readers to view both the original article, the letter and response from the original authors and helps provide additional information about the original article [1].

One would think that once a paper is published, that is the end of the discussion. However, the publication of an article is just the beginning of the discussion since, through letters, a type of post-publication peer-review process occurs and a more complete picture is recorded [1, 2].

Most journals allow the authors of the original article to respond to any published letters related to their article. In the reply, the authors of the original article may provide additional information and clarifications and either agree with or argue against points raised in the letter. The letter and the reply might be published in the same issue of the journal [2].

Typically, letters address the contents of an original journal article for one or more of the following [1]:

- identify errors and make a correction;
- provide an alternate theory;
- provide additional information;
- offer additional evidence;
- provide a counterpoint

Comments should be supported by references. For comments made about published articles, many journals would only entertain letters sent within a prescribed time period, ranging from three weeks to three months after the article's publication [3].

The letter which comments the original article, should not repeat it at length. Since it is already assumed that a specific article is replied to, there is no need to repeat substantial portions of the original article in the letter. A few points that deserve clarification may be noticed, but addressing several minor issues in a letter makes it too long. Instead it should be kept brief and to the point and stay focused on the primary purpose for writing [1].

Effectively commenting on several issues can be difficult with the word-count and reference limits for letters in many journals. It is also important to avoid anecdotal discourse and ensure that statements are accurate, objective, and backed up with appropriate references [2].

The most popular errors in letters to the Editors are [3]:

- Comments not related to the original article,

- Too general comments,
- Unclear message of the letter,
- Lack of new information,
- Too much of text
- Repetition of issues discussed in the original article.
- Too much details,
- Too many tables, figures or references,
- Use of inappropriate language,
- Comments on fairness or competence of other authors

Apart from commentary function, a letter to the Editor may have also other purposes, such as presentation of new hypothesis, drawing attention to a new issue, or statement of interest of potential collaboration. Moreover, it might be a brief scientific or clinical communication, for example research report or case report.

In some journals, letters to the Editor are regular part – e.g. Journal of Allergy and Clinical Immunology states as follows:

“Letters to the Editor are brief reports of clinical or laboratory observations, substantiated by controlled data but limited in scope, and without sufficient depth of investigation to qualify as Original Articles. Like Original Articles, these manuscripts are subject to peer review. Letters to the Editor are indexed in Medline, accessible to literature searches, and cited like original articles”.

On the other hand, some journals, e.g. Lancet, rarely publish original research or case reports, and this is clearly stated in their Instructions to Authors. Some journal editors regard reporting clinical observations or research in letter format as a “backdoor” to publication, and hence discourage this practice. Letter to the Editor often should not exceed 1000 words, not including the figure legends and references. Such form of original research may only contain 2-3 figures and up to 10-15 references [3, 4].

For most journals, a letter to the Editor is treated as one of the categories of manuscript, and submission is *via* the usual channels. For example, for journals with online manuscript

submission and peer-review systems, authors submitting letters will need to register, log in and track their manuscripts, and later submit revisions online. The structure is in Guidelines for Authors of specific journal, but, though much shorter, it is often the same as in original papers - background, (objectives), methods (and) findings, discussion and references [3, 4].

Writing an article for a peer-reviewed journal for a new practitioner might be a difficult task, thus starting with a shorter article, such as a letter can be a good way for new authors to gain experience with scientific writing and publishing, and it may be more manageable for authors without much writing experience [2].

Letters to the Editor and author replies should offer objective and constructive comments on published articles or discuss matters of medical, scientific or general interest to the journal readers [3].

ABSTRACT AND CONFERENCE REPORT

Thousands of abstracts are submitted to stroke conferences each year. Preparing an abstract for presentation at a scientific meeting is an integral part of the research process, and aids the completion of a project in several ways. Success in abstract writing comes from application of the same basic principles that promote success in research. Focusing on the primary issues of why the work was done, how it was carried out, what was found, and what the potential implications are, is the most important strategy for preparing the abstract .

In the writing process, clear, direct communication, strict adherence to published specifications, format requirements, and careful proofreading will increase the likelihood of producing a high-quality abstract and of having it accepted for presentation [5, 6].

Why write an abstract?

Presenting posters at national meetings can help to develop a national reputation. They often lead to interesting and fruitful networking and collaboration opportunities. They also help with promotion in academic medicine and can reveal new job opportunities. Practically,

presenting posters can help justify funding to attend a meeting. Finally, this process can be invaluable in assisting with manuscript preparation [7].

The main purpose of abstracts is to help reviewers decide whether the material they summarize can be presented at conferences. If the reviewers decide that the material is suitable, they may publish the relevant abstracts in conference programmes [8].

Article abstract and conference abstract

Scientific papers have abstracts that are similar to but not the same as abstracts for presentation at meetings. Depending on the conference requirements, the format may be different, but meeting abstracts generally allow more liberal and extensive use of abbreviations than article abstracts, and may contain references, tables, and/or figures. The abstracts of published articles are retrievable through electronic search engines such as PubMed. Although meeting abstracts are often published - either as supplements to or in regular issues of the host society's journals, they are not indexed by the National Library of Medicine and usually cannot be found by searching on the Internet [6].

How is the abstract evaluated?

According to Frazer et al., reviewers want to know if the study [8]:

- Is contemporary. Delegates attend conferences to find out what is new and what can help them in their practice. Thus, an abstract should follow the latest clinical guidelines, and this should be made clear. The value of conferences for disseminating new advances in science should not be underestimated. The studies are presented to a motivated and enthusiastic audience, the members of which are likely to discuss and promote the work in their workplaces.
- Concerns a specific issue that is relevant to the theme of the conference. Abstracts of work on a particular topic are likely to be reviewed more favorably than those with a broader scope. team is more likely to be accepted than one on that of an admissions unit.

- Is researched rigorously. Work in which the sample populations are too small or that cannot support the conclusions reached are unlikely to be accepted

Where to start writing conference abstract?

The first step in writing an abstract is to read the instructions. Professional societies nearly always provide guidelines and specifications for submitting abstracts to their meetings, and while certain things are common to all of them, there are also important differences [6].

Therefore, the applicant should carefully consider specific regulations made by the conference organizers. If the abstract does not adhere to these rules, the submission is at high risk to fail [5].

The abstract preparation instructions may specify which font to use and are usually clear about margins and minimum sizes. However, it is important not to try to get around the rules by using a smaller font or decreasing the line spacing below single-spaced. These things show [6].

In any abstract, it is particularly important to focus on the title as it is often the only item people will look at while scanning the meeting program or wandering through the poster session [7].

The title should be an accurate promise of the abstract's contents. It should convey as much as possible about the context and aims of the study. In addition, an abstract's title is most effective when it refers to its overall "take home message." Ideally about 10–12 words long, it should include the scope of the investigation, the study design, and the goal. In general it is preferable to make the title a description of what was investigated rather than to state the results or conclusions [6, 9].

The title should be easy for readers to understand and should not include jargon or unfamiliar acronyms. It should be engaging, but not tiresome and distracting. Plays on words and cute or deliberately provocative expressions catch the reader's attention but may appear to trivialize the serious work being reported [6].

Below the title, there should be a list of authors and their affiliations [7].

Authors and Affiliations:

The list of authors should be restricted to those individuals who actually did the study - conceived it, designed it, gathered the data, crunched the numbers, and wrote the abstract. Author lists are rough rank orders of the relative contributions of the persons named [6]. Briefly, the most involved is first with the most senior last. Only affiliations relevant to the project should be included, disclosures are often included here as well [7]. In general, the author listed first is the person who conceived the study and did most of the creative work on the project. With few exceptions, this should be the person who will present the poster or slide presentation if the abstract is accepted. Full names and formal credentials should be used . Only affiliations relevant to the study should be included - generally the department and institution at which the work was done [6].

The structure of an abstract

Objectives: The first sentence (or two) should provide a short, sharp description of the importance of the topic to draw attention of reader (reviewer or conference delegate) [10, 11].

This brief section answers the question, “Why did you start?” and should provide a context or explanation for doing the study. Space is at a premium, so a short sentence or two must suffice. This section should also state the aim of the study, and ideally should include a concise statement of the study’s hypothesis. A legitimate scientific study is not done to prove that something is true, but, rather, to find out whether it is true. The importance of that distinction may not be immediately apparent, but it actually makes a huge difference [6]. Sometimes this information is included at the end of the introduction/background [7].

Introduction/Background: Only background that is relevant to why the study has been done should be included. General background statements should be avoided, instead, the author should focus on clearly describing the hole in the research that this study fills [7].

Usually only one or two sentences may be included here. Some organization request Background that comprising the goal of the study instead of Objectives and/or Introduction section. Introductory statements sum up then what is known or remains unsettled in the field, and a goal of your study.

A few abbreviations are so familiar that they do not need to be spelled out in the abstract on first use, but there are not many of these. Examples are COPD, PEEP, FEV₁, and PaCO₂. However, an abstract's readers may have widely different backgrounds, and all but the most common abbreviations or acronyms should be spelled out the first time they appear [6].

Methods is the section describing the study design, population studied, specific needs identified, methodology, sampling methods and data-collection methods [11]. Different types of trials will require different information [7].

This section is most often identified by reviewers and editors as deficient and the reason for rejection. It has to be concise, and many details of what was done must be omitted. However, in the space available the reader can be given a good idea of the design of the study, the context in which it was done, and the types of patients or measurements that were included. For a study involving patients or other human subjects, it should be explicitly stated whether the study was retrospective or prospective, and whether there was a randomization [6, 12].

Results section is the most important in the abstract. A summary of the main results or findings is presented, comprising only a very brief overview of the most pertinent [10, 11]. It should be presented clearly, logic and without long and confusing sentences. Accurate presentation of data in the abstract is extremely important [5, 12].

Groups of subjects should be named clearly, especially if there more than two. If too many analyses were generated, only key data points should be presented and the rest should be left for writing a paper. For example, if pretreatment characteristics of patients in a controlled clinical trial were similar between the groups, there is no need to show all of them for each group. Statistically significant of the most important results should be marked out [5].

The results that pertain to the study's hypothesis and that constitute the primary end points described in the methods, must be included, even if no statistically significant differences were found. Data from which the conclusions will be drawn should be reported in as much detail as space allows. In such study, it is better to say that there was no difference in the primary outcome of the study (noting any additional results, significant or not, as space permits) than to refocus the study toward the findings that were statistically significant [6, 12]. While drawing conclusions from the results, statistically significant difference does not necessarily translate into clinically significant difference [5].

Relevant statistics such as odds ratios, confidence intervals, and p values for key outcomes should be included so that reviewers can judge the significance of observations. Discussing the results that “trend toward significance” should be avoided [7]. If space permits, statistical tests should be mentioned. Details of statistical analysis are usually left to the research paper and presentation at a meeting. Abstracts without such data are given low priority. Data, not arguments should make points [5].

In potential poster presentation, the results section is likely to be the area of particular interest to the audience and should therefore be given more attention than the preceding sections [11].

The **conclusions** section (for some meetings this section is labeled “implications”) should be a brief statement of why the study’s findings are important and what the author believes they mean. They should be straightforward and specific to observations. Conclusions should be reasonable and supportable by the findings of the study [6]. In this section the author may briefly discuss how the research will impact clinical practice, health care policy, or subsequent research. It is very important to avoid overstating the results [7]. Quite often, the conclusion section consists of two sentences - the first concisely summarizes the main findings, and the last states interpretation or clinical implications.

Readers and reviewers commonly check the title and, if become interested, skip right to the last sentences before they read the full abstract in detail. Clear formulation of conclusions attests to your ability to interpret data and understand the evidence-based approach. Conclusions logically connect the title, study methods and results all together to deliver the ‘take home’ message [5].

Depending on the conference guidance, **a table or figure** may be included in the abstract if it conveys the findings of the study more effectively than text alone. The abstract should be then reduced in size for publication, and labels and data points must remain legible [6]. The tables or figures should contain the most representative data set that delivers the key message or summarizes most important data and leaves space for other details in the text [5]. Table should include the same font as the whole abstract. Unless instruction for authors have specified otherwise, data should be presented as mean \pm SD. All variables in table must

include units, and if any marks are used (e.g . * or †) information which data have been compared has to be provided (table 1).

Table 1. An example of table included in conference abstract.

	Day 1	Day 2	Day 3	Day 4
N	87	82	79	88
Age [years]	34 ± 8	39 ± 6	34 ± 7	34 ± 3
FEV₁ [%]	115 ± 4	110 ± 7	108 ± 7	114 ± 5
FEVC [%]	111.9 ± 3	111.5 ± 8	115.7 ± 4	112.9 ± 3
H₂O₂ [μM]	0.32 ± 0.06	0.37 ± 0.03	0.41 ± 0.08	0.39 ± 0.06
NO₃⁻ [μM]	8.4 ± 1.7	8.9 ± 2.7	8.4 ± 0.9	9.0 ± 1.9
pH	7.3 ± 0.07	7.8 ± 0.08	7.3 ± 0.07	7.4 ± 0.07

Common mistakes in abstract writing

The most frequently occurred mistakes in conference abstract are:

- not adhering to the submission guidelines. For example, not using the specified font (some guidelines are this specific), exceeding the word limit, incorrect referencing style (where references are required), or failure to submit required information.
- grammatical, typographical and spelling errors, and poor expression. Many people submit abstracts at the last minute and may be under pressure of time. However, the reviewing of abstracts is a time-consuming process, generally undertaken by people in addition to their regular workloads [10].
- overdoing the context, with insufficient attention to the details, purpose, or implications
- overdoing the details, purpose, and/or implications, with insufficient attention to the context
- too much background information and not enough specifics [11].
- too many details and not enough background. Some abstracts state exactly what was done, seen or found without any context as to why the research or intervention was important, and what the findings or outcomes mean for practice.
- not enough information provided [10].

A poster

Conference abstracts are often accepted as a poster presentation. This means, that all (or more) information comprised in the abstract should be presented in a scientific poster. Mostly all organizations provide clear instruction for poster preparing, including paper orientation, size, font type etc. However, it is author responsibility to prepare the poster according to standards occurring in the specific field of science.

It is helpful to remember the rule of 10s: the average person scans a poster for 10 seconds from 10 feet away. When someone stops, the author should be able to introduce your poster in 10 seconds and they should be able to assimilate all of the information and discuss it the author in 10 minutes [7, 13].

As it has been mentioned, the most important section is the result section, as the results presented by figures and tables speak for whole the study presented. Typical layout of a poster is presented below. Nevertheless, it is the author's decision (and invention) to present the abstract content in the most proper.

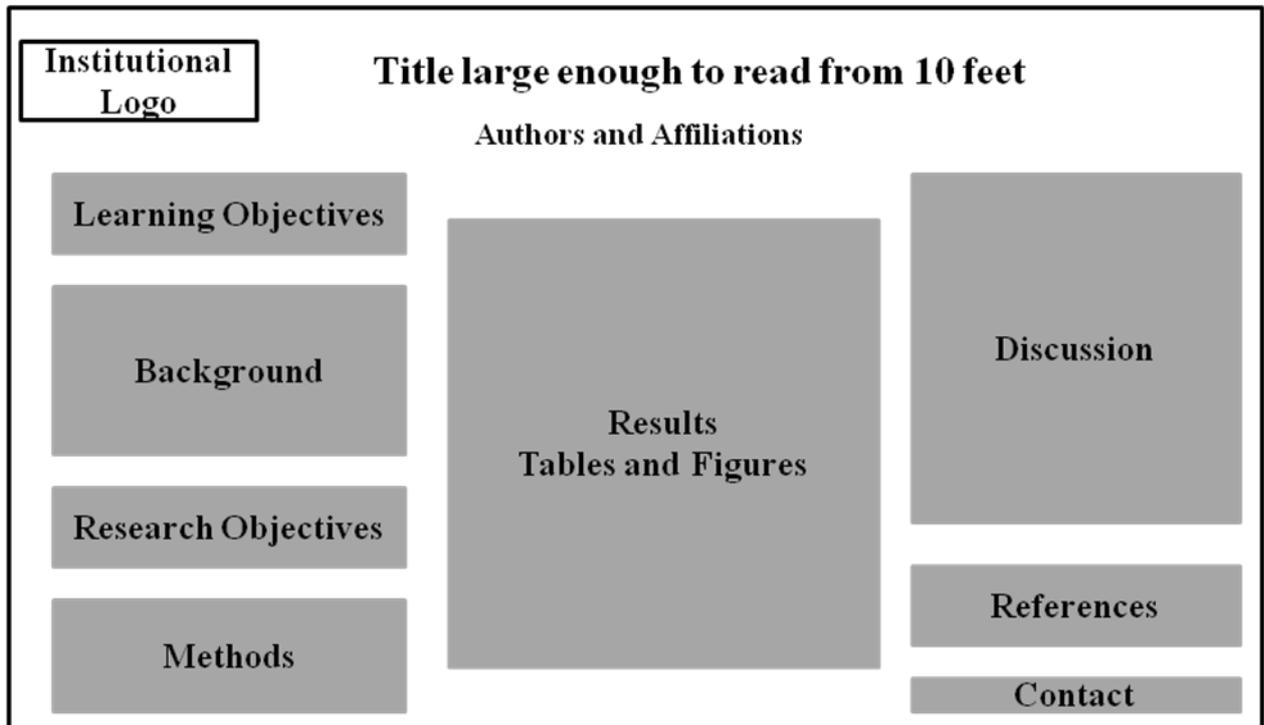


Figure 1. Poster for original research [7].

Concluding remarks

Preparing an abstract for presentation at a scientific meeting is an integral part of the research process, and aids the completion of a project in several ways. Success in abstract writing comes from application of the same basic principles that promote success in research. In the writing process, clear, direct communication, strict adherence to published specifications and format requirements, and careful proofreading will increase the likelihood of producing a high-quality abstract and of having it accepted for presentation. Conference abstract is the first step towards publication, communication and dissemination of research results that is imperative for advancement of science [12, 14].

REVIEW ARTICLE

Scientific review articles are critical analyses of available information about a particular topic. Unlike research articles, review articles do not present new data. Their purpose is to assess and put into perspective what is already known and to initiate a discussion about the research methodologies and the findings related to the said topic. Unlike research articles written on narrowly defined topics for a specialized audience of peers, review articles often examine broader topics for a more general audience [15, 16]. A review article is expected to provide a summary and/or a synthesis of the findings of selected research contributions being published by other authors. Such papers of good quality are frequently needed in the presence of the growing number of research papers. Therefore, a review article should contain a comprehensive list of supporting references being thoroughly cited in the text [16].

The detailed aims of a systematic review can be varied and include [17, 18]:

- clarifying the relative strengths and weaknesses of the literature on the question,
- summarizing a large amount of literature,
- resolving literature conflicts,

- evaluating the need for a large clinical trial,
- avoiding a redundant unnecessary trial,
- increasing the statistical power of smaller studies,
- improving the precision or identify a smaller treatment effect,
- improving the generalizability of treatment outcomes

Review articles can be classified into three basic types:

- a. non-systematic,
- b. systematic
- c. meta-analysis.

Ad. a. The most common and the most widely discussed in this script is the traditional narrative or review, in which the author evaluates and synthesizes what is already known about a topic [15]. The non-systematic type may include a selection of a wide range of technical results related to a chosen topic which reflects the professional experiences and interests of the authors. The quality of such papers depends on the competency and the sincere efforts of the authors to provide a good review of the subject matter [16, 19].

The problem with many narrative reviews is that they are unclear in the collection, selection, and interpretation of the information they discuss. Often only a selected group of studies is considered (“*cherry picking*”), and the selection is quite likely biased [15].

Ad. b. The systematic type requires an advanced preparation and relies on a specific methodology being chosen in advance, where selected foundation studies are being analyzed in connection to a long-standing problem statement [16]. These reviews use explicit and rigorous methods to identify, critically evaluate, and synthesize all relevant studies in order to present a concise summary of the best available evidence regarding a sharply defined (clinical) question. A review protocol defining the design and methods for a systematic review—including how studies or trials will be identified and the inclusion and exclusion criteria—is written before the review begins. A systematic plan is established to see that all relevant studies or trials (or at least as many as possible) are identified and included in any analyses that are done [15, 19].

Ad. c. The third type of review article is the meta-analysis, which is a systematic review that uses a specific methodological and statistical technique for combining quantitative data from several independent studies. Established standards already exist for conducting and writing a systematic review or meta-analysis [15, 20]. This type of the review will be discussed separately in this script.

Although a review article serves a different purpose than a research paper, a well-written review article also tells a story by answering similar questions [15]:

- Why is it important to review the topic?
- What specific aspect of the topic needs a fresh look?
- How did I undertake the literature review?
- What did the literature show, and what does it mean?
- What can I conclude from my review?
- What recommendations can I make?

Reviewers should make specific suggestions for future research based on the findings. Results from review papers enlighten researchers to gaps in the literature and create a push for additional primary research, which may highlight alternative sampling, theoretical frameworks, study design, and/or measures [21]. Just as primary studies influence reviews, the development of reviews also has an indirect impact on the quality of primary studies [14, 21].

The title should clearly describe the topic of the review and highlight what aspect of the topic is being covered [15]. Typically, review articles are entitled in the way that allows the reader to distinguish it from an original paper. Often the title is a question or has a provocative nature.

Writing a systematic review might be generally cumulated in 4 steps [22]:

1. Formulate the review question and eligibility criteria.
2. Identify all of the literature that meets the eligibility criteria.
3. Extract and synthesize data.
4. Derive and present results: the answer to the review question

The first step in performing a systematic review is to formulate a primary research question as part of the research protocol. The goal of developing a research protocol is to allow formulation of the questions and methods of the review before retrieving the literature. This helps minimize bias. The focus of the question is an important issue. If the question is too narrow then very few studies may be identified and the generalizability to any other populations may be limited. If the question remains too broad it can be difficult to reach conclusions applicable to any single population [17, 22, 23].

A well-reasoned protocol and well-formulated research question increase the efficiency of the review by limiting the time and cost of identifying and obtaining relevant literature. At the outset, investigators must determine the level of evidence that will be included in the systematic review; for example, randomized clinical trials (RCTs) *versus* observational studies, and any method restrictions, such as allocation concealment [17].

The structure of a review article may differ from the structure of a regular paper due to the optional omission of some basic sections such as: Introduction, Materials and Methods, Results, or Discussion. Sometimes it is difficult to classify a paper submission as a review article, a regular paper, or just a comment after noticing the combined use of an extensive literature review, original research contributions, and specific comments concerning only a few cited papers. Although there is no strict limitation concerning the review topics, it is preferable that even narrow focused contributions are being written from a more general perspective which would only benefit the authors with an eventual increase of the number of citations referring to their articles [16]. The reviewer should make sure the organizational principle of the review is explicit by stating the sequence in which topics are discussed - for example, chronological order, general to particular, or most frequent to rarest [15, 22].

The goal of the **literature search** is to be exhaustive enough to develop a comprehensive list of potentially relevant studies. All of the studies included in the systematic review have to come from this list. Before finalizing the search, it is important to screen the studies to remove any duplicate studies by entering them into a computer-based referenced management system (ie, EndNote, ProCite, or Reference Manager). This also makes it easy to provide a list of initial references if a reader or journal editor requests them [17, 23].

The **abstract** should stand on its own and include, at a minimum, the topic or question and the need for a review, what is included in the review, and conclusions about the topic or

field at the end of the review. Abstract requirements for content and format differ, depending on the type of review and journal, so it is important to consult the instructions provided by the journal of choice. Some journals prefer unstructured abstracts, whereas others require structured abstracts containing several elements [15].

The **Introduction** should state the purpose of the review, why a review of the field or topic is needed at this time, describe its relevance to family practice, and what is going to be covered [15, 19]. In clinical reviews, the traditional way of doing this is to discuss the epidemiology of the condition, stating how many people have it at one point in time (prevalence) or what percentage of the population is expected to develop it over a given period of time (incidence). A more engaging way of doing this is to indicate how often a typical family physician is likely to encounter this problem during a week, month, year, or career [19].

The **discussion** of current challenges or future prospects is the only area that allows the author subjectivity and opinion. If appropriate, the scientific, economic, and social impact of the work reviewed might be also considered [15].

The review should be ended with a brief concluding paragraph or conclusion section that gives the reader a sense of “what it all means” or “what the future holds” [15].

Some reviews are structured according to issue they tackled and are divided into parts as a result of various aspects of the topic. In such articles only introduction and discussion/summary section is included and the body of the review discusses further questions of the subject. This is due to the selection of literature by the authors, which include only range of topics and the results used to review the work, and not other factors.

Despite the various levels of complexity of the technical topics, the review articles are limited in including analytical and experimental parts from cited papers. The amount of text should be well balanced with the number of figures so that the addressed issues are clearly stated in a simple and efficient way [16]. The real challenge here is in transforming a collection of technical information into a coherent script which provides an alternative point of view on previously unknown or not well understood relations among distinct studies. A proper balance should be found between the levels of differentiation and integration of different aspects of technical information as well as between the statistical analysis of experimental data and its theoretical interpretation, etc. The review articles have to provide

forums for further discussions about the problem statements and not just summarize the peculiarities of each cited paper but rather transform the presented information into an inspirational material for future studies [16, 22].

Some believe systematic reviews represent less effort than a primary clinical study, but a quality systematic review requires substantial preparation and planning. After adequate development of the research question and protocol, a considerable amount of effort is required to search the literature, appraise the study quality, and reach thoughtful, appropriate conclusions [24]. Systematic reviews can suffer from a variety of weaknesses during their preparation. A less than thorough literature search may miss important studies, which may affect conclusions. The level of conclusions reached, however, cannot exceed the level of the studies reviewed. A critical search for biases is required to adequately assess the studies. An understanding of the issues critical to studies of a particular topic is important to determine those potential biases critical to the conclusions of a study [17].

ORIGINAL RESEARCH ARTICLE

The essentials of any paper include a description of what is known, an assessment of what is unknown, a clear statement regarding the question and hypothesis being addressed by the current study, and a discussion and summary of new information that has been learned as a result of the study [25]. Scientific research articles provide a method for scientists to communicate with other scientists about the results of their research.

According to many authors, original research article is the most difficult to write. Mostly due to the fact, that it is difficult to “sell” effectively the results. Indeed, while the vast majority of manuscripts are published on their merit, there is subjectivity that can sway the reviewer toward a positive decision. This subjectivity is often based upon how the paper is presented to the reader (in this case, the reviewer) and can be nearly as important as the scientific quality of the manuscript [26].

The ingredients of a good paper with a high probability of acceptance are [27]:

- a. originality of research,

- b. relevance and applicability,
- c. good scientific data,
- d. simple writing style,
- e. a lot of luck

The journal selection

There are several considerations when selecting the appropriate journal to submit a manuscript to. This is based not only on the topic, but also, on the strength of the manuscript and its appropriateness to the type of reader. Often, more than one journal could be an appropriate home for an article. Once the author(s) have narrowed their selection to a few journals, it is best to choose the journal with the highest impact factor. Generally, the impact factor is a reflection of the quality and reputation of the journal, and the manuscript will likely generate greater recognition and potentially have a greater influence both on stimulating others to write similar articles and/or influencing patient care [26, 28].

Basic structure

The vast majority of scientific reports can be divided into the following components:

1. Title
2. Abstract
3. Table of contents (optional)
4. Introduction
5. Methodology
6. Results
7. Conclusion
8. References

This structure is also called **IMRAD** structure (acronym for **I**ntroduction, **M**ethod, **R**esults and **D**iscussion), which is the body of the paper; the title and the abstract are two important show windows.

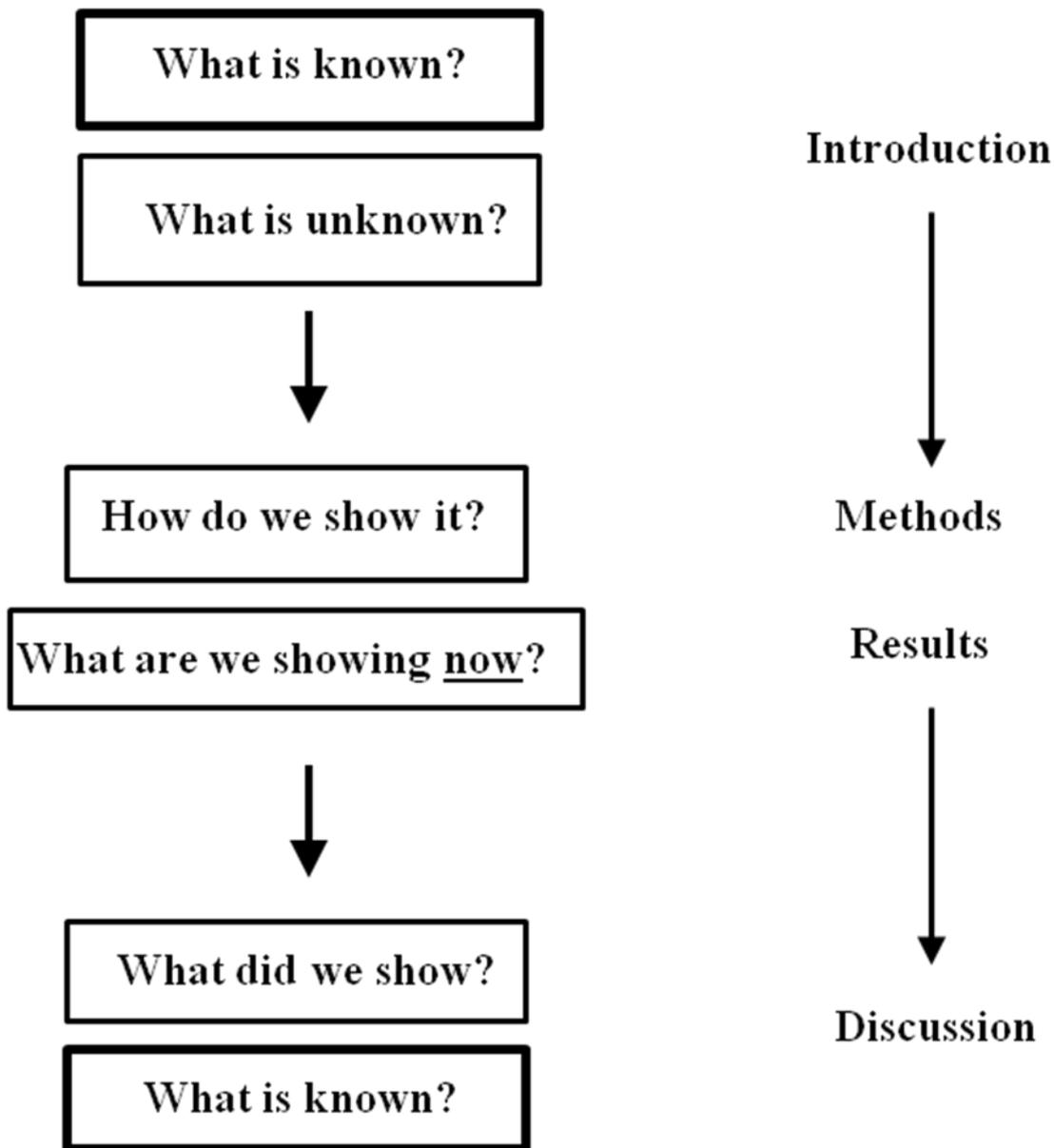


Fig. 2 Overall approach to writing a scientific manuscript and a description of its major components [25].

The title must also be short and simply worded to catch the reader's attention [9, 27]. It should be specific enough to describe the contents of the paper, but not so technical that only specialists will understand. Although attractive titles are more eye-catching, they should avoid sensationalism. A good, reliable and simple technique is to briefly write the question that was asked, or the answer that was arrived at [27, 29]. The title usually describes the subject matter of the article, for example: "Effect of aspirin on epithelial cells". At times a title summarizes the results, e.g.: "Aspirin up-regulates APC protein".

The scholar writing and performing the study should be the first author and the mentor could be the senior or last author. All authors should fulfill the criteria described by ICMJE (International Committee of Medical Journal Editors). Anyone who claims authorship should have made a significant contribution to the study [30, 31].

The **abstract** is the most crucial part of the report because anybody searching for the research on a database or in a journal will read the abstract first. It is a sample of the research which should inform the readers that the article contains the information they need [9].

Abstract should be written after the rest of the paper is completed. A good abstract provides, in 150-250 words all the information about the paper; the aim of the study, the methodology, the results obtained and the conclusions drawn. Moreover, most journals demand a structured abstract where the abstract is split into subheadings [26]. Article abstract is similar, but not the same as the conference abstract.

No abbreviations or citations should be used in the abstract. It should be able to stand alone without any footnotes. There are a few ways to write an abstract but the best advice is to look at some journals relevant to our research and try to format the abstract in a similar way. Nevertheless, each abstract should contain:

- The purpose of the study – goal, hypothesis,
- Brief description of the experiment, model organism, methods,
- Results, including specific data
- Important conclusions or questions that follow from the research.

Introduction

The introduction section's purpose is to introduce the topic to a reader. It includes parts:

1. What do we know? (Identify the scientific or clinical problem)
2. What is not known? (Explain the unknown issues related to the problem)
3. What the authors did? Why the authors did it?

4. What the article aims to accomplish? (End with an unambiguous statement about the *hypothesis* of the study) [25].

Answer to these questions will allow the reader to have a clear understanding of the nature of the study, and will know context in which the study is being performed.

It is important to clearly show the gaps in existing knowledge and how the article fills this gap. In the introduction section, the author provides a broad review of the major findings in the current area of study. It is not easy due to the fact, that the literature used here needs to be complete and well balanced [25, 27]. Only literature concerning these or similar issues should be reviewed in the introduction section. The most often errors concern omitting an important paper and thus overstating the novelty of the current study [25].

Methods

This section provides the reader with a detailed analysis of the methodology used in the conduct of the experiments [25]. This section must give three details [26, 27]:

- How was the study designed? - prospective, randomized, cross-over, etc.,
- How was the study carried out? - patients recruitment, intervention, exclusion criteria etc;
- How were the results analyzed? - statistical methods

Methods section has to convince the reader (and the reviewer) that the results were obtained using appropriate methodology. Moreover, it should give sufficient information so that others can repeat the experiment. These features of the section will judge the authenticity and validity of the publication [26, 27].

Methods should be written as clearly as possible and in as few sentences as possible. If a method used is similar or identical to one described in a prior publication it may be said: “Hydrogen peroxide concentration was determined as previously described” (reference number).

After that, short method description should be included. E.g. “Briefly, 600 µl of EBC was mixed with 600 µl of 1 U/ml HRP solution (Manufacturer, Company location) containing 100 mM homovanillic acid and was incubated for 60 min at 37 °C” [26].

The methods section should always provide information regarding each of the controls used, and should list all of the necessary sequence information used for the generation of oligonucleotides, antibodies, or siRNAs [25].

Statistical analysis are also a part of methods section and all statistical pathways used should be described here. Each test and correction must be mentioned here. Preferably, statistical analysis should be done prior to writing the paper and is a basic principle of prospective studies since sample size calculations and identification of primary endpoints are needed. Many manuscripts are rejected on the basis of incorrectly or inadequately performed statistics [26].

Pitfalls in the completion of the methods section include failure to acknowledge the source of vectors, constructs, antibodies or key reagents, and in omitting a critical step in either the set-up or conduct of an important experiment. When appropriately written, the methods section can provide an extremely useful resource for the scientific community [25].

Results

This section provides the evidence that leads to the answers to the question was posed in the Introduction. Along with figures and tables, it provides all or almost all the results obtained in the study [27]. It is appropriate to describe the results in a manner that makes sense, as opposed to describing the experiments in the temporal order in which they were performed [25]. However, the author should not jump from one group of patients to another and then back to the first [27]. It is helpful to use subheadings to introduce new paragraphs, and to devote a paragraph to individual or closely related figures [25].

In text, each of results should be described, pointing the reader to observations that are most relevant. Properly, the results should be introduced in relation to the control. Apart from exceptional cases, percentage should not be used, only absolute numbers. However, all the data presented are to be statistically analyzed (according to statistical methods described in the methods section). The results might be described in a narrative manner, but terms like “majority”, “most of the patients”, “in some cases” should be avoided, as they introduce impression of generality [27, 32]. It is important to point out which results are presented in a figure or table and not to double data description in the text.

The figures and tables are the jewellery of a scientific paper - if used tastefully it can enhance the worth of any paper. The basic purpose of tables and figures is that it should help the reader understand the text [27]. Clarity and consistency should be uniform among the parts of a multi-part figure, and among all the figures in a manuscript. Computer programs tempt to show graphics expressively and vividly, but scientific standards keep them calm and sober. The figures presenting results usually do not show gridlines; numbers should be spread to maximize clarity [33]. It is also important to use contrasting colors, usually black or/and grey, as often the authors must pay additional charge for each printed color page. Instruction for authors clearly state the resolution, size of the figures etc. Each figure has to have a caption, which should comprise a brief title and a description. In the caption all symbols and abbreviations used should be explained.

Tables should also supplement, not duplicate, the text and a brief title should be provided directly above each table (see Table 1). Any abbreviations should be defined - in contrast - at the bottom of the table. Transverse subtitles should be avoided [34]. Columns and rows of data should be made visibly distinct by ensuring that the borders of each cell display as black lines. Color and shading may usually not be used; parts of the table can be highlighted using symbols or bold text, the meaning of which should be explained in a table legend. However, as mentioned before, full information can be found in instruction of authors section of each journal [35].

The term “data not shown” should be avoided - since data are worth mentioning, it should be shown as long as the space allows. Moreover, no results should be discussed, interpreted or explained in this section, as this is the role of discussion section [25]. The result section is the heart of the manuscript and at the same time – this part is probably the easiest to write as it is a compilation of facts and observations.

The **discussion section** allows the writer to communicate the significance of his/her findings, to indicate how they support the experimental hypothesis, and to describe how these results advance the field of study [25]. The discussion section should address the most important points the author want to make in the manuscript. Discussion section should begin with an introductory basic overarching statement that summarizes what is known about the topic, and what led to the performance of the study [26]. It is usually a good idea to begin this section by giving the answer to the question the article was set out with [27], and summarize the main results, culminating in a statement describing the overall significance of the work

[25]. Then the data should be compared with other published information and similarities and conflicts should be brought out. This is appropriate place to discuss in detail the implications of the article findings [27]. It is also correct to use phrases that leave room for criticism or differences of opinion on the part of the reader. This indicates that the writer respects the reader's insights and interpretation of the data presented. For instance, the phrase "together these data strongly suggest that..." is probably preferable to the stated "this means that..." [25]. Useful phraseology may include, "One possible interpretation of the results in figure...includes the possibility that..." or "The results shown in figure...are in contradiction to the work of..." [25].

A good practice is to show the limits of the study, which will be noticed by readers or reviewers anyway. The discussion section should be concluded with highlighting the message to the reader and the practical implications of the observations. The authors may also suggest the need for additional research and the direction or format this research should take [27].

There are some obvious errors in the manuscript that can lead to rejection. Although these may not be enumerated specifically by the journals, some of the features which might be highlighted are [30]:

1. Insufficient statistical power;
2. The topic is not interesting;
3. Methodology insufficient to address the hypothesis;
4. The topic is not novel and has been already covered widely;
5. The topic, although novel, does not need special attention;
6. Improper review of literature
7. Poor statement of the hypothesis;
8. The hypothesis is clear, but the manuscript fails to address it;
9. Contradictions in the manuscript
10. The topic is unrelated to the scope of the journal;
11. Conclusion based on the data not provided or generated;
12. Inconsistent and confusing use of terminologies;
13. Avoidable blatant spelling errors;
14. Failure to cite all tables, figures, and references in the manuscript.

A section references ties the author in knots if not properly handled. All references must be numbered consecutively and citations of references in text should be identified using numbers (in brackets or not, as guidelines indicate). All references should be cited within the text, it is author's responsibility to ensure that the information in each reference is complete and accurate. Most journals would like the references to be cited in the Vancouver style [27].

After submission, each manuscript is peer-reviewed. Reviewers are asked to provide detailed, constructive comments that will help the editors make a decision on publication and the author(s) improve their manuscript. A key issue is whether the work has serious flaws that should preclude its publication, or whether there are additional experiments or data required to support the conclusions drawn.

Questions asked by peer reviewers [27]:

- Is there a clear hypothesis or question?
- Has appropriate methodology been used and are the techniques up to date?
- Are the results understandable and believable?
- Are the conclusions supported by data?
- Does it add to the existing knowledge?

And probably the most important:

- Is the study interesting, important and worthwhile to the reader of the journal?

CASE STUDY

Case report is the oldest and best-known type of publication in medicine [36]. It is a description of a single case with unique features i.e. a previously unreported clinical condition or observation of a recognized disease, unique use of imaging or diagnostic test to reveal a disease, previously unreported treatment in a recognized disease, or complication of a procedure [37, 38]. Writing a case report allows formal sharing of experiences and knowledge in the practice of medicine. Case reports have become a standard and indispensable part of the medical literature [36, 38].

For many doctors, a case report represents the first effort at getting papers published in medical journals and because the basic methodology is similar, it is a useful exercise in

learning how to write scientifically. As the case report is one of the many types of papers that are published in medical journals, authors need to be aware of the specific requirements for a case report, in order to maximize the material at hand [38, 39].

Case reports may be classified into:

- retrospective,
- prospective,
- time series case reports,

The second classification, more comprehensive comprises [38]:

1. Diagnosis-related
 - a. Unusual or new disease.
 - b. Unusual presentation of known disease.
 - c. New methods of diagnosis.
 - d. Unusual or new etiology.
 - e. Unexpected association between diseases or symptoms.
2. Management-related
 - a. New or improved treatment type.
 - b. New or rare side effects or complication of treatment

The structure of a case report usually comprises a short unstructured (or no) abstract, brief (or no) introduction, report of the case, and discussion. Case reports should be short and focused, with a limited number of figures and references. There are usually a restricted number of authors. Unlike original articles, case reports do not follow the standard IMRAD structure of manuscript organization. As there is a wide variation in format for case reports among different journals, it is essential for authors to follow exactly the target journal's instructions to authors [38, 40].

The title should be informative to interest the reader - redundant words such as "case report" should be omitted. Some journals restrict the number of authors for a case report, and justification may be required if more than four authors are listed [38].

For some journals, no abstract is needed for case reports. If required, the abstract should be unstructured, and should include age and gender of the patient, salient clinical information, diagnosis, management and follow-up, and the take-home message [38, 41].

Introduction section is often redundant in journals and the body of the case report starts simply with a description of the case. If the introduction is needed, it should be short, and provide the background information on why a particular case was worth reporting. The information should be supported by relevant references. For a new disease, a brief explanation of the disease, usual presentation and progression should be provided. For an adverse event or complication, a background of the treatment indications and previously-reported side effects or complications should be provided [38, 39].

The presenting signs and symptoms should be objectively described, together with the relevant past medical and family history. Details of medication, laboratory and electrophysiological tests, and imaging should be provided. Authors should resist the temptation to provide their own interpretation or inferences in the body of a case report. Embellishing with one's own additional descriptions and censor information, especially adverse outcomes, should be avoided [39, 40].

The discussion serves to explain, clarify and interpret key findings, and should be brief and to-the-point. The authors may suggest or explain his hypothesis, and express their own opinion here. A commentary that puts the case in context of other similar cases or explains specific management decisions is useful. Authors should also try to indicate the direction for future investigation, or diagnosis or management of similar cases. The take-home points should be emphasized, with focus on the main learning points [37, 38].

References should be limited to those that are directly relevant to the case reported, and are usually not more than 15 in number. Any case report that is authentic, understandable, and ethical deserves to be published as it will help both the authors and the readers to learn and it does not have to be original or important [36, 38].

Common problems with case reports [38]:

- a. Title includes redundant words, e.g. "case report and review of the literature".

- b. Case is not worth reporting - only slight variation in diagnostic or therapeutic approach.
- c. Therapeutic approach without strong rationale and no impact on outcome.
- d. Excessively long manuscript.
- e. Excessively complicated case.
- f. Lack of scientific evidence.
- g. No proof of diagnosis.
- h. No additional or incremental knowledge.
- i. Over-generalization.
- j. Over-ambitious conclusion - not supported by evidence

Case reports are definitely a time-honored, important, and integral part of the medical literature [37]. Many scholars who publish usually have at least one case report published and many scholars who read scientific publications read case reports interestedly. Case reports have become a standard and indispensable part of the medical literature. This form of publication is a great learning experience for the author as well as the reader [36, 40].

META-ANALYSIS

Meta-analysis is the objective synthesis of previous quantitative studies which employs statistical methods to combine and summarize the results of several studies [14]. Meta-analysis has the unique strength of statistically comparing studies to test possible moderators of findings, such as whether particular kinds of interventions are more effective than other types of interventions [14, 42].

The steps to performing a meta-analysis include making a hypothesis and defining the domain of research, defining inclusion/exclusion criteria, literature search, selecting the final set of studies, extracting data on variables of interest, coding procedures, calculating effect sizes and interpretations, selecting potential moderators and examine their relationships, report writing, and critical evaluation [43].

Meta-analysis refers to the analysis of analyses. I use it to refer to the statistical analysis of a large collection of results from individual studies for the purpose of integrating findings. It connotes a rigorous alternative to the casual, narrative discussions of research studies which typify our attempts to make sense of the rapidly expanding literature (Gene Glass, 1976) [44].

The main goals of meta-analysis are (according to Jain et al.) [43]:

- To summarize the large volume of data for easy comprehension.
- To establish the presence, and determine the magnitude, of an effect.
- To increase the power and precision of studies.
- To resolve conflicts among different reports.
- To document need for further trial(s), if any.
- To shed light into areas with insufficient research.
- To investigate variations, if any

Meta-analysis is a powerful tool to cumulate the knowledge in a research field and to identify the overall measure of a treatment's effect by combining several individual results [45]. However, it is a controversial tool, because several conditions are critical and even small violations of these can lead to misleading conclusions. In fact, several decisions made when designing and performing a meta-analysis require personal judgment and expertise, thus creating personal biases or expectations that may influence the result [44, 46].

Field et al. [47] divided the process of meta-analysis into six steps:

1. a literature search;
2. decision on some inclusion criteria;
3. calculation effect sizes for each study to be included;
4. basic meta-analysis;
5. consideration of doing some more advanced analysis such as publication bias analysis and exploring moderator variables
6. writing up the results.

Effect size measures (ad.3) are the “common currency of meta-analysis studies” that summarize the findings from a specific area of research [20]. Effect sizes can be calculated

and interpreted using ‘Cohen’s d statistic’ (for categorical variable) or ‘Correlation coefficient r ’ (for continuous variable) [43].

Two models can be utilised to predict the combined effect sizes:

- ❖ Test of homogeneity – ‘Fixed effects model’ (FEM): Is used for analyzing within-study variance and detecting random sampling errors.
- ❖ Test of heterogeneity – ‘Random effects model’ (REM): Is used for analysing between-study variance and detecting differences due to differing populations [43].

As such, effect sizes across different studies that have measured different variables, or have used different scales of measurement, can be directly compared: an effect size based on the Beck Anxiety Inventory could be compared to an effect size based on heart rate. Many measures of effect size have been proposed (Figure 3) and the most common are Pearson’s correlation coefficient, r , Cohen’s d , and the odds ratio (OR) [47].

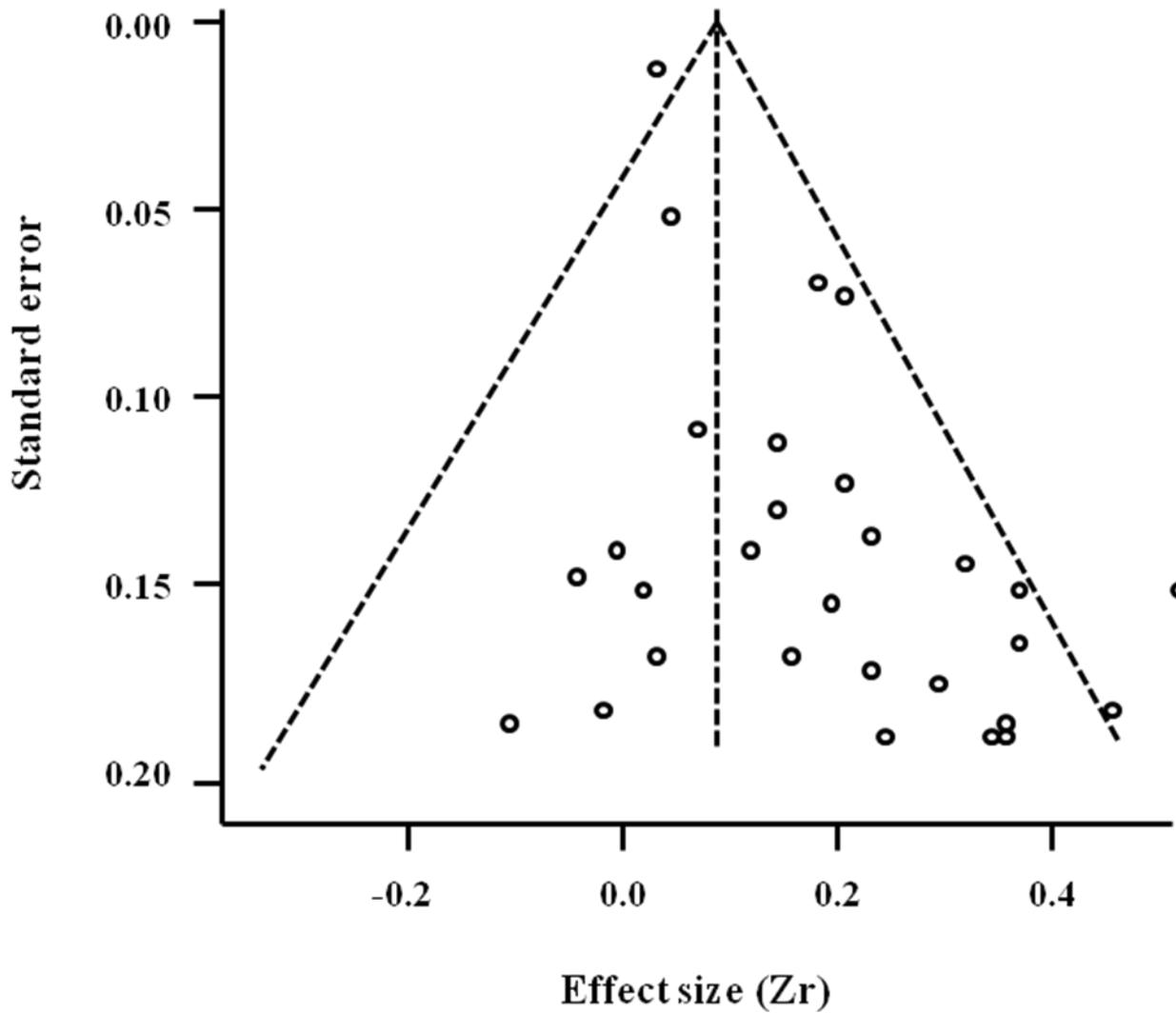


Figure 3. Example of a funnel plot showing approximate symmetry around the population effect size estimate [47].

Pooling data through meta-analysis can create problems, such as non linear correlations, multifactorial rather than unifactorial effects, limited coverage, or inhomogeneous data that fails to connect with the hypothesis. Despite these problems, the meta-analysis method is very useful: it establishes whether scientific findings are consistent and if they can be generalized across populations, it identifies patterns among studies, sources of disagreement among results, and other interesting relationships that may emerge in the context of multiple studies [44].

Apart from statistical analysis and data presentation, meta-analysis should concretely define the topic area of analysis and place the topic into a broader context. It should include [43]:

- a. A generalized description of literature that is to be analyzed along with a discussion of theoretical conflicts.
- b. An explanatory justification on the necessity of meta-analysis for the given topic.
- c. Any terminology/technical jargon used in the paper.
- d. Details about the process of analysis of literature

Methods section should describe search procedures in such a detailed way that other researchers could replicate the work. It should include description of search procedure, retrieval of studies, inclusion and exclusion criteria, coding and calculation of effect sizes [43].

Organizing and carrying out a meta-analysis is hard work, but the findings can be significant. In the best case scenario, by revealing the magnitude of effect sizes associated with prior research, meta-analysis can suggest how future studies might be best designed to maximize their individual power [44].

COVER LETTER AND CONFLICT OF INTEREST

Most journals require a cover letter with all submissions. The purpose of the cover letter is to introduce authors' intentions to submit the work to only this journal, to declare if there are any conflicts of interest, and to include any other details as to why the authors feel this article is important and should be published. Cover letters should be succinct and focus on the importance and novelty of the article submitted. It should include an introduction stating the title of the manuscript, the reason why this study is important and relevant to the journal, the question the research answers major experimental results, the most important conclusions [48]. Additionally a statement that the manuscript has not been published and is not under consideration for publication in any other journal is necessary as well as details that will convince the editor that the work is worth to be published.

In addition to the cover letter, an assignment of copyright for each author of the letter must be submitted. The copyright forms must be submitted in order for the article to be published [1, 48].

The conflict of interest burden is shared as well by reviewers and editors, who theoretically have no financial interest in whether a paper is published but who must additionally prevent their own opinions from seeping into the evaluations of any manuscripts that they referee. To eliminate potential bias, some journals have attempted to “blind” reviewers to the authors’ names, just as the authors who submit articles to this journal are blinded to the reviewers’ identities and our reviewers are blinded to each other [49]. In each type of work, statement of conflict of interest must be included – usually between the body of article and references.

CONCLUSION

According to Krishma’s work, there are certain fundamental principles of any kind of writing and particularly relevant to writing medical research, that researcher must never lose sight of [27]:

- a. Writing is always hard work, and there can be no short cuts if one hopes to produce something that other people would want to spend time reading.
- b. Don't start writing only because you must. You must have something to say, only then are you likely to succeed.
- c. Never manipulate data or mislead, because the truth will ultimately be out.
- d. It is never possible to cover up lack of scientific substance by literary flourishes. Therefore, it is not necessary to know Shakespeare to be able to write a good scientific paper.
- e. One must avoid duplicating publications or breaking up one research subject into three or four papers ('salami research').

The aim of writing up research is to contribute to the advancement of science and, if the paper is clinical, patient care. However, for an individual researcher the aims are that a

good paper appears in a first-rate journal and that the research is read by the largest possible number of people. Unfortunately, even amongst the published papers, only a minuscule number actually contribute to an advancement of scientific knowledge [27].

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