

# Writing and Publishing a Scientific Research Paper

Subhash Chandra Parija  
Vikram Kate *Editors*

 Springer

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Editors

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*Editors*

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## Foreword



सत्यमेव जयते

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## Writing and publishing a scientific research paper

Research today has become an integral part of every professional's life. Once the research study is done, it is imperative that the knowledge be shared. And the best platform to do so would be in the form of a publication. However, if research is a gray area, publishing is, to most professionals, a completely uncharted territory. And to explore these terrains, one needs not only to know the broader rules of the land but also the finer nuances, keeping in mind the words of D. J. Griffin "the road to publishing success is paved with writing." Many a time, it's the lack of guidance in the various aspects of writing and publishing that keeps the valuable research in the dark. And so the need for assistance, a helping hand, in this situation is a welcome thing, the want for which need not be further exemplified.

The present book entitled *Writing and Publishing a Scientific Research Paper* by Prof. Parija and Prof. Kate goes above and beyond to serve the same purpose. The well-structured content addresses the most pressing needs of a novice researcher and helps the reader to easily navigate the path to develop a well-designed research approach and in successfully publishing the results. Further, the book also helps to understand the finer points of writing and publishing a manuscript that elude many

an experienced individual. In over 18 chapters, the authors have managed to encompass all the vital aspects of research in a simple and easy to understand language aided with multiple illustrations that both provide comic relief and help in driving the point home. It also touches upon issues like what a reviewer expects, and such inputs from the other side of the fence help the researcher appreciate another perspective of the work being done. By the end of the read, the reader is no longer daunted by the jargon of a researcher or unnerved by the idea of initiating a research project.

Both Prof. Parija and Prof. Kate are experts in their respective fields. Professor Parija has to his name several papers in national and international journals and has authored ten textbooks. He has been awarded the B. C. Roy National Award of the Medical Council of India for his contribution to the development of medical microbiology. Professor Kate has contributed more than 25 chapters in reputed textbooks of surgical gastroenterology and surgery and has several papers to his credit. Between the two of them, they have amalgamated decades of experience with respect to research, experience that they have poured into this book making it an invaluable read to young researchers and which speaks like an old friend to the ones familiar with the game that is research.

In the end I would like to quote the words of Gore Vidal: “In writing and politicking, it’s best not to think about it, just do it.” So to all the creative and enthusiastic minds out there, I urge you to go on board with research and promise you it will be one of the most rewarding rides of your life!

  
( Soumya Swaminathan )

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## Preface

Around the world, evidence-based medicine has become the essential component of healthcare. Researchers are expected to find the answer and solution for the scientific query and convey that vital piece of information by means of presenting it in a scientific forum or publishing it in a scientific journal. Publication of research work has the advantage of reaching the maximum number of audience in addition to being available permanently for future reference.

‘Work not published is work not done’ – a critical quote that pronounces the importance of publishing the research work. However, very often, it is the lack of information/knowledge on scientific writing and publication that hinders the valuable research work from reaching the audience. Young faculty and trainees who are starting their research career find themselves stranded and are in need of a comprehensive guide which provides all essential components of scientific writing and aid in getting their research work published.

In this book, we have attempted to cover all essential components of writing a scientific research article through carefully selected 18 titles having essential content that is a must know for writing a robust scientific article. This book also covers the other underdiscussed areas of scientific writing including dealing with rejected manuscript, the reviewer’s perspective as to what they expect in a scientific article, plagiarism and copyright issue and ethical standards in publishing the scientific paper. Illustrations, line diagrams, cartoons and scenarios have been included for a better understanding of the chapters. We have included “key points” and an “application scenario” in all the chapters to enable the reader to identify the core areas as well as to test them at the end of each chapter.

We thank all the authors for their contribution. The authors have consistently maintained the lucid style across chapters to make it easy to understand and adapt into practice. We thank our publisher, Springer, for their unwavering support in bringing out this book. We are hopeful that this book will serve as a simple and comprehensive resource for beginners as well as senior faculties in publishing their research.

Pondicherry, India

Subhash Chandra Parija  
Vikram Kate

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## Acknowledgements

First of all, our thanks go to the participants and the authors of this book. We would like to thank all the authors for their contribution to the scientific content and preparation of this book. We would like to express our deep gratitude to Dr. Kalayarasan, Dr. Suresh Kumar and Dr. Mohsina Subair for the editorial assistance, assembling the text, tables, graphs and reference from the various authors into a coherent manuscript. We thank Dr. Surendiran for providing assistance for plagiarism checking for the content of this book. We are grateful to Dr. Niroj Kumar Sahoo, Junior Resident, Department of Ophthalmology, JIPMER, for providing wonderful cartoons for the chapters, which made the book look more reader friendly. Last but not the least, we would like to thank the publisher, Springer Nature, for the association and for helping to bring out this book for the readers.

Subhash Chandra Parija  
Vikram Kate



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**Part I**

**Writing a Scientific Research Paper**

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# Why Write a Scientific Research Paper

# 1

Subhash Chandra Parija and Vikram Kate

*Various advantages result even from the publication of opinions; for though we are liable to errors in forming them, yet their promulgation, by exciting investigations and pointing out deficiencies of our information, cannot be otherwise than useful in promotion of our science. – John Abernathy*



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## Key Points

- Research work published as a scientific research paper disseminates the knowledge and information to a larger audience.
- Dissertation and thesis have a different meaning although both are used synonymously.
- Publication of research paper enhances fellowship and job opportunities for young researchers.
- Publication of research paper gives funding and leadership opportunity for senior researchers.
- Publication of both positive and negative results contributes to future research.
- Research papers provide reliable information about a disease and the available treatment options for patients.

Scientific research refers to the systematic and critical evaluation of research question about the presumed relation of an observed phenomenon. A scientific research paper is a written and published report describing the results of scientific research [1]. A research work carries meaning when it becomes widely known to the scientific community. The results of the unpublished scientific research are known only to the researcher and his peers. Publication of the research work in the scientific journal results in dissemination of knowledge and enables a larger audience to become aware of the scientific work [2].

A scientific research paper in addition to giving confidence to the young researcher helps in his career advancement as scientific research paper is a mandatory requirement for appointment to professional posts and the promotion of academic jobs. The present chapter outlines the need to write a scientific research paper by briefly taking through the history of scientific writing and elaborates the various benefits of writing a scientific research paper.

---

## 1.1 History of Scientific Writing

The word ‘science’, derived from the Latin word ‘scientia’, refers to knowledge [3]. The term research stems from the Middle French ‘recherche’ and Old French term ‘recherchier’, which means ‘to go about seeking’ or ‘search’. The present concept of communicating ‘researched knowledge’ through scientific journal evolved over a period [3, 4]. The earliest scientific documentation and communication in the form of clay recordings of astronomical data by Mesopotamian empires dates back to 3500 BCE. Ancient Greeks notably Aristotle’s publication of *Art of Rhetoric* in fourth-century BC in which he describes logical persuasion or argumentation formed the basis for scientific research [4, 5].

In the middle ages, the invention of paper and establishment of universities resulted in systematic collection and documentation of scientific data. However, dissemination of scientific knowledge was still limited as all books were copied by hand. The invention of the printing press in the fifteenth century by Johannes

Gutenberg quickly changed that as millions of printed books helped in rapid and extensive dissemination of new scientific findings [6]. While printed book served as an active reference guide, it was not effective in sharing new concepts or research results as a significant amount of information has to be gathered for a book. The need to disseminate novel results of research findings led to the birth of scientific journal in the seventeenth century [7].

The first journal in French *des Sçavans* published articles about all fields of knowledge [8]. *Philosophical Transactions* published by the young Royal Society of London soon after the French journal focussed only on scientific articles. The journal was aimed to create a public record of researcher's original contributions to clinical science and to encourage scientists to 'speak' directly to one another [9]. In addition to original research articles, earlier journals published abstracts of interesting papers already published in other journals. By the end of the eighteenth century, there was a significant increase in the number of scientific journals to overcome the long lag period in publishing novel scientific research. The increase in the number was accompanied by the introduction of specialty-specific journals.

The concept of peer review was introduced in the late nineteenth century to facilitate unbiased publication [10]. The idea of adding references to acknowledge findings already reported in the literature was soon added. By the twentieth century, the original scientific articles became more structured with the introduction of the standard format of introduction, methods, results, discussion and conclusions.

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## 1.2 Need for Scientific Research Paper

One of the mandatory requirements of a postgraduate course and PhD degree is to do a dissertation or thesis. Although the terms dissertation and thesis are used synonymously, the two have a different meaning. The definition of the dissertation in Oxford dictionary is 'a long essay on a particular subject especially one written for a university degree or diploma'. In the dissertation, the emphasis is on systematic approach and research methodology rather than the originality of the research or research findings. On the other hand, in the PhD thesis, the focus is more on the novelty of research in addition to the research methodology.

The study outcome also plays a significant role in the acceptance of thesis. Both dissertation and thesis help in developing writing and research skills and critical analysis of experimental data and understand the statistical principles. However, most postgraduate students approach dissertation and thesis as just an essential requirement for the completion of the course. Once their course is completed, no special effort is taken to write a scientific research paper based on the dissertation or thesis. It is important to understand that any scientific research work carries significance only when it is widely disseminated among the scientific community. Publication of the dissertation and thesis as a research paper gives wider visibility to the research findings. Other reasons for writing a scientific research paper are outlined below.

### **1.2.1 To Develop a Scientific Writing Skill**

Science could not have advanced, if scientists did not document every experiment performed, every data collected and every result obtained. But scientific writing does not stop with the maintenance of records, but to publish the research results in scientific journals. While maintenance of records is quite easy to do, publishing scientific papers can be tough, especially for young researchers who are entering the world of scientific publications. The process of doing a literature search, developing a hypothesis, doing actual research, analysing data, editing the research findings to a scientific paper and publishing an article for the first time will provide valuable experience and improve scientific writing skill of young researchers [11].

### **1.2.2 To Connect with Senior Colleagues**

Young researchers are guided by the senior professors in the department to write a scientific research paper. It helps them to connect with faculty members in a way that is not often achieved in the typical classroom setting. Publication of research paper may also help young researchers to connect with researchers in other fields, providing new opportunities for interdepartmental and inter-institutional collaboration and future research.

### **1.2.3 To Enhance Academic Career**

Publication of research paper in scientific journals improves your academic profile and resume. It improves your chance of getting admitted in fellowship programs offered by reputed institutes. Young researchers with strong research background have more chance of getting travel grant from various scientific societies to attend international conferences. Overseas fellowship programs and international conferences provide an excellent opportunity to shape the academic career of young clinicians [12].

### **1.2.4 Improves Job Opportunity**

Academic institutes prefer clinicians with research articles published in reputed scientific journals for faculty posts. At the time of the interview, additional scores are given for the scientific publications. The number of publications and impact factor of the journal in which the article is published will determine the final score given for publications [13]. Naturally researcher with high-impact published articles stands more chance of getting faculty posts in academic institutes.

### **1.2.5 Benefits for Senior Researchers**

Writing scientific research paper improves funding opportunities for senior faculty members as funding agencies are inclined to offer research grants to researchers with active publication history. In most of the academic institutes, scientific publications in PubMed indexed journals are a mandatory requirement for getting promotions. Landmark publications in high impact factor journals like New England Journal of Medicine and Lancet enhance self-esteem and visibility among peers. It gives them the leadership opportunity to become the editor in chief or editorial board member in various scientific journals [14]. A senior researcher with high impact publications is often invited as faculty to various conferences and scientific meetings that can result in fruitful new scientific collaborations.

### **1.2.6 Guides Future Research**

As mentioned earlier publication in scientific journal disseminates the information and improves the visibility of your research. It helps to generate data for future research by raising unsolved questions. The scientific publication provides an opportunity for others to develop novel concepts, ideas or procedures. Publication of negative results obtained from the study can guide researchers that there is limited value in proceeding with a similar research in the future [15].

### **1.2.7 Provide Reliable Scientific Information**

In the current Internet era, common people are bombarded with a multitude of information. However, the majority of the information given on the Internet does not have a scientific background. The ocean of information can confuse patients seeking medical attention. Research papers provide reliable scientific data about a disease condition and the available treatment options for patients and young doctors.

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## **1.3 Moral Responsibility of the Researcher**

It is a moral responsibility of the health researcher to disclose the information of the data/finding and the implication of the research results/outcome as the brunt of the intervention either positive or negative may have a tremendous impact on the health care of the community.

Reporting the adverse events/unfavourable results of the research is considered as the responsibility of the researcher, to condense the use of that particular intervention or drug and to prevent further unfavourable and detrimental events. Writing the research outcome in the form of the scientific article provides the best platform to deliver such vital information to a larger population in a shorter time; hence, the use of a particular intervention/drug can be recommended or discouraged based on the research results.

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# Components and Structure of a Manuscript

# 2

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*The meaning of the paper is hidden by the way it was written – Mary Evans*



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## Key Points

- Writing a manuscript is an art and science which helps disseminate the researcher's work to the scientific community.
- The majority of original articles are written in a structured manner following the Introduction, Methodology, Results, and Discussion (IMRaD) format with the addition of conclusion and acknowledgment section.
- Guidelines for reporting various study designs are available to help authors address specific and pertinent issues in the manuscript.
- Reviewing the "Instructions to the Authors" page to which the manuscript is intended for submission increases the possibility of acceptance.

## 2.1 Background

One of the goals of research is knowledge dissemination by publication. Scientists are valued not by their skills in the laboratory, not by inherent knowledge in their respective disciplines, and undoubtedly not by their academic achievements; they are appreciated and become identified (or remain in oblivion) by their publications. We, researchers/academicians (barring a few), are more oriented toward completion of the research projects and dedicate very less time to see the logical conclusion – to enlighten the scientific community through publication. In short, many good scientists are poor writers and often leave the work midway due to various reasons [1]. Our training (undergraduate and postgraduate) and English not being our mother tongue were cited as major hindrances in quality writing.

In this world where "publish or perish" is the norm, scientific writing is a skill that must be acquired by all scientists/researchers irrespective of their place of work or hierarchy of position.

The objective of a scientific paper is to narrate the story with sufficient details to allow the reader to:

- Evaluate the interpretations derived.
- Reprise the research.
- Judge if the conclusions drawn are accurate.

The basic component of a research article is summarized by the acronym IMRaD [2] as described in Box 2.1.

### Box 2.1: Components of Research Paper

Introduction	(What was the question asked?)
Methods	(How was that studied?)
Results	(What were the findings?)
	and
Discussion	(What do they mean and what is their implication?)

Though individual component mentioned in the acronym is going to be dealt in detail in subsequent chapters, we are going to provide an outline regarding each of them with a note on some additional components.

Please refer to “Instructions to the Authors” page before you start writing the manuscript

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## 2.2 Introduction

The introduction is the first component of research publication after title and abstract. It is usually brief and communicates precisely the scope (what was the rationale and aim of the study) of the paper. It should describe the study background (the available base of knowledge), significance, and aims. It should clearly define or describe what research questions/hypothesis being tested, respectively.

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## 2.3 Methodology

Whether a study is valid or not is judged by the methodology employed. The Methodology section should be described with such details and clarity that it will help other investigators to replicate the same work in their setting. The Methodology section consists of two parts: “Materials” and “Methods.”

The “Materials” section provides answer to:

- Who/what was examined (e.g., humans, animals, cadavers, tissue preparations)?
- What interventions were employed (e.g., oral, injectable, gases)?
- What instruments were used (e.g., HPLC, hemoglobinometers) in the study?

The “Methods” section provides information on how subjects were manipulated to answer the experimental question, how measurements and calculations were carried out, and how the data were managed and analyzed.

The other notable components that should be described in the Methods section are given in Box 2.2.

It is a good practice to refer to checklists available like “Strengthening the Reporting of *Observational Studies in Epidemiology* (STROBE)” meant for observational studies for completeness of the methodology section [3]. Similar checklists are available for reporting intervention studies, systematic reviews, and qualitative studies. Articles presenting with results of randomized clinical trials should provide information on all major study components, including the protocol, assignment of interventions (methods of randomization, concealment of allocation to treatment



**Box 2.2: Subsections of Methodology**

- Study design
- Study setting
- Selection of participants (inclusion and exclusion criteria)
- Sample size calculation and sampling techniques adopted
- Variables included in the study and their methods of measurement
- Data collection and data management process
- Loss of data such as dropouts or patients lost to follow-up
- Outcome measures: primary and secondary
- Data management and statistical methods used
- Ethical guidelines followed by the investigators

groups), and the method of masking (blinding), based on the CONSORT Statement [4]. It should also be mentioned that the approval from the institutional/local ethics committee was obtained for the study protocol. All clinical trials should be registered in a Clinical Trial Registry [5], and the registration number should be given under Materials and Methods sections.

The Methods section should mention and abide by the ethical guidelines laid down by the country or region. For example, for research carried out in India on human subjects, the ICMR's Ethical Guidelines for Biomedical Research on Human Participants is a good resource for reference [6]. For experiments carried out on laboratory animals, the ICMR's Guidelines for Use of Animals in Scientific Research [7] /INSA's Guidelines for Care and Use of Animals in Scientific Research [8] or Guidelines of the Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA) [9] should be followed.

The last subcomponent of the Methodology section deals with data management and statistical analysis part. It is very important to indicate in the manuscript how data quality was ensured during the study – whether single data entry or double data entry method was used for data management. The authors should describe if consistency or random checks were carried out as part of the data management method. It is essential to mention the name of the statistical software with appropriate references used for data entry and analysis. The outcome variables should be clearly identified in the manuscript, and appropriate statistical tests should be employed depending upon the objective of the study. It is a good practice to mention the exact p-value obtained during the analysis, and confidence interval should be mentioned wherever appropriate.

The Methodology section should always be written in past tense and should be presented in an orderly and logical manner.

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## 2.4 Results

The Results section is the easiest section to write. One has to describe the findings of the intervention/observation in this section. Usually, the Results section consists of three components: Text, Tables, and Graphs. The text should be used to convey unique information and highlight the most important aspects of the figures and tables so that unnecessary duplication of data presented in tables and figures is avoided in the text. Only important observations need to be emphasized or summarized. The same data need not be presented both in tables and figures. When reporting values for commonly studied components such as cholesterol, blood glucose, blood urea, and creatinine, report the value in the International System of Units (SI). Results should be presented in a simple, logical, and orderly fashion to meet the objectives of the research projects. The details of framing tables and graphs will be discussed in another section.

It is a common mistake that the authors commit as they tend to describe the meaning/interpretation of the data in the Results section. The best part to describe the interpretation of the findings is the Discussion section.

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## 2.5 Discussion

The Discussion section is one of the most difficult sections to write in a manuscript. The discussion provides value to the paper and compares the work of the authors with other scientists. The discussion should deal with the interpretation (findings are similar/consistent with other studies or dissimilar with other reported literatures) of results without repeating information which has already been presented under the Results section. The discussion should review how the study observations add to the current scientific literature, offer explanations for the findings, compare the study's findings with other literatures, and discuss the limitations and, if possible, the implications for future research. The discussion usually ends with a brief summary statement.

Authors should avoid presenting general statements which are not emerging from the research study as conclusion. Sometimes depending upon the results, the authors may recommend future work to be done in the area and provide way forward. This component can also be included toward the end of the Discussion section. Utmost care should be taken in drafting the Discussion section as it provides value to the paper.

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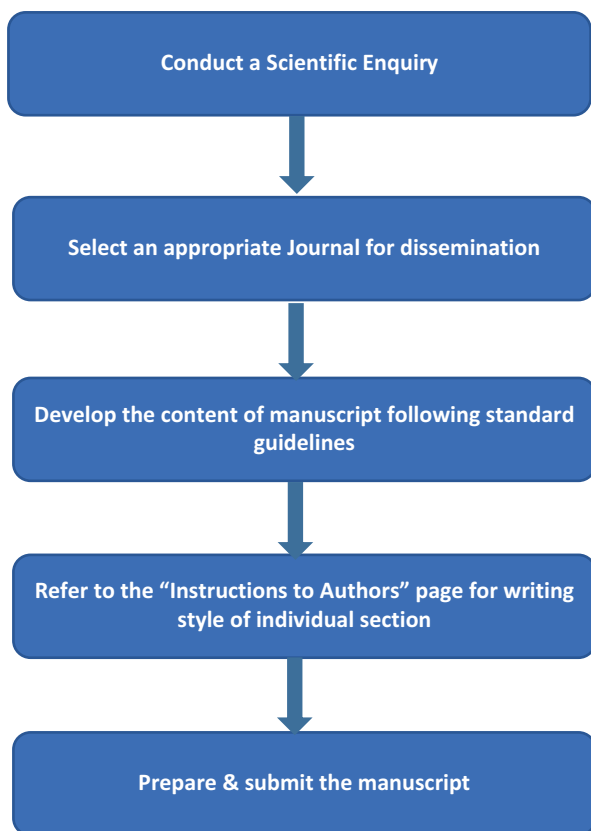
## 2.6 Acknowledgment

People who don't meet the authorship criteria should be acknowledged. Acknowledgment should be brief and intended to be made for specific scientific or technical assistance and financial support only. It is not required to acknowledge

individuals for providing routine departmental facilities and not mandatory for help in the preparation of the manuscripts without actually contributing to scientific content.

## 2.7 References

The total number of references depends upon the type and nature of the manuscript. It is always a good practice to refer to the “Instructions to the Authors” page for clear guidance. References cited should be numbered consecutively as they appear in the text and should be placed at the end of the manuscript. Style of referencing also depends upon the journal; hence, considerable attention should be paid before writing references. Figure 2.1 depicts the components of a scientific manuscript.



**Fig. 2.1** “Components and Structure of a Manuscript”

## Case Scenario

An academician submitted his original manuscript to an indexed peer-reviewed journal. Within 48 h of submission, the manuscript was returned to the corresponding author citing the following reasons:

- (a) There were significant formatting issues with your manuscript.
- (b) References were not correct by Vancouver style as followed in the journal.

What should be the next step to be followed by the authors?

1. Read the “Instructions to the Authors” page carefully for the original manuscript/article section.
2. Modify the manuscript as per the writing style mentioned in the journal.
3. Check for references and ask coauthors to go through once.
4. Resubmit the manuscript to the journal.
5. All of the above steps should be followed.

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S. Shyama Prem

*Title is the key part of the article which should be designed to engage the readers attention at first sight*



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## Key Points

- The title, abstract, and keywords often hold the key to publication success.
- The title of an article should be simple, precise, and catchy.
- The title should contain pertinent, descriptive words pertaining to the research.
- The three most commonly used types of titles are declarative, descriptive, and interrogative titles.
- Running title is an abbreviated form of the main title, usually cited at the top of each published page or left-hand text pages.
- Running title serves to guide a reader while scanning through a journal or toggling through multiple pages of the journal online.
- Title page is the first page of the manuscript which contains general information about the article and the authors.
- Title page generally consists of 11 main components mainly the title, running title, author names, affiliations, number of pages of the manuscript, no. of figures, tables, references, conflict of interest, source of funding, acknowledgments, and disclaimers.
- The covering letter is a vital document, which serves to create an important first impression on the editor.
- The goal of a covering letter is to convey to the editor how the manuscript meets the criteria of the journal to which it is submitted.

---

## 3.1 Introduction

Scientific writing has the difficult task of capturing and holding the attention of a researcher sitting through mountainous volumes of literature without having the liberty of using the full flowery power of the language.

While writing an article, it is always recommended to follow the author's guidelines of the specific journal. General guidelines have also been laid out by the International Committee of Medical Journal Editors (ICMJE). The ICMJE website has freely accessible recommendations for the conduct, reporting, editing, and publication of scholarly work in medical journals [1]. There are also other sources available like the Authors' Submission Toolkit, drafted by the British Medical Journals [2]. Both these resources summarize the best practices required for manuscript preparation and submission to a journal.

---

## 3.2 Title

The title is the first part of the research paper, which the editor reads. Researchers often struggle to write good titles for their research. They spend most of the time writing the principal part of the research including methods, results, and discussion. Little time and thought are spared for the title, keywords, and abstract. However, the

title, abstract, and keywords are the three most decisive factors which play a pivotal role in communicating the crux of the research to the readers and editors.

Most often, the title of the research paper functions as the sole factor which influences the decision of the readers on whether to read or skip a particular paper. However, there are no standard guidelines for writing a good title in various scientific disciplines [3]. Seeking the professional assistance of a research paper writing service could help the author write the paper, but the best judge of the paper would be the author.

---

### 3.3 Importance of Writing a Relevant Title

Title, abstract, and keywords often hold the key to publication success. Haggan (2003) observed a trend toward titles being more informative and referred to them as “texts in miniature” [4]. Essentially a title provides a description of the complete article. It gives information to the readers regarding the essence of the research paper and helps them decide whether to read the paper or not.

It also includes information that will help in the electronic retrieval of the article, as most search engines and journal websites use words in the title, keywords, and abstract to display the article to readers. Most people use electronic databases, to find relevant articles, and therefore it is imperative that the title represents a reliable summary of the researcher’s work or else it will not be displayed in the search results [5–7].

The title and abstract are most often the parts of a paper that are freely available online. Hence, once the readers find the paper, the title and abstract will be the deciding factor which determines whether the reader purchases a copy of the paper and continues reading [7].

---

### 3.4 There Are Three Basic Rules to Be Followed While Writing a Title

1. The title should be simple, precise, and catchy.

The main function of a title is to provide a concise summary of the research. Therefore, the title should be brief and clear. One should use active verbs and avoid complicated noun-based phrases. A lengthy title will distract the readers’ attention away from the important aspects of the research. The title should also be able to convey to nonspecialists [example is the editor of a journal] the gist of the article.

Ideally, the title should be written after one has completed writing the main article and has developed an in-depth knowledge and understanding of the article contents. This will help in writing a clear concise and scientific title. The guidelines of the *Publication Manual of the American Psychologist Association* recommend simplicity and brevity to avoid misleading indexing services [5]. The title generally should not exceed 150 characters or 12–16 words, though this should be tailored to the instructions of the specific journal.

2. The title should contain pertinent, descriptive words pertaining to the research.

The title should be as specific as possible and include some of the keywords listed in the manuscript. It should accurately reflect the nature and focus of the study. Information about the study design should be a part of the title especially for randomized controlled trials [RCTs], systematic reviews, and meta-analyses. This is mandated by many journals. If the article reports on results using solely nonhuman model systems, the species must be specified in the title.

The following format can be used as a rough guide for writing a title – research question + research design + population + geographic area of study (what, how, with whom, where). The last two may be excluded in case of word constraints. There is no full stop at the end of the title.

For example, “Prevalence of iron deficiency anemia before and after food fortification with iron in a rural community in North India, a randomized controlled trial” (23 words, 147 characters with spaces).

3. Avoid abbreviations/numerical parameters in the title.

As a rule, abbreviations are not used in the title, but if for some reason commonly used abbreviations are used in the title, they should be defined in the abstract. If the article reports on results using solely nonhuman model systems, the species must be specified in the title.

For example, “Dosimetric profile of VMAT in post-mastectomy radiotherapy” uses abbreviations which may not be immediately familiar to the readers. A more suitable title would be “Dosimetric profile of volumetric modulated arc therapy in post-mastectomy patients.”

For example, “The use of morphine decreases the duration of pain by 14 h in patients with bone metastasis” uses a numerical parameter which is unnecessary and may decrease the relevance of the article.

---

### 3.5 Types of Titles

There are many different types of titles, but the three most commonly used ones have been outlined by Jamali and Nikzad [8, 9]:

(a) Declarative Titles – Declarative titles state the main findings stated in the paper. These titles convey the most information and are the most appropriate for research articles.

For example, “Food fortification decreases the prevalence of iron deficiency anemia in rural India.”

(b) Descriptive Titles – Descriptive titles describe the subject of the research without revealing the conclusions. It includes the relevant information of the research hypothesis which is studied (e.g., participant, intervention, control, and outcome; PICO). A descriptive title has certain advantages. The readers



will get a snapshot information about the contents of the article. A descriptive title contains important “keywords,” which increases the probability of the article being discovered by the search engines [10]. Unlike a declarative title, the conclusions are also not revealed and it will help to sustain a reader’s curiosity.

For example, “Effect of food fortification on the prevalence of iron deficiency anemia in rural India.”

- (c) Interrogative Titles – Interrogative title poses the subject of research as a question. They are more appropriate for literature reviews. For example, “Does food fortification decrease the prevalence of iron deficiency anemia in rural India?”

Generally, of the three types, descriptive titles are the most commonly used.

Titles can also be classified based on the construction of the sentence. They are categorized into three groups – nominal titles, compound titles, or a full sentence.

- (a) Nominal titles capture the main essence of the paper, e.g., “The effect of fast food on obesity and weight gain.”
- (b) Compound titles or hanging titles consist of two parts separated by a colon. Dividing a title into two parts helps to provide additional information on the study design, e.g., “Impact of food fortification in children with iron deficiency anemia: a randomized controlled trial.”

It also provides information regarding the geographic area, e.g., “Prevalence of tuberculosis in children in a rural community of South India: a 5-year epidemiological study” and the temporal relation of an intervention, e.g., “Long-term benefits of 5 years of adjuvant Anastrozole: a 10-year follow-up of a randomized trial in breast cancer.” Compound titles also correlate with higher number of citations [11].

- (c) Full sentence titles tend to be longer and assert the outcome of the study. For example, “Post radiotherapy dysphagia is an independent risk factor for increased mortality in elderly patients: a prospective observational study”.

A longer title is more likely to contain a given search term and is therefore identified more easily. Since most of the journals have a limit on the number words which can be used in a title, they are uncommonly used.

---

### 3.6 Running Title

Many journals require a short title, which should not exceed 60 characters (including spaces). This is the running title/short title/running head which is an abbreviated form of the main title. This title is usually displayed at the top of each page of the article or left-hand text pages.

It serves to guide readers while scanning through a journal or toggling between multiple papers. The running title can include abbreviations even if the main title cannot. Articles (a, an, the) may be omitted to decrease the number of characters,

and complicated words should be minimized. However, if the main title itself is brief, it can serve as a running head as well.

Being catchy is not important for a running title; instead, clarity and precision are important. The maximum length is often set by the publisher; for example, American Psychological Association [APA] style sets the maximum length of the running head to 50 characters, while American Physiological Society [APS] style allows 55 characters. In general, most of the journals recommend that the running title generally does not exceed 50–60 characters.

Title – “Prevalence of hookworm infestation among school-going children in rural North India” (11 words, 86 characters with spaces)

Running title – “Hookworm infestation among school-going children in rural India” (8 words, 59 characters with spaces)

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### 3.7 Title Page

Title page is the first page of the manuscript which contains general information about the article and the authors. A title page includes the following components:

1. Title
2. Abbreviated or running title
3. Author names and affiliations and order of authorship

Full and accurate names of all the authors, each author’s highest academic designation, department, and institution should be provided. If the name of a research group is included, then there must be at least one individual author in addition to the group, and the group name must be mentioned in full.

Guidelines for authorship (“who is an author?”) can be accessed from the ICMJE website which has recommendations for the conduct, reporting, editing, and publication of scholarly work in medical journals [1]. The corresponding author must be highlighted with his/her e-mail, fax no., mailing address, and telephone no. The corresponding author is the one responsible for responding to a reader’s queries on the work published in the article. The submitting author’s e-mail, fax no., mailing address, and telephone no. should also be included. Only the corresponding author has the right to withdraw, correct, or make changes to the manuscript.

4. Number of pages of the manuscript
5. No. of figures, tables, multimedia, or 3D models

This enables the editorial staff to confirm that all figures and tables have been included in the manuscript and that it fits in within the space limits of the journal.

6. No. of references
7. No. of words in abstract, main text, and references

This allows editors and reviewers to assess if the length of the article is warranted and if it fits in with the journal’s word limits.

8. Conflict of interest

Most of the journals have a conflict of interest declaration form. Despite this, editors will sometimes require a conflict of interest declaration on the title page. If there are no conflicts, the usual wording is “the authors declare no competing financial interests.” Any source of funding, honorarium received, or post held by any of the authors which could pose a possible conflict of interest should be mentioned.

9. Sources of support

This includes funds, drugs, equipment, or other support that facilitated the work described in the paper. All the sources of support should be stated on the title page.

10. Acknowledgments

This includes all funding sources and other technical or intellectual assistance that does not warrant authorship. Acknowledged individuals should be informed prior to submitting the manuscript.

11. Disclaimer

A disclaimer is a statement that disclaims responsibility. It specifies the scope of rights and obligations of all the authors of a particular paper. An example of a disclaimer is that the views expressed in the paper are the author’s own and not the views of the institution or the funding agency.

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### 3.8 Covering Letter

Many authors question the relevance of writing a covering letter when the abstract and title page can convey all the essential information about the article and its authors. The covering letter is a small but vital document which serves to create an important first impression and therefore should be tailored to the interests of the individual editor. The role of an editor is to publish novel work which not only lies within the scope of the journal but also captures the interest of the readers. The goal of a covering letter is to convey to the editor how the manuscript meets these criteria.

Every covering letter should contain the following elements and follow certain guidelines enlisted below [12, 13]:

1. If the journal requires paper submission, preferably use letterhead paper. Electronic submissions should be formal and include the full name, designation, and contact information of the submitting author in the signature.
2. The letter should preferably be addressed to the editor, and in the first paragraph, he/she should be requested to consider the article for publication.
3. The length of the cover letter should be restricted to one page which translates into three to five paragraphs. Benson and Silver recommend stating only two or three points about the article in the covering letter [14].
4. In the first paragraph the author should provide the title of his/her paper with a request to consider the article for publication.

5. It should be emphasized that the manuscript is not being considered for publication elsewhere.
6. The next paragraph should cover the main idea of the article with background information to show its relevance. The methodology and the core argument which makes it necessary for the research to be disseminated widely to the readers should be highlighted.
7. In the subsequent paragraphs, a frank discussion of potential conflicts of interest and ethical issues can be discussed. This will help to assure the editor that your work complies with the ethical guidelines.
8. In the final paragraph, the authors should thank the editor for considering the manuscript for publication.

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### **3.9 Attributes of a Good Title, Running Title, and Covering Letter**

- A good title is simple, brief, and captivating.
- It informs the reader and the editor precisely about the contents of the article.
- It contains pertinent keywords which are used for indexing.
- It does not contain abbreviations, unnecessary technical jargon, and numerical parameters.
- A good running title is accurate and contains relevant keywords used for indexing.
- A good covering letter captures the editor's attention by focusing on the strengths of the research.
- It highlights the important aspects of the research which will be exciting for the readers.
- A good covering letter avoids irrelevant and distracting details and avoids repetition.

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### **3.10 Conclusions**

Scientific writing should be kept simple. While writing a scientific article, you should recall more than once Einstein's famous quote "If you can't explain it simply, you don't understand it well enough."

Most often, maximum time and effort are spent on writing the main text of the article with little thought and effort spared for writing other parts of a research, like the title, running title, title page, and covering letter. The editor spends a relatively short time for reviewing the relevance of your work. Giving due time and consideration for these three vital parts of a research holds the key to publication success. Hence every effort must be spared to create these critical parts of the document.

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## Case Scenario

You have conducted a randomized controlled trial comparing home-cooked ragi versus Horlicks in assessing the weight gain of children. Write an appropriate title, running title, title page, and covering letter.

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Vikram Kate, S. Suresh Kumar, and Mohsina Subair

*The abstract is the lure that beguiles the elusive researcher to the article*



I HOPE THEY ACCEPT MY ABSTRACT THIS TIME...

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## Key Points

- An abstract of a scientific article is a precise, clear, and stand-alone statement that provides an overview of the work to the reader and plays an important role in increasing the visibility.
- An effective abstract should encapsulate the essence of the article and give all essential information about the study/paper, as it's often only the abstract that's scrutinized by potential readers and reviewers.
- An abstract can be descriptive or informative. Informative abstracts can again be divided as structured and unstructured abstracts.
- The components of an abstract are introduction/background, methods, results, and conclusion. The discussion is not necessarily a part of the abstract unless specified. Results followed by methods should be the main emphasis of the abstract.
- The title of an article is keyed and hence the specific words/phrases that are used repeatedly in the manuscript can be used as keywords.

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## 4.1 Abstract

### 4.1.1 Definition of Abstract

The origin of the word “abstract” is from the Latin word “abstractum” which refers to condensation of a long written work [1].

An abstract of a scientific article is a precise, clear, and stand-alone statement that provides an overview of the work to the reader and can help in making an informed judgment regarding the utility of the manuscript/research study. Despite its brevity, it is required to fulfill in entirety the task of the manuscript that follows [2].

### 4.1.2 Why Is a Good Abstract Important?

A good abstract is important for numerous reasons which can be summarized as “selection and indexing” [3]. Many a times an abstract is the only component of the manuscript that is read by the readers while doing an electronic database search or while leafing through the printed journals [2]. Very often, articles are cited solely based on abstracts. The abstract is sometimes the only part that is scrutinized by reviewers for journals or selection for presentation in conference platforms. The abstract sets the tone and entices the potential readers to gain access to your full work. Hence it should encapsulate the essence of the article and give all essential information about the study/paper.

In the current era of online journalism, most of the libraries provide with facilities to search the abstracts thus saving the time spent in carrying out a full-text search [3]. It is important to include keywords in its text thus increasing the ability to be found amidst many others of the same kind. Apart from finding its audience,

the use of keywords in the abstract helps emphasize the core areas of the manuscript. Hence it is advisable to use accurate, clear, and direct terms in abstract and avoid unnecessary jargon.

### 4.1.3 Types of Abstracts

Abstracts can be broadly classified as descriptive and informative abstracts [4].

#### 4.1.3.1 Descriptive Abstracts

These abstracts describe the purpose and scope of the paper but do not mention about the findings. Typically it is short ranging up to 75–100 words and often used in papers in the field such as social science and humanities. There is no discussion on the results or the conclusion derived from the study.

#### 4.1.3.2 Informative Abstracts

These abstracts, on the other hand, apart from providing an overview of the work, emphasize on the important findings and conclusions. It is commonly used for scientific abstracts with usual word limit of 250–300. It can be roughly estimated as one-tenth the length of the original manuscript which is clear and concise and can sketch a succinct picture as an independent entity. Further description in this chapter is pertaining to an informative abstract. The layout of an informative abstract can be classified as structured and unstructured abstract [5].

#### 4.1.3.3 Unstructured Abstracts

In these types of abstracts, there are no pre-labeled sections in the abstract. However, all the details required in the abstract are included similar to a structured abstract. This is more commonly used for case reports rather than original articles.

#### 4.1.3.4 Structured Abstracts

The layout of these abstracts has distinct and labeled sections thus enabling better comprehension. It has been reported that, with the use of a better-structured format, there has been a significant improvement in the quality of information provided [6]. Hence, structured abstracts are now the preferred layout by most of the journals. Though initiated for original articles, it is being used for case reports as well. For example:

*The following table demonstrates how a structured abstract enhances the quality of information and ease of comprehension of the same abstract [7].*

The abstract has been modified for explaining the details.



<i>Unstructured layout</i>	<i>Structured layout</i>
<i>This prospective randomized controlled trial was conducted on 120 patients of elective bowel surgery to compare safety and tolerability of early oral feeding. Patients in the early feeding group and traditional feeding group were started on oral fluids on postoperative day 1 and after the resolution of ileus, respectively. The study group had a lesser time to first flatus and defecation and a decreased hospital stay with similar complications. The length of hospital stay was reduced by 3.4 days in the study group. Early postoperative feeding is safe, well tolerated with reduced hospital stay following elective open bowel surgery</i>	<p><b>Objective:</b> <i>To compare the safety, tolerability of early oral feeding vs. traditional feeding in patients undergoing elective open bowel surgery</i></p> <p><b>Methods:</b></p> <p><i>Design: randomized controlled trial in 1:1 ratio</i></p> <p><i>Setting: tertiary care hospital</i></p> <p><i>Participants: 120 patients of elective bowel surgery</i></p> <p><i>Intervention: early feeding – fluids on postoperative day 1</i></p> <p><i>Control: traditional feeding – orals after resolution of ileus</i></p> <p><i>Main outcomes: length of hospital stay, time to first flatus and defecation, complication rate</i></p> <p><b>Results:</b></p> <p><i>The number of days to first flatus (<math>p &lt; 0.0001</math>), first defecation (<math>p &lt; 0.0001</math>), length of postoperative stay (<math>p = 0.011</math>) and time of starting solid diet (<math>p &lt; 0.0001</math>) were significantly earlier in the early feeding group. Complication rates were similar.</i></p> <p><i>The length of hospital stay was reduced by 3.4 days in the study group (<math>p = 0.037</math>)</i></p> <p><b>Conclusion:</b></p> <p><i>Early postoperative feeding is safe, well tolerated with reduced hospital stay following elective open bowel surgery</i></p>

#### 4.1.4 What Makes an Abstract “Effective”?

A good and effective abstract is characterized by the following:

- It should be a coherent paragraph that can summarize the essence independently in a subtle and lucid manner.

- It should cover all areas and provide an explicit synopsis of the purpose and scope of the study, the methodology used, the results, and the conclusions and its implications. It should serve as a mirror for the report.
- It should be comprehensive not only to the readers with particular interests but to a larger audience.
- It should not have any information that is not reflected in the original work and should be scrupulously honest in drawing conclusions.

#### **4.1.5 Components of an Abstract**

In many instances, an abstract is written as a single paragraph. However, many journals do prefer a structured abstract. In either form, it is advisable to follow a checklist so as to write an effective abstract. It should answer the following broad headings: motivation, problem statement, approach, and results.

The components of an abstract can be listed as:

- Background/introduction/aims and objectives
- Methods
- Results
- Conclusion

It is important to note that although an abstract is a reflection of the paper, the discussion is not a part of an abstract.

#### **4.1.6 Title**

It is often described as the “one line summary of the work” and should be precise and to the point. This part has already been described in the previous chapter.

The title and author affiliations are usually part of abstracts submitted for conferences and are often not a part of abstracts submitted to journals. In most journals, the reviewing process is blinded and hence instructs the authors to prepare the submission comprising title page, abstract, and the manuscript as a separate file.

#### **4.1.7 Background**

The motivation and the problem statement components are often described using terms such as “background”/“introduction.” This area should describe the importance of the report and emphasize on its purpose. It is often appropriate to put forth the problem statement and how the study helps in filling up the existing lacunae directly at the onset. However, if the problem statement is not widely known, it is advisable to introduce the motivation as to “why do you care about the problem” before actually describing the problem. At times, it is appropriate to directly put the objectives instead of the problem statement or reasons for conducting the study.

This becomes important when it is essential to encompass a larger volume of information within a stipulated word count. For example:

*This prospective observational study was conducted to determine the incidence, morbidity and mortality due to Venous Thromboembolism (VTE) in surgical patients, and to assess the validity and reliability of Adapted Caprini scoring in risk stratification for VTE prophylaxis. [8]*

The background should always conclude with the aims and objectives of the study. The aims can be framed appropriately by utilizing the PICO process which is self-explanatory: P – patient population, I – intervention/exposure, C – comparison intervention, O – outcome. For example:

*To determine whether fluorouracil or gemcitabine (I/C) is superior in terms of overall survival (O) as adjuvant treatment following resection of pancreatic cancer (P). [9]*

Background/introduction, thus, should focus on providing a brief and lucid build up that smoothly translates into the other components that follow. However, this should be the shortest part of the abstract as it is the findings that the readers are keen to know and not the background. Hence, while writing an abstract, care should be taken not to elaborate in the background so as to allow adequate room for the results.

#### **4.1.8 Methods**

The methods section indicates your “approach “to the problem and how you went about solving it. This is the second largest part of the abstract and should succinctly explain how and what was done. The credibility of a study depends on the study design and the methods, thus emphasizing the need for an explicit methods section in the abstract.

It should explain the study design, what was the approach used to answer the problem statement and how it was analyzed, sample size, and so on. It is imperative that the end points be clearly described so as to capture the focus of the reader toward the problem.

All the highlights can be easily communicated precisely using structured format. Some journals such as the JAMA Surgery recommends the use of a highly structured abstract with distinctly labeled sections such as objective, study design, setting, intervention/control/exposure, and outcome measures [9]. This will improve the quality and precision of the information.

#### **4.1.9 Results**

This is the largest and the most important component of the abstract. The need for brevity should not compromise on the quality of information provided under results section. It should be precise and should be a detailed description of all the findings

that can be fitted in the word limit. It should describe the number of patients included, number analyzed, dropouts, if any, results of the variously described end points preferably with p values, and confidence intervals. The use of vague phrases such as “very small difference” should be avoided. Rarely, use of a table or figure is allowed in the abstract, which can be utilized to project the results section. This happens in the case of conference abstracts rather than abstracts submitted to journals.

#### 4.1.10 Conclusion

This section should provide the explicit answer to the “research question.” It should precisely describe the “take-home message” in one or two sentences.

*Aim & objectives: Comparison of incision time, blood loss during incision, postoperative incision site pain, and wound infection between electrocautery and scalpel incision following midline laparotomy*

*Conclusion: Postoperative incision site pain, time taken for the incision and wound infection rate were comparable in both the groups whereas the blood loss with electrocautery incision was significantly lower than scalpel incision following midline laparotomy. [10]*

It may also describe the important corollary findings and the authors’ perspectives and recommendations. It is the responsibility of the author to be scrupulously honest in drawing conclusions as many a time; these assertions are taken into consideration by the readers at face value. When a review is carried out for acceptability for publication, an important criterion assessed is whether the conclusions are being drawn from the findings of the study.

The core of the information in the abstract is consistent, but specific journals or article types may have specific requirements. The abstracts of case reports/series/video presentations should describe the following though the broad headings remain similar:

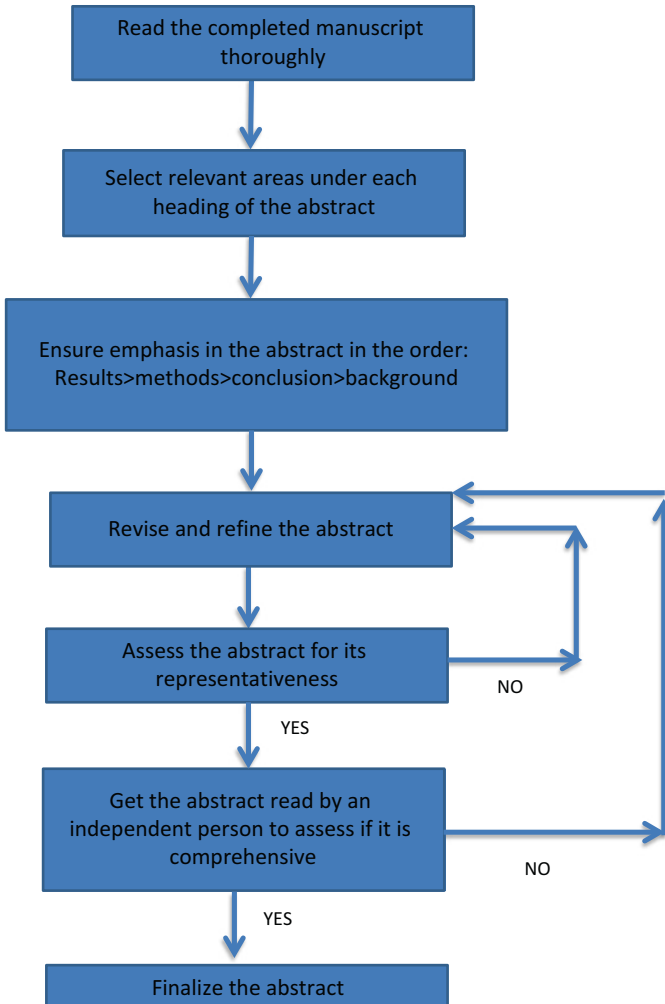
- Introduction/background should describe the rarity of the case/novelty of the procedure, etc.
- The methods section is often replaced by the description of the case summary. For a video abstract, the highlights of the video should be described.
- The conclusion should convey the take-home message for the clinician/reader from the case report/video.

#### 4.1.11 How to Write an Abstract?

*Though an abstract is the first thing reader sees, it’s the last thing the author writes.*

This is the most difficult part of the manuscript for the author as it is extremely difficult to cut down on the outcome of your innumerable days of hard work.

Although the abstract is an outline of your work, it is prudent to write it at the end of the report so as to make it succinct and clear. Although it’s a summary, it is



**Fig. 4.1** Flowchart demonstrating the “reverse outlining” process for writing an effective abstract

advisable to write it afresh rather than rephrasing your own text. This method will avoid redundancy, however, requires an effort on the part of the author.

Another recommended method to write an effective abstract is by using the technique of “reverse outlining” especially when you are abstracting your own work [3]. The technique is to reread your manuscript and identify the core idea of each section and to distill it into one powerful statement. You can “cut and paste” the relevant areas under each heading and then revise it to correct the flaws in the organization, remove the inessential information, and correct the language to develop a coherent paragraph.

It is always recommended to revise your abstract again and again and correct the superfluous errors. To ensure whether you have communicated appropriately, get your abstract read by someone who is not involved in the study and analyze their extent of understanding on the topic based on your abstract. This will help you in refining the key areas. Figure 4.1 describes this process of “reverse outlining” for writing an abstract.

#### 4.1.12 How to Avoid Pitfalls?

The importance of a well-written abstract has been emphasized; however, pitfalls do occur due to oversight. Here we describe a few precautions to avoid pitfalls and difficulties while writing an abstract. Avoid the direct use of abbreviations, as it will require explanation, which will unnecessarily use up space for other relevant information. Avoid jargon and superfluous vocabulary in the abstract to avoid confusion among the readers. Do not include any references or citations while writing the abstract. Importantly, there should not be any misleading speculations stated in the abstract.

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## 4.2 Keywords

Keywords are part of the abstracts submitted to the journals.

As the word denotes, these are “key” words that identify the core concept of the study. These are the words which are often used by readers in the search engines to retrieve the abstracts [11]. Journals search engines and abstract services often classify journals based on the keywords. The visibility of the article to the interested audience is decided based on the title and the keywords provided. Hence using appropriate keywords can help the potential readers in easily identifying the abstract and also increase your chances of being cited [12].

### 4.2.1 How to Select Keywords?

It is important to note that the title is “keyed” and appears automatically in the search engines, and hence it is advisable to use keywords that are separate from the title to ensure a wider reach for the report. Use single or two words (e.g., electrocautery, midline laparotomy) and avoid using sentences or multiple words (e.g., *H. pylori* eradication regimen, risk factors for colon cancer). Journals generally allow three to five keywords to include in the manuscript. To identify the appropriate keywords, it is advisable to read through your manuscript and identify words/phrases that are used repeatedly. Make a list of these main items along with a few additional ones. Care should be taken to add the common variants of the term (e.g., neoplasia and cancer) and abbreviations to your list of keywords. Before finalizing your list of keywords, refer to the common indexing standards such as MeSH (Medical

education Subject Headings) thesaurus and ensure that the terms used are matching with that of the standards. Moreover, there are tools such as “MeSH on demand” that can help the authors to find appropriate MeSH keywords from the text. To ensure its appropriateness further, type your keyword into the search engines and analyze whether papers similar to yours are being listed.

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### 4.3 Summary

To summarize, a good abstract should be as representative of the study with special emphasis on the results and methods. A brief, preferably one-lined introduction, with a clear and concise take-home message, will make an effective and good abstract.

An effective abstract writing is an art that every researcher should master so as to enhance their readability. It is advisable to tailor the abstracts to the requirements of the journals to which the study is to be submitted. Though challenging, the time spent in writing an effective abstract and identifying appropriate keywords is worthwhile as these two smallest components have a major impact on the dissemination of your research.

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### Scenario/Test Yourself

Read the abstract given below and answer the questions that follow:

**Title:** Harmonic scalpel incision versus conventional scalpel incision in elective laparotomy – A double-blind randomized controlled trial.

**Aim and objectives:** The study was carried out to compare the harmonic scalpel incision with conventional scalpel incision in patients undergoing elective laparotomy using a midline incision with respect to time taken for the incision time, blood loss that occurred during incision, postoperative incision site pain, and infection in the incision. The length of hospitalization (LOH) also was compared between the groups.

**Methods:** All consecutive patients undergoing elective laparotomy were randomized into the harmonic scalpel and the conventional scalpel groups. The incision time and blood loss during incision were noted.

**Intraoperative and the postoperative incision site pain and wound infection** were recorded on every alternate postoperative day for the first 2 weeks. The LOH was compared between the groups.

**Results:** A total of 400 patients were included in the study with 199 in the harmonic scalpel group and 201 in the conventional scalpel group. The blood loss that occurred during the incision and the LOH in the harmonic scalpel group was less than that of the conventional scalpel group.

**Conclusion:** Harmonic scalpel incision is superior to conventional scalpel group.

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**Questions:**

1. What is the layout of the abstract? – structured/unstructured
2. Are the components of the abstract appropriately prioritized so as to be representative of the study?
3. Is there information about the clinical relevance of the study and clear definition of what the study aims at?
4. Which components of the abstract appear satisfactory?
5. Is there adequate information about the methodology available from the abstract?
6. Will you consider this a valid study based on the information available from the results?
7. What other information will you look for in the manuscript if you were to rewrite this abstract into a more comprehensive one?

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Tamilarasu Kadhiraavan and Molly Mary Thabah

*Introductions should be short and arresting, and they should tell the reader why you have undertaken the study. – Richard Smith [1]*

*The introduction is not a data dump or an exercise in mental throat clearing. A proper introduction has a definite format and sets the tone for the remainder of the article. – MaryAnn Foote [2]*



## Key Points

- The introduction should convey why you did the study.
- Succinctly present the conflicting data, knowledge gaps, or uncertainties.
- Begin with the big picture and narrow down to your research question.
- Cite key references. However, avoid a detailed literature review.
- The introduction should blend seamlessly with the rest of your paper.

Arguably, the introduction is the most frequently read part of a research paper next only to the title and abstract. Readers often make a decision to continue further or not, after going through the introduction of your paper. If you manage to

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convince the reader that your paper is worth reading, the role of introduction is done. The purpose is the same as far as editors and peer reviewers are concerned—to impress upon the reviewers and editors that you are addressing an important question. Editors could only form an opinion on the importance of your work by reading the introduction. If the editor is satisfied that your work addresses an important unanswered question, your manuscript most likely would progress to peer review.

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## 5.1 Why Introduce?

The essence of introduction is that it should succinctly state why you conducted the study [1]. Trying to answer this question is not that simple as it seems. If the reader happens to be a peer who shares your research interest, it is really needless to say why you did the study. Unfortunately, that is not the case most often. Editors of medical journals are usually broad in outlook, whereas authors are often much narrowly focused. Even though editors have their own areas of subject expertise, they may not be very familiar with the nitty-gritty of the issues surrounding the problems which are of interest to you. So is the case with peer reviewers—more often than not, your manuscript would be reviewed by peers who are tangentially related to your work, who might be experts on methods used in your study yet are unfamiliar with the clinical condition you are interested in. On the same note, most of the readers of a research paper are going to be nonspecialists. However, a nonspecialist could very well understand any problem if sufficiently explained. Hence, it is very important to provide readers the necessary background information while trying to explain why you did the study. For this reason, many journals call the “introduction” as “background.” Both essentially are the same.

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## 5.2 Ingredients of Introduction

How much background information should be provided in the introduction and how it should be structured are two important points to ponder. First, you should set the context—i.e., what is the clinical condition or biological phenomenon you are talking about and how important it is. If it happens to be a very common one, do not bore the readers with information that everybody knows. For example, if you are writing for a tuberculosis specialty journal, it would really sound funny if you begin by saying, “Tuberculosis is caused by *Mycobacterium tuberculosis*.” Remember not to reinvent the wheel! On the other hand, if you are talking about a disease condition which you think many of the readers might not be quite familiar with, it is prudent to first clearly say what it is—like saying “Lemierre’s syndrome is septic thrombophlebitis of the internal jugular vein, secondary to an oropharyngeal infective focus, resulting in metastatic septic complications.” It is a good practice to also say a line about the relevance of the clinical condition or problem—about the public health burden or clinical or biological importance.

Having stated what you are talking about, without beating around the bush, proceed straight to the heart of the problem—explain what is the specific issue regarding the said clinical condition that is of interest to you. This is very essential—if there is no such thing, there would be no justification for undertaking a study in the first place. This perhaps is the most difficult part of the introduction. This is where the author would be put to the test—to succinctly present the conflicting data/views, knowledge gaps, or uncertainties about the issue, which are often technical in nature to nonspecialist readers, and to make them understand and appreciate the same. Place the points one by one in front of the reader, substantiating them with appropriate carefully handpicked contemporary references. In the process, make it explicitly clear to the reader what is the problem with the existing literature on the issue. This should be written in such language and detail that even nonspecialist readers are able to understand and appreciate the problem without much difficulty.

Finally, end the introduction by saying what you intended to fill the knowledge gap and to resolve conflicting data or expert viewpoints. While doing so, subtly hint at the merit of your current investigation, especially those pertaining to your study design. At the same time, take care not to be pompous. For example, you might have done a controlled clinical trial on a controversial issue, could have used improved measurement techniques, or else might have studied a population not studied before. Essentially, the introduction ends with the research question that instigated the study.

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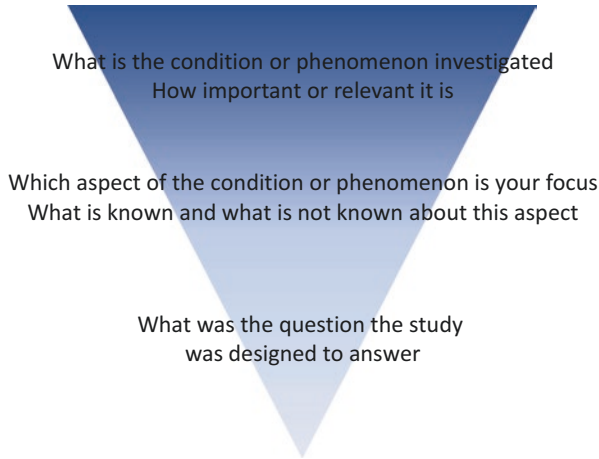
### 5.3 Structure of Introduction

It is important how you structure the answer to the questions which are expected to be clarified in the introduction. Typically, introductions begin with the big picture and narrow down to the research question—just like we zoom in on a street using Google Earth. This structure is often likened to a funnel or inverted pyramid (Fig. 5.1) [3]. It is equally important to appreciate the fact that the discussion is meant to be structured as a mirror image of the introduction—beginning with the answer to the question you asked and then gradually zooming out to generalize your findings.

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### 5.4 Don'ts for Introduction

First, avoid being unduly lengthy. Although there are no strict word limits for introduction, the shorter the better. Experts advise that the introduction should not exceed a page of three paragraphs or about 300 words. The crux of the matter is being comprehensive, yet concise. This balance is improved by multiple drafts—initially beginning with a well-reasoned introduction that says whatever you have to say, then by chopping off redundant points, sentences, and words without losing continuity and clarity. The final version is one where each and every word is essential for conveying the intended meaning. Second, do not confuse introduction with the discussion. Often, the introduction and discussion sections of manuscripts read alike, saying the same things all over again. This should be avoided at any cost. Try to tell



**Fig. 5.1** Funnel shape of a typical introduction. Schematic depiction of the sequential flow of questions to be addressed in the introduction

only the gist of the existing literature in the introduction and avoid going behind the intricacies of individual studies which are better dealt with in the discussion.

Third, subheadings are customarily not used in the introduction. Notwithstanding, subheadings could be used in other parts of the manuscript to aid clarity. Another common mistake is to let loose some of the results into the introduction, which is strictly forbidden. Fourth, a remarkable difference between clinical research papers and basic science papers is that the latter often conclude their introduction by stating their important finding, whereas that is not the case with the former. It is interesting, but the reasons are unclear. We think the reason is purely pragmatic. Works in basic science often involve a series of hypotheses which are sequentially tested in a logical chain of experiments, one leading to another. Thus, it is imperative to forewarn the reader of the direction of the investigation, lest the reader might feel lost in a mass of data. On the other hand, clinical research papers typically work on a single hypothesis at a time, obviating the need to let the cat out of the bag. Finally, if your work is focused on a particular area, while writing introductions for a series of related papers, there is ample chance for copying your own words—known as text recycling. This should be avoided as much as possible. The recommendations by the International Committee of Medical Journal Editors (ICMJE) on how to write an introduction are presented in Box 5.1 [4].

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## 5.5 When to Write the Introduction

Even though medical research articles traditionally follow the IMRAD format, the different parts of the manuscript are rarely written in the same temporal sequence. To a large extent, the sequence of writing depends on individual style and expertise. If you are in the habit of writing the introduction first before other parts of the paper,

**Box 5.1: Introduction: ICMJE Recommendations**

- Provide a context or background for the study (i.e., the nature of the problem and its significance)
- State the specific purpose or research objective of, or hypothesis tested by, the study or observation
- Cite only directly pertinent references
- Do not include data or conclusions from the work being reported

Reproduced from Ref. [4]

make it a point to revisit the introduction once the full paper is done. Ensure that the introduction blends seamlessly with the rest of your paper both in focus and style. Authors often commit the mistake of copying the introduction of their protocol. If done so, the introduction is likely to stand out like a sore thumb. One, the focus of your paper may not be entirely congruent with your protocol. Two, new information that has emerged while your study was underway would not be reflected in your introduction, sometimes giving an outdated picture of the issue being studied. Therefore, always revisit the introduction once the full paper is ready. It is also a good practice to ensure that the introduction still reads well when you resubmit your manuscript after any major revision or abridgment following peer review and editorial comments.

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## 5.6 Conclusion

Brevity, clarity, and direction are the hallmark of a good introduction. Apart from its intended role of conveying why the study was undertaken, introduction reflects the style of the writer and sets the tone of the paper. A well-written introduction goes a long way in impressing the editors, reviewers, and readers. After all, the first impression is the best impression.

*Authors often are not clear about what they want to say; they start with some sort of idea and hope that the reader will have the wit to sort out what's important. The reader will not bother. – Richard Smith [1]*

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## Case Scenario

Read the “introduction” of an original article on typhoid fever, provided here (Fig. 5.2; adapted from Kadiravan T, Wig N, Kapil A, Kabra SK, Renuka K, Misra A. Clinical outcomes in typhoid fever: adverse impact of infection with nalidixic acid-resistant *Salmonella typhi*. BMC Infect Dis 2005;5:37.).

### Background

Typhoid fever is a common illness in developing countries like India [1] and is a potential threat to developed nations, in an era of increasing air travel and global operations [2]. In the absence of appropriate chemotherapy, typhoid fever was often a fatal illness and introduction of effective antibiotic therapy in 1950s led to a sharp decline in the rates of complications and mortality due to typhoid fever [3]. However, in early 1990s multidrug-resistant strains of *Salmonella enterica* serotype *typhi* (MDR-ST) that were resistant to all the three first-line drugs then in use, namely chloramphenicol, amoxicillin and co-trimoxazole emerged, and sooner MDR-ST became endemic in many areas of Asia, including India [4]. This change in pattern of susceptibility was reflected even in places far away, such as the United Kingdom [5] and the United States of America [6]. Fluoroquinolones are very effective against MDR-ST, achieving fever clearance in less than four days with cure rates exceeding 96%, and are currently the first-line drug for the treatment of typhoid fever [7].

Describe the condition and its relevance

However, towards the end of the last decade, it was observed that fever took longer time than before to clear, and at times surprisingly failed to respond to ciprofloxacin therapy [8-10]. These isolates had comparatively higher minimal inhibitory concentrations (MIC) of fluoroquinolones, although they were susceptible to fluoroquinolones by conventional disc diffusion testing and recommended MIC breakpoints [8-10]. Nevertheless, such strains of *S. typhi* are resistant to nalidixic acid and it was noted that clinical response to fluoroquinolones in patients infected with nalidixic acid-resistant *S. typhi* (NARST) was inferior to the response in those infected with nalidixic acid-sensitive *S. typhi* (NASST) strains [11]. However, it is not clear whether fluoroquinolones can still be used as first-line drug for the treatment of typhoid fever, and if used whether this has any adverse impact on clinical outcomes other than treatment failure such as development of complications and morbidity assessed in terms of total duration of illness. In this scenario, the present study was undertaken to evaluate the impact of infection with NARST on clinical outcomes in patients with typhoid fever.

What aspect is your focus?

What is already known?

What is not known?

Why did you do this study?

Fig. 5.2 Case scenario- example from an original article

- Is it written in a way that is understandable to a nonspecialist reader?
- Does the organization conform to the “inverted pyramid” shape of flow?
- Does it provide all desired information? Is anything missing?
- Are the important points/facts/assertions supported by judicious use of references?
- Have the authors elaborately described the findings of previous studies?

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and G. Krishna Rao

*Truth has nothing to do with conclusion and everything to do with the methodology. – Stefan Molyneux*

MAKING A ROCKET WILL BE EASIER THAN THIS...



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## Key Points

- The methods section should be written in a simple and vivid manner avoiding repetitions and unrelated information.
- The design of the study has to be mentioned at the commencement of the methods section.
- Description of the population and how participants were selected for the study has to be stated.
- Clear research protocol followed must be mentioned along with all the reagents and instruments used for the study.
- Methods employed for data collection and statistical analysis have to be stated clearly.
- To ensure quality and accuracy of reporting, standard reporting guidelines have to be followed according to the type of study.
- A clear mention of the ethical clearance and funding information has to be made.
- All clinical trials which involve human subjects are expected to be registered at the clinical trials public registry.

The methods section of the scientific paper generally follows the introduction, and it basically addresses the question of how the problem was studied. It describes the design of the study and provides a vivid and precise description of the procedures used for collection of data [1]. It is the most crucial section of a manuscript as it gives information to assess the validity of the study [2]. If a new method has been followed, all the steps have to be discussed clearly so that any other trained person who wants to execute the same methodology can replicate it [3].

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## 6.1 Characteristics of Ideal Methods Section

### 6.1.1 Precise and Meticulous

It has to be written meticulously and includes all necessary details. Any study, which has been performed, requires a solid and accurate methodology. Any flaws in the methodology will make the result and inference of the study invalid. Following the correct methodology will help avoid unnecessary conflicts regarding the validity of the results. If the method is very complicated, then use of tables or flowcharts to make the reader understand better could be considered. Similar to the methods section of a thesis or experimental protocol, the methods section of a research paper should contain all the details in a crisp manner. The major difference between the methods section of a protocol and research paper would be the “tense,” future tense in protocol, and past tense in manuscript [4].

No results should be mentioned in this section although the preliminary results, which led to the selection of the methodology, could be hinted. The information at the time of planning of the study can be mentioned in the methods section, whereas other information collected during the course of study should come only under

results section. Studies, which support the methods section like the reliability of tests or validation of outcome measures, can be incorporated in the methods section [1].

### 6.1.2 Structured or Unstructured

The methods section can be presented either in a structured format or unstructured. The structured format helps in expressing the details of the methodology in a simple and easily comparable way. Unstructured format, though lacks structure and objectivity, could be used for descriptive and qualitative studies [5]. The unstructured format may also be preferred in the case of print versions of the journal where there are space limitations.

### 6.1.3 Avoid Shifting of Voices (Active and Passive) Inside the Paragraph

The descriptions of the methods section should be in past tense. The use of compound sentence structures should be avoided. Although either active or passive voice can be used throughout the method section, the descriptions can be preferably in third person voice. For example, consider the following statement taken from a research paper [6].

*After an overnight fast, we anaesthetized animals with an intraperitoneal injection of sodium pentobarbital (50mg/kg). We induced sepsis by CLP.*

This statement could be better represented if given in third person voice.

*After an overnight fast, the animals were anesthetized by intraperitoneal administration of sodium pentobarbital (50 mg/kg). Sepsis was then induced by CLP as per the previous literature. [reference]*

If the description is in the point of view of the experimenter, then we may end up with a lot of “wes” (active voice) inside the section which may be abrupt for the reader. It is always better to minimize the “wes,” and for this, the description should be in the point of view of the experiment [7]. Although most other sections of the manuscript are in active voice, the methods section of a research paper is usually in the passive voice.

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## 6.2 Components of the Methods Section

The methods section, generally included as the “Material and methods,” had to incorporate all the components which were used in the study and the research protocol followed. The methods section explains how the subjects were altered in order to address the research question. There can be an initial paragraph which gives an outline

of the overall study design and procedures followed. This can also comprise of inclusion and exclusion criteria for selecting the desired population. This can be followed by the most detailed description of the procedures used. The collection of data, whether it was done retrospectively or prospectively and whether it was a single-blind or double-blind study, could also be described [1]. The last portion of the methods section should consist of the statistical methods used for the analysis of data [8].

A clear methods section should incorporate the following points [1]:

- (i) Participants/subjects used in the study and how and why the population was chosen
- (ii) Study environment, the time span of study, and study design
- (iii) Materials used in the study and how the materials were prepared
- (iv) Ethical issues, confidentiality, informed consent for clinical trials, and source of funding (if any)
- (v) The research protocol followed and what are the outcomes and their evaluation
- (vi) Data analysis methods used

---

### 6.3 Subjects Used in the Study

A description of the participants in the study is mandatory and should be mentioned clearly. Give a description of the population, which has been chosen, how many were chosen, and why they were chosen. It is also important to mention the sampling technique (simple random, cluster, stratified, or convenience) followed for selecting the participants. When human subjects are used in the study, it is important to explain the simple demographic profile of the population like age, gender, etc. In clinical trials, it is mandatory to mention how randomization and allocation of subjects to various groups were done. Instead of naming the different groups with numbers or variables, use the names to label groups, e.g., sepsis group, placebo group, and control group. It is equally important to describe the characteristics of the control group in case-control or controlled trials. The inclusion and exclusion criteria for selection should be clearly mentioned, and there should not be any overlap between the two. The subjects fulfilling the inclusion criteria must only be screened for exclusion criteria. When mentioning the subjects, the selection criteria and rationale for choosing the subjects have to be mentioned clearly. For example, consider the following hypothesis:

*Changes in mir-223 level and inflammatory mediator's levels will affect the outcome in IUGR babies.*

The following inclusion and exclusion criteria were given:

#### *Inclusion Criteria*

Cases: Babies with birth weight less than the tenth percentile for the gestational age.

Controls: Gestational and sex-matched babies for the case with birth weight between 10th and 90th percentile.

### *Exclusion Criteria*

- (i) Surgical conditions and congenital malformations
- (ii) Apgar score <6 at 5 min
- (iii) Maternal history of infections, inflammations, or antibiotic therapy before delivery

This study is on analyzing the changes in microRNA-223 levels of samples from intrauterine growth restriction babies, and so one can expect that appropriate for age babies will not be recruited for the study as cases. Maternal history of infections would also eliminate the baby from recruitment for the study.

The use of Simplified Acute Physiology Score (SAPS) developed for predicting the risk of death in critically ill patients in intensive care units [9] and the use of sickness impact profile when assessing patients in rehabilitation units are other examples [10].

When animals are the subjects of the study, it is ideal to mention the species, strain, gender, and age. For example, consider the following statements:

*A number of mice were procured from the animal house and divided into four groups.*

The statement can be better represented as below.

*Male Balb/c mice aged 2–3 months were procured from the animal house and were randomly divided into 4 groups consisting of six animals in each group (n=6).*

---

## **6.4 Study Environment, Time Span of Study, and Study Design**

Once the definition of subjects and population characteristics are described, the next thing is to clearly mention the place of study and sample recruitment. In single center study, only one center is involved, whereas in a multicentric study for a joint collaborative project, more than one institution are involved. All the collaborating departments of an institution must be specified, and in the case of multicentric study, the names of all the centers and the specific departments of each center should be mentioned. Suppose the samples or data are collected in a hospital setting, the specific place of data collection like ICU or inpatient ward or medical registry should be mentioned. The duration of the study and the time taken for collection of data and samples should be clearly defined. The date of enrollment of patients and their follow-up period should also be mentioned.

In order to explain a cause and effect relationship between subjects, variables are categorized as independent, dependent, or confounding. A dependent variable is the one which changes in response to change in another variable; an independent variable does not change, but when it is altered, it causes a change in the other variables, and a confounding variable is something which affects the dependent variable. For example, increased levels of adenosine in neonates inhibit IL-12 and reduce the T

helper 1 type response. Adenosine is the independent variable and IL-12 is the dependent variable, as IL-12 changes depending on the levels of adenosine. Likewise, the reduced gestational age in preterm babies may increase their susceptibility to neonatal sepsis, so when choosing the cases for the study, babies with term gestational age should only be chosen in order to eliminate that confounding variable. The evaluation of a possible cause-effect relationship between two objects is through the development of study design [2].

The design of the study is crucial and should be specified at the start of the methods section. Primary research can be classified as clinical research, basic medical research, and epidemiological research [11]. Epidemiological studies can be descriptive or analytical. Descriptive studies try to develop a hypothesis between two population variables, and analytical studies enable to experiment the hypothesis. Analytical studies can be done as observational or experimental. In an observational study, the investigator does not induce any manipulation of variables but observes the natural pattern of things/events, which vary due to any risk factor or exposure. Observational studies can be cross-sectional, case control, or cohort type. Experimental studies involve alteration of the independent variable by the experimenter to observe for changes in the dependent variable [12]. Experimental studies can be randomized or non-randomized trials.

When presenting the results of diagnostic accuracy studies, the readers must be able to understand the design, principles, analysis, and conduct of the studies which could only be achieved through complete transparency from authors. There are certain reporting guidelines for the different study designs which should be followed for quality reporting. The STARD guidelines on diagnostic research accuracy gave a checklist of 25 items and flow diagram describing the way of patient recruitment, the number of patients undergoing a test, reference standard, etc. The checklist and flow diagram could be used for improving the quality of reporting of diagnostic research [13]. When presenting the research involving a randomized controlled trial, the consolidated standards of reporting trials (CONSORT) can be used [14]. The PRISMA guidelines and checklist could be used for presenting systematic reviews and meta-analysis, which are of interest for clinicians and researchers who like to be updated in their field [15]. The Table 6.1 shows the reporting guidelines to be followed for the different types of studies.

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## 6.5 Materials Used in the Study

A clear description of all the materials and measures used in the study has to be mentioned. This must include the chemicals, kits, reagents, instruments, and all other facilities used for the study. Measures are the source of actual data like survey or questionnaire. The results obtained depend on the validity of the source of data. The measure used must be reliable and valid. If standard measures are used, they should be cited using previous standard references. For nomenclature (species name), abbreviations used should follow standard system. For units of measurement, the International System of Units (SI) system can be followed, and

**Table 6.1** Various types of study designs and their reporting guidelines to be followed [<http://www.equator-network.org/>]

Study type	Reporting guidelines	Address/reference
Observational study	<b>STROBE</b> (Strengthening the Reporting of Observational Studies in Epidemiology)	<a href="http://strobe-statement.org/index.php?id=strobe-home">http://strobe-statement.org/index.php?id=strobe-home</a>
	<b>RECORD</b> (Reporting of studies Conducted using Observational Routinely collected health Data)	<a href="http://www.equator-network.org/reporting-guidelines/record/">http://www.equator-network.org/reporting-guidelines/record/</a>
Randomized controlled trials	<b>CONSORT</b> (Consolidated Standards of Reporting Trials)	<a href="http://www.consort-statement.org/">http://www.consort-statement.org/</a>
Study protocols	<b>SPIRIT</b> (Standard Protocol Items: Recommendations for Interventional Trials)	<a href="http://www.spirit-statement.org/">http://www.spirit-statement.org/</a>
Diagnostic/Prognostic studies	<b>STARD</b> (Standards for Reporting Diagnostic accuracy studies)	<a href="http://www.stard-statement.org/">http://www.stard-statement.org/</a>
	<b>TRIPOD</b> (Transparent Reporting of a multivariable prediction model for Individual Prognosis or Diagnosis)	<a href="http://www.equator-network.org/reporting-guidelines/tripod-statement/">http://www.equator-network.org/reporting-guidelines/tripod-statement/</a>
Case reports	<b>CARE</b> (Case Reports)	<a href="http://www.care-statement.org/">http://www.care-statement.org/</a>
Systematic reviews and meta-analysis	<b>PRISMA</b> (Preferred Reporting Items for Systematic Reviews and Meta-Analysis)	<a href="http://www.prisma-statement.org/">http://www.prisma-statement.org/</a>

for chemicals, the International Union of Pure and Applied Chemistry (IUPAC) can be used.

The reagents should also be mentioned along with their manufacturer name. All calculations/quantitative measurements must be presented wherever necessary. This includes concentration, solubility, rpm, dose, times, and temperature. When a treatment is administered and a drug is used, the generic name of the drug and the manufacturer, concentration, and dose need to be clearly mentioned. When a working solution is prepared from stock, the solubility and percentage of stock dissolved in the solvent should be mentioned. For example, consider the following statement:

*The cells were suspended in DMEM medium (Gibco) supplemented with 10% FBS (sigma), 1% penicillin, 100µg/ml streptomycin and 2mM glutamine (Gibco).*

The above statement clearly describes the percentages and concentration of each individual component which has been prepared from the stock. The manufacturer name has also been mentioned.

Likewise, it is necessary to explicitly state the conditions and specific parameters at which the process has been performed. Consider the following statement:

*The cells were washed twice in PBS by centrifuging at 200 ×g for 10 min at 4°C.*

The above statement expresses clearly the specific values of the processes done, the temperature, and time along with their appropriate units.

The description of variables and how they were estimated forms an important part of the methods section. The instrument used for estimation has to be mentioned along with the manufacturer name and model number. Calibration forms an important part of instrument operations, and it is important to mention the calibration processes followed or calibration kits purchased and run before the actual reading is taken. It is better to mention explicitly the value for any variable used to relate to a condition/state.

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## 6.6 Ethical Clearance/Informed Consent

Depending on the subjects used in the study, the appropriate ethical clearance has to be obtained before starting the study. For clinical studies involving humans, the appropriate clearance from the ethics committee should be obtained and should be mentioned in the paper. Similarly for animal studies, the clearance should be obtained from the animal ethics committee, and the details of the approved clearance should be mentioned in the manuscript. The World Medical Association has framed a set of ethical principles for experimentation with human subjects known as the “Declaration of Helsinki” which should be adhered to by all human studies [16].

All the details of the patients recruited should be maintained confidentially, and the names should not be used for any reason inside the manuscript. The details regarding the informed consent obtained from subjects should be mentioned, and for use of any clinical information/photo obtained during the study, appropriate permission from the subjects should be obtained. For all subjects more than 7 years old, individual assent must be obtained.

All the clinical trials involving human subjects should be registered in the public trial registry, and the registration number must be given at the end of the abstract of the manuscript. For all clinical trials in India, the registration should be done at the Clinical Trials Registry of India ([www.ctri.nic.in](http://www.ctri.nic.in)) which has been hosted by the National Institute of Medical Statistics of the Indian Council of Medical Research (ICMR) [11]. The registration of clinical trials will help in avoiding duplication of research performed and also prevent from selective reporting of research outcomes. Any researcher can access the registry at any time to get information on the ongoing trials which may help in designing novel studies and not replicating the already ongoing trials. The funding source can either be mentioned in the methods section or separately, depending on the requirement of the journal.

## 6.7 Research Protocol (Intervention and Outcome Measures)

The research protocol comprises of the arrangement of the changes or alterations levied on the independent variable which causes variations in the dependent variable. It explains to the reader how the samples were recruited and data was collected. Baseline conditions or measurements should be mentioned before the start of the protocol. It is important to specify the rationale/assumptions based on which methods were chosen. The authors must keep in mind the likely audience, and it is always better to mention explicitly the rationale behind the protocol. For example, a clinician writing the methods section may shorten few medical terminologies which he is well versed in, but it may not be understandable to a researcher with life science background. So it's always better to make all the details clear and define the purpose of the procedure when it is not obvious.

### 6.7.1 Intervention

The type of intervention given to subjects in trials and the description of the drug or any other source should be mentioned. The dosage level, schedule, and duration of intervention should be stated clearly.

It is also important to mention the preliminary preparations like the use of anesthesia, dose of drug, and route of administration while presenting the methodology for animal experiments [17].

Consider the following example:

- (i) *All the mice in sepsis group were given LPS.*
- (ii) *The treatment group was administered with curcumin.*

These statements refer to the administration of a drug or agent, and more details on preliminary preparations should be given for accurate representation. They could be modified as follows:

- (i) *The mice in the sepsis group were given intraperitoneal administration of 1mg/kg LPS dissolved in 0.9% saline.*
- (ii) *The treatment group was given intraperitoneal administration of 1mg/kg curcumin per mice.*

The concentration of drug/agent administered per animal should be calculated considering the body weight of the animal. It is essential to mention the concentration and dose of the drug administered.

### 6.7.2 Outcome

The outcome measures are the ultimate changes/results which can be expected from the study and can be divided as primary and secondary outcomes. The primary outcome is the major parameter that constitutes the hypothesis and forms the main objective of the study. The secondary outcomes are the other parameters that are important in the study. For example.



- (a) *Primary outcome:*
- Decrease of serum inflammatory cytokines (TNF- $\alpha$  and IL-6) levels and reduction in mortality rate
- (b) *Secondary outcomes:*
- Reduction in the duration of hospital stay
  - Decreased requirement of antibiotics
  - Reduced complications like DIC and shock

The major outcome of the study is the reduction in the inflammatory cytokines and mortality rate. The secondary outcomes are other minor parameters that can be expected from the study.

### 6.7.3 Validity and Reproducibility

The validity of the study is the credibility of the results and how far it can be applied for the general population. Internal validity means the extent to which the conclusions of the study accurately represent the observations in the study, and external validity means the extent to which the results can be applied to the general population [2]. When introducing a new novel method, it has to come under rigorous discussion before it is applied. It's better to have it validated in a separate publication before it can be included in the main experiment protocol.

The details of the established standard methods need not be repeated, and only the reference paper can be cited. For example, consider the following statement:

*Preliminary phytochemical screening of the plant extracts for phenols, sterols, tannins, terpenoids was performed according to the standard protocol [18, 19].*

This is the right method to mention a previous standard protocol in a meticulous way.

Likewise, consider another statement taken from the methods section of a research paper [20].

*CLP was produced as described by Wichtermann et al. [21].*

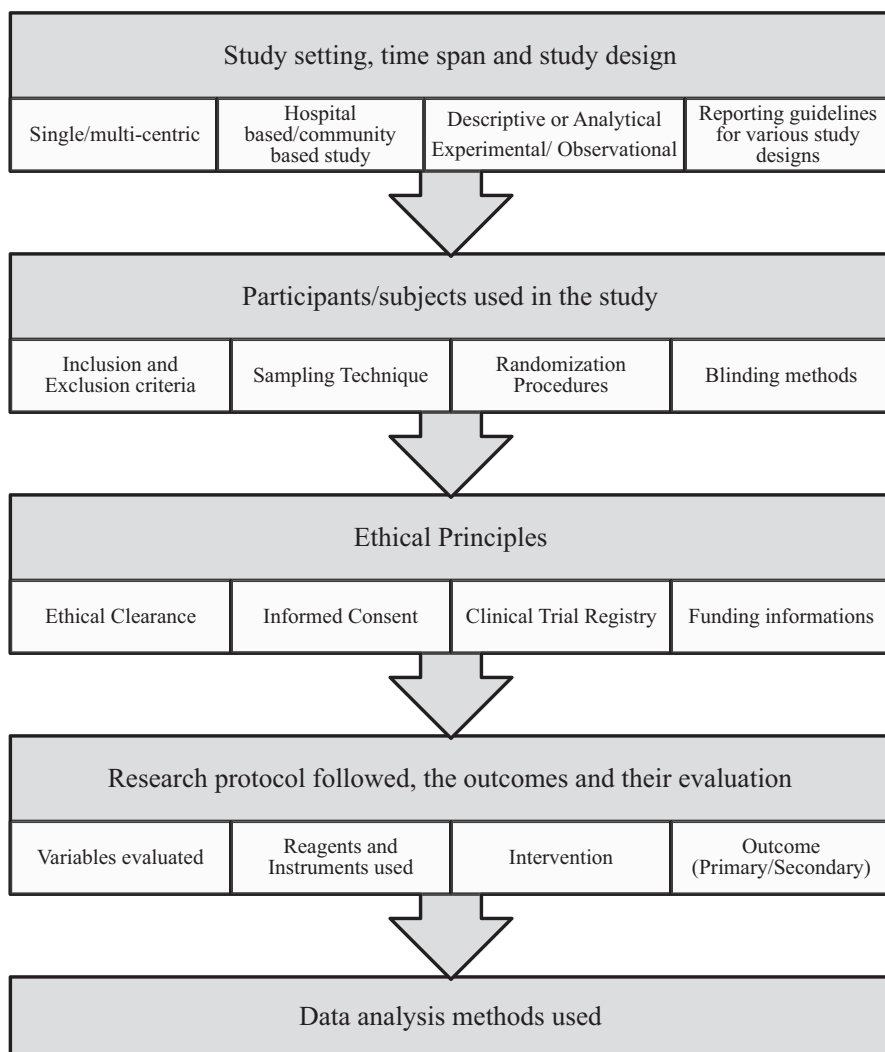
This statement describes the cecal ligation puncture model of sepsis, and though it involves a tedious explanation of the invasive procedure, it is a standard protocol, and hence just the reference is mentioned.

---

## 6.8 Data/Statistical Analysis

The final step in the methods section will be to mention how data was analyzed and presented in the results section. The sample size calculation method and the software used for data analysis should be mentioned. Statements mentioned should be specific to the parameters studied and the outcome variables. There are various methods for data collection, and data analysis is usually done at the end of the study. Researchers also simultaneously analyze data to observe for patterns throughout the data collection phase [22].

Accurate data analysis is essential for ensuring data integrity, and inappropriate statistical analysis may mislead the readers and create a negative public perspective of research [23]. There are different statistical tests which could be used depending on the types of data and number of samples. Depending on the number of variables and the design of study, the type of statistical test can be decided. The explanation of the statistical analysis of the primary outcome should be before that of the secondary outcome [11]. A significant “P value” will be essential for concluding whether the difference is statistically significant. Generally, P value <0.05 is statistically significant. The common statistical tests used can be just mentioned, whereas any new method could be described or mentioned with references. Figure 6.1 depicts the components of the methods section.



**Fig. 6.1** Components of the methods section

## 6.9 Conclusion

Scientific writing is an art which has to be developed, and providing a clear and concise methods section is part of the process. The methods section of a scientific research paper is the most significant as it determines the validity of the study. Mentioning the rationale or assumptions involved in the various procedures of the study is a vital component. Reliability is a crucial component of the methods section which implies the extent to which the same protocol could be replicated by another researcher. Precise and accurate presentation of the various subjects, materials, preparations in the study, and presentation of the various steps of the research protocol in the chronological order, along with the final data analysis comprises the methods section of a research paper.

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### Scenario

Scenario 1:

There are many assays involved in my research under each objective of the study. Each of them has various steps. Is it essential to describe all the individual steps of an experimental protocol?

- (a) Mention the steps of each assay separately.
- (b) Need not describe every step but just mention the name of the test.
- (c) If it is a standard method, then give the name of the test with the reference number, and if it is not, then explain the steps of the method.

Just give an outline of the assays without elaboration.

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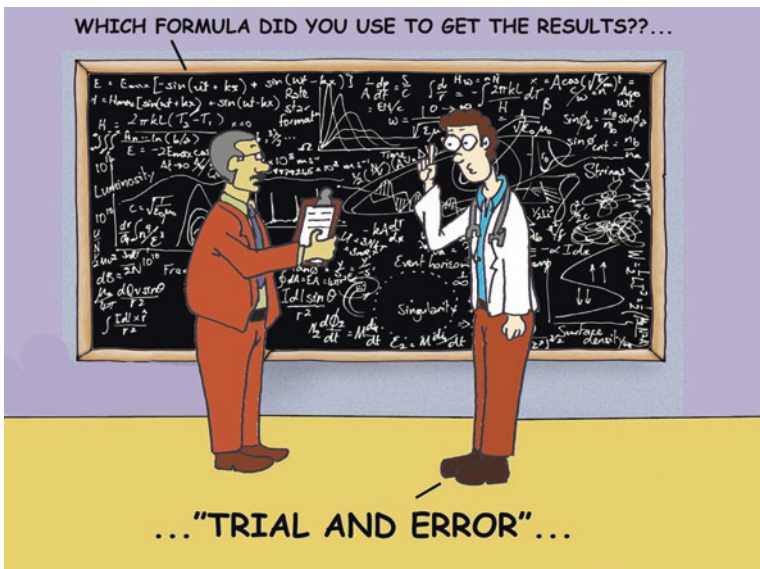
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*Publish your results...results cannot always be interpreted accurately, but they can always be reported accurately. Someone else may define relevance, or the context, or the meaning of something that you have done better than you.*  
–Donald E. Fry



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## Key Points

Sequential steps for writing results:

- Summarize the objectives that you have investigated.
- State the specific hypothesis being evaluated.
- Describe the analysis that you have performed to test the hypothesis.
- Organize your data in chronological order according to that listed in the objectives.
- Determine whether the data can be presented in the form of tables or charts.
- First present the descriptive statistics.
- Present the results of inferential statistics and explain what these tests mean in relation to your aims and objectives.

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## 7.1 Results

The results section in a research paper serves to present the data collected during the study in a sequential and cogent fashion and to provide interpretation of the analysed data drawing attention to significant findings without going into the details of methods or discussion. As is easy to understand, since it refers to work already completed, it should be in the past tense.

### Components of the Results Section

- (a) Introduction
- (b) Text part of results
- (c) Tables
- (d) Figures, charts and graphs
- (e) Photographs

#### 7.1.1 Introduction

The introductory paragraph is very important in the results section, and it should summarize briefly the objectives investigated and also restate the research problem and emphasize the purpose of the study. For example, the section may start such as the following: “*A study was conducted in order to determine whether .....etc.*” or “*This study was carried out with the principal aims of ..... etc. The following parameters were studied*”. The introductory paragraph should ease the reader into looking at the findings and tempt him to read further.

The following sections after the introduction should be in brief paragraphs with each paragraph referring to one table or a figure or one parameter of study. The sequence of paragraphs in the results section should be in the same order as the order of aims and objectives. In describing any experiment or protocols in this section, refer to the methods section, e.g. SNP analysis was performed as described in

“materials and methods”, and try to avoid repeating what is in the methods. In these paragraphs, state the specific hypothesis being evaluated, and describe the analysis that was performed to test the hypothesis. First present the descriptive statistics, and then state in words what was found. Include the results of any statistical tests and explain what these tests mean in relation to your aims and objectives.

To begin, organize the data in the results section in order according to that listed in aims and objectives. Determine whether the data are best presented in the form of tables, graphs and texts or text alone. Data which occupies only one or two lines of a two by two table is better described in textual form rather than as a table since most editors would like to keep the number of tables and figures to a minimum in the interests of space.

Plan the tables and figures so that their sequence tells a story and enables the reader to read the conclusion of the study without any complexity. Do not duplicate the data in both figures and tables. For any data set, one should use only either a table or a figure. Where details are required, as a matter of policy, a table is better, but where visual effect is desired, a figure is more appropriate.

Placing of tables and figures with reference to the corresponding text requires planning. It is better to have the text and the table or figure that the text refers to adjacent to each other in a publication, whereas in a dissertation all tables and figures can be grouped together at the end of the text section.

Each table and figure must be referenced in the text portion of the results. The text should refer to only one or two key points in the table or figure that the author wishes to highlight and not repeat every data which forms part of the table or figure. Each table and figure must also be sufficiently complete so that it can stand on its own such that the reader does not have to read the whole paper to look for the results of statistical tests or the rationale behind a curve fit. The text should complement figures or tables and not repeat the same information.

One should provide a clear description of the magnitude of a response or difference like presenting the data as percentages and cumulative percentages which can make your data more meaningful and interpretive as in Table 7.1.

In the tables and the text, one should give the actual p-value and not indicate by using symbols such as  $<$  or  $>$ . For example, say  $p = 0.0053$  instead of saying

**Table 7.1** Serum cholesterol levels among secondary grade students in and around Pondicherry

Category	Count	Cumulative count	Percent	Cumulative percentage
100–110	33	33	4.39	4.39
110–120	94	127	12.52	16.91
120–130	160	287	21.30	39.21
130–140	161	448	21.44	59.65
140–150	120	568	15.98	75.03
150–160	89	657	11.85	87.48
160–170	39	696	5.19	92.67
180–190	28	724	3.73	96.4
190–200	15	739	2.00	98.4

$p < 0.01$ . One should mention confidence intervals for all analysis. It is not a good policy to cut and paste tables straight from SPSS or any other software used for statistical analysis. Instead, tables should be reformatted keeping only relevant information.

Number the table and figures consecutively and use the same sequence in the text. While referring to a figure in the text, "Figure" is abbreviated as Fig., e.g. **Fig. 1**. The "Table" is never abbreviated, e.g. **Table 1**. Legends for tables should be at the top of the table, and **legends** for figures should be at the bottom of the figures. The legends for tables and figures should be sufficiently descriptive so that the reader knows what the table or figure refers to instead of having to read the text.

In stating results, mention the findings without giving reasons for them or comparing them with the findings of other authors. For example, "*Homocysteine levels were found to be increased in T2DM patients with Vitamin B12 deficiency but not in T2DM patients with normal Vitamin B12 levels*". However, do not go on to explain why homocysteine levels are increased in T2DM patients with vitamin B12 deficiency. This should be saved for the discussion.

Negative results which go against your hypothesis should not be ignored in the results. The reason why the findings were negative should be explained in the discussion.

## 7.2 Tables

A table is a systematic arrangement of data in columns and rows. To begin with, one should arrange table rows and columns logically as the orientation of a table can considerably influence readability and draw attention to the purpose of the table.

It is easy for a viewer to make comparisons within a column of numbers than within a row. Therefore, if the table is intended to demonstrate differences between groups for a number of variables, the group should define the rows of the table and the variables should define the columns. Simplify data entries as much as possible. Important data should be emphasized. One should summarize the data to assist in

**Table 7.2** Comparison of anthropometric and physio-biochemical parameters among prehypertension and control group

Parameter	Control (N = 50)	Case (N = 50)
	Mean + SD	Mean + SD
Height (cm)	144.02 + 10.36	145.63 + 09.74
Weight (Kg)	49.80 + 8.47	62.10 + 11.45
SBP (mmHg)	128.5 + 17.57	143.31 + 15.8
DBP (mmHg)	75.72 + 8.46	89.65 + 12.2
Total cholesterol (mg/dl)	162.43 + 43.94	183.68 + 49.43
Triacylglycerol (mg/dl)	105.36 + 23.15	131.34 + 43.93
HDL (mg/dl)	38.56 + 5.93	40.54 + 6.55
LDL (mg/dl)	100.23 + 21.75	126.13 + 35.66
Uric acid (mg/dl)	4.85 + 121	5.59 + 1.29

Case = prehypertension



**Table 7.3** Plasma Glucose levels (N =10)

Patient No.	Glucose levels
P001	189.02
P002	191.32
P003	187.58
P004	171.69
P005	198.41
P006	189.75
P007	192.76
P008	174.25
P009	185.34
P010	197.66

**Table 7.4** Stages of Chronic Kidney disease (CKD) (N = 10)

Patient No.	CKD stage
P001	Stage 1
P002	Stage 3
P003	Stage 2
P004	Stage 4
P005	Stage 3
P006	Stage 4
P007	Stage 3
P008	Stage 1
P009	Stage 2
P010	Stage 3

comparison. It is useful to have grid lines separating different parts of the table. Tables may need to be comprehensive enough to include information such as sample size, types of statistics (total, rates, means, etc.), units, time periods, the source of data, geographical or sector coverage, etc., if not in the heading, at least in the footnotes accompanying the tables.

Tables are useful for looking up individual values or comparing them. There should be a clear statement at the foot of the table what figures in parentheses refer to in different columns or rows.

Table 7.2 depicts the different components of a table.

In a table, the parameter being described should always be aligned to the left and the counts to the right as illustrated in Tables 7.3 and 7.4. Decimal values should be uniform for the whole table, for example, if one says 38.98 in one part of the table for one parameter, all figures for the same parameter should have the same number of decimals even though they are whole numbers, e.g. 23 should be written as 23.00 as illustrated in Table 7.3.

## 7.3 Charts

Charts are used as a supplementary to the text and tables to visually depict pattern, trends, chronological change, etc. Charts can be used to depict seven types of relationship. The situations where charts can be used are given below:

1. Size comparisons (how much? And which is bigger?)
2. Time series (how does a variable evolve?)
3. Ranking (quantities ordered from highest to lowest)
4. Relationship of one value to another
5. Deviation of one value from another
6. Distribution correlation (are two variables linked?)

### Charts have two main components:

1. Data components represented as bars, pie charts, line diagrams, etc.
2. Title, legend, data labels, grid lines, footnotes and data source which enable interpretation of the information shown in the data component

### Some commonly used charts include:

1. Bar charts
2. Histograms
3. Line diagram
4. Pie charts
5. Scatter plots

Categorical data like grade, race, etc. are better represented by bar graphs, line graphs and pie charts. Continuous data such as weight or test scores are represented by histograms.

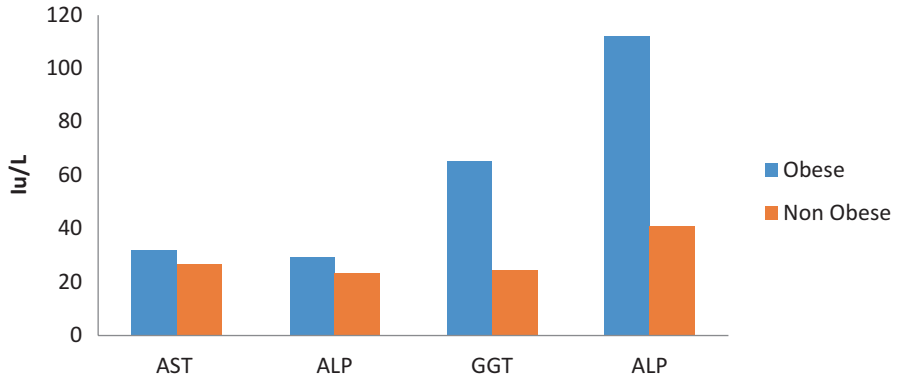
### 7.3.1 Bar Charts

Bar charts are best used for numerical data that splits nicely into different categories and enables to quickly see trends within our data. Bar charts help to compare data quickly and also to reveal the high and low values at a glance.

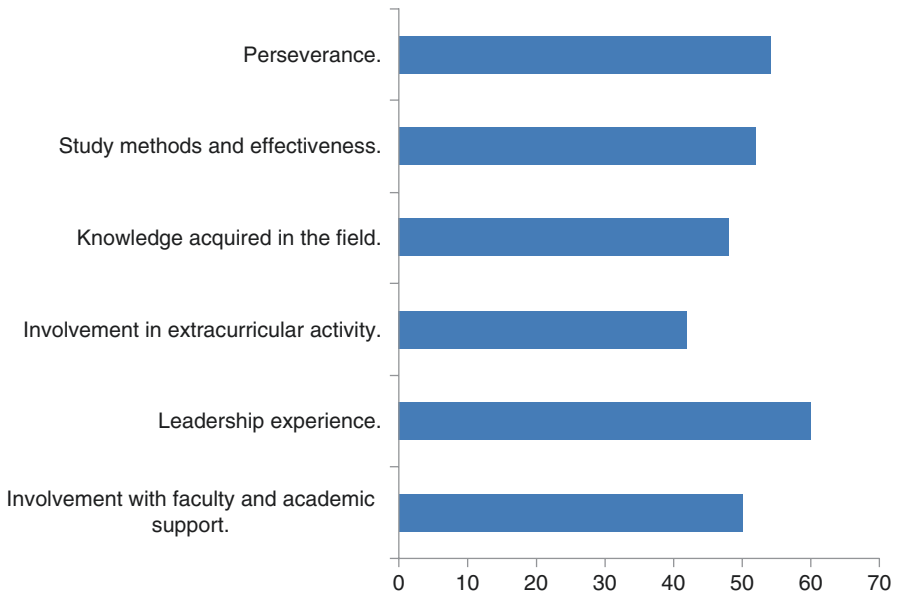
#### 7.3.1.1 Types of Bars

1. Horizontal bar charts
2. Vertical bar charts
3. Stacked bar charts

Horizontal bar graphs can be used when the labels for the bars are too long to fit into a vertical format. The space between adjacent bars should be greater than the width of the bar itself. Examples of different types of bar charts are shown in Figs. 7.1, 7.2 and 7.3.



**Fig. 7.1** Vertical bar chart – comparison of liver enzymes in obese and nonobese adults



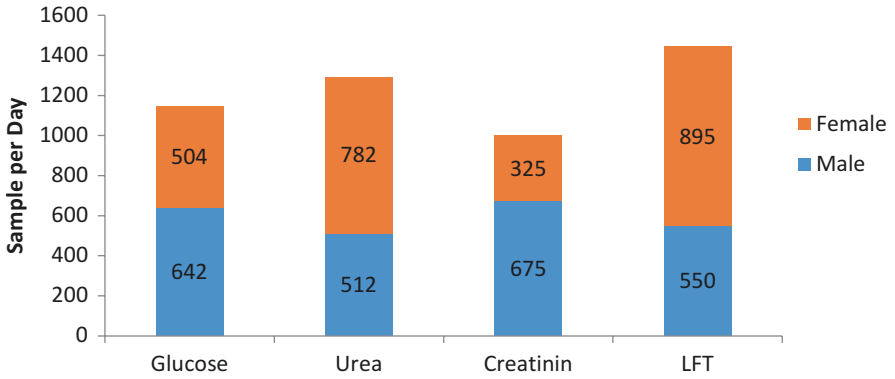
**Fig. 7.2** Horizontal bar chart – non-cognitive scores among first year MBBS students

### 7.3.2 Histograms

Histograms are used to understand the distribution of the data.

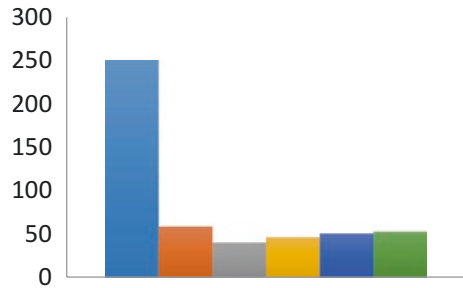
Examples are student performance in examinations, distribution of serum cholesterol levels among people of a particular place, etc.

Do not use multiple colours as shown in Fig. 7.4 and keep the colour uniform as in Fig. 7.5.

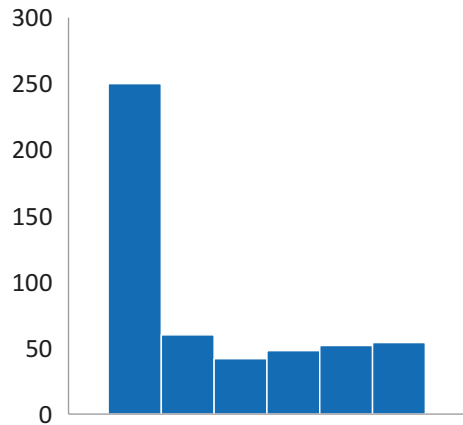


**Fig. 7.3** Stacked bar chart – gender-wise distribution of sample received in the clinical chemistry department for various parameters

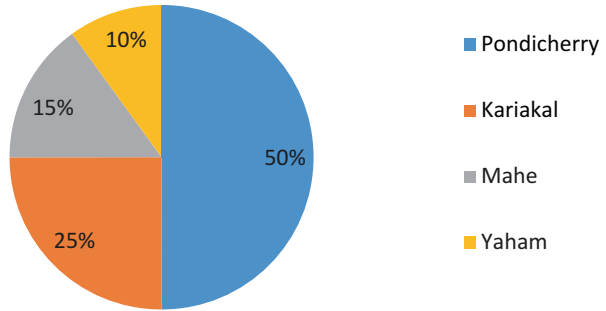
**Fig. 7.4** Do's and don'ts for histogram



**Fig. 7.5** Do's and don'ts for histogram



**Fig. 7.6** Demographic pattern of patients who underwent CABG in a private hospital in Pondicherry



### 7.3.3 Pie Charts

Pie charts are used for showing proportions or percentages. It follows, therefore, that when depicting percentages, the sum of all the components of the pie should add to 100%. When showing proportions within a subunit (such as different age groups within a gender), a stacked bar is more appropriate. When trying to emphasize one particular component of a pie, that segment can be made to come out of alignment (exploded pie). This cannot be used for drawing attention to multiple segments of the pie. Exploding several pie segments is meaningless and tends to confuse the reader. Use no more than five slices in the pie and don't use bright contrasting colours. Avoid special effects like shading. Example of a good use of a pie chart is shown in Fig. 7.6.

### 7.3.4 Line Graphs

Line graphs are used to track chronological changes over short and long periods of time. When chronological changes are small, line graphs are better than bar diagrams. Line graphs can also be used to compare changes over the same period of time for more than one group. A line graph should not have too many lines. This will make interpretation of data difficult especially if the lines intersect. As a policy, it is best to use less than four lines. Legends for the lines (labels) are best written immediately at the end of the line rather than in boxes separately. The latter makes it mandatory for the reader to constantly shift between the line and the box to understand what the line refers to. When using a number of intersecting lines, it is better to clearly have different colours or patterns for each line and label them clearly in the legend. Consider using multiple plots, if you have to represent many data series in line graphs.

Figures 7.7 and 7.8 are examples of good and bad line graphs, respectively.

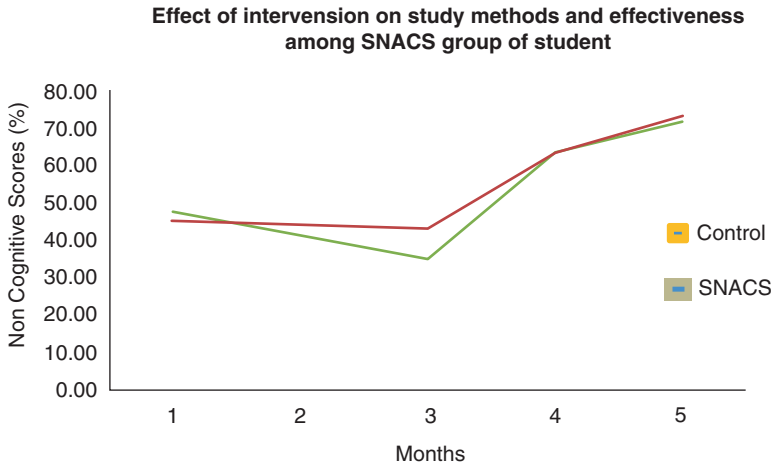


Fig. 7.7 Good line graph

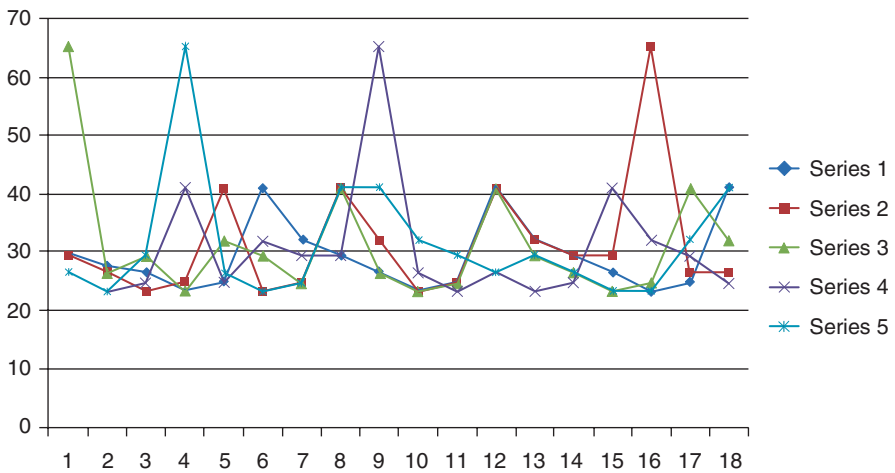


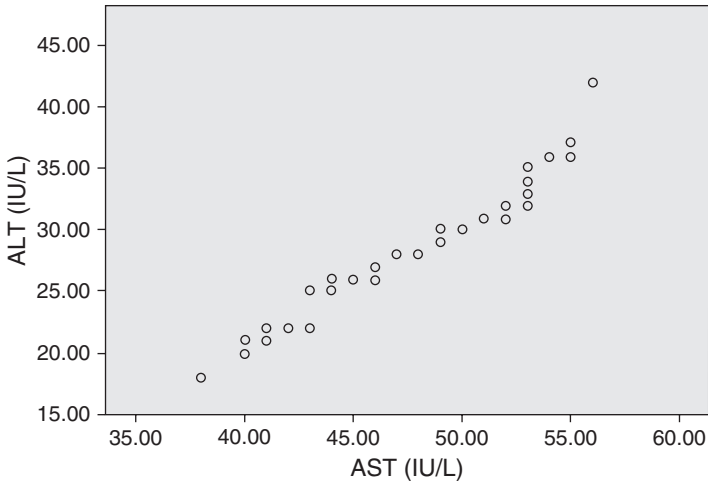
Fig. 7.8 Cluttered line graph

### 7.3.5 Scatter Plot

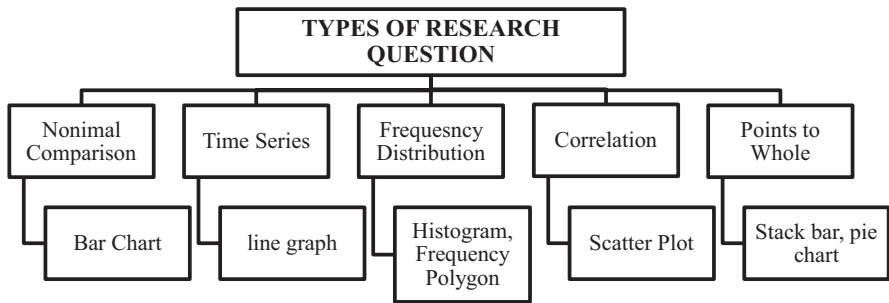
This is used to describe the presence or absence of correlation or its degree between two variables. Scatter plot also serves to highlight outliers. Figure 7.9 is an example of good scatter plot.

**Charts are best avoided for:**

- (a) Widely dispersed data
- (b) Depicting very few values
- (c) Depicting a large number of values or when most of the lines overlap



**Fig. 7.9** Correlation between AST and ALT level in patients with non-alcoholic hepatitis



**Fig. 7.10** How to choose your charts and graphs

In charts, in the interests of clarity, one should avoid:

1. Shaded backgrounds
2. Borders
3. Patterns, textures and shadows
4. 3D effects
5. Markers superimposed on the lines

Figure 7.10 shows how to choose your charts and graphs.

**Table 7.5** Checklist for tables

Sl. no.	Contents
1	Table no. and title
2	Column headings
3	Serial no. for rows/row headings
4	Units
5	Asterisks to indicate significance
6	Footnotes
7	Alignment – horizontal and vertical

**Table 7.6** Checklist for figures

Sl. no.	Contents
a.	Figure no. and title
b.	X and Y axes graduated?
c.	X and Y axes titled?
d.	Axes have their units mentioned (if appropriate)?
e.	Different groups indicated with different markers?
f.	Legend
g.	“n” – number of subjects?
h.	Any other info
i.	Is the figure clean, simple and easy to understand?

### 7.3.6 Photographs and Photomicrographs

Editors do not normally encourage colour photographs except on payment of special processing fees. Hence black and white photographs which are usually published should have clarity. However, one should not hesitate to use colour photographs when absolutely required, for example, to show microscopic slides, organs removed after autopsy, echo cardiograms, colour doppler findings.

In patient photographs, the identity should be masked by covering the eyes or avoiding the whole face. The legend for photographs should be clear and descriptive and point to be highlighted shown by an arrow, wherever required.

In photomicrographs, one should always indicate the magnification and the stain and highlight the important finding (Tables 7.5 and 7.6).

**Some common errors encountered in the results section include:**

1. Illogical sequence of data presentation
2. Inaccurate data
3. Repetition of data
4. Expected data from the materials and methods section not reported



5. Misplaced information between materials and methods and results section
6. Overuse and abuse of tables, charts and figures
7. Attempts to draw a conclusion: this should be covered in the discussion section
8. Avoid verbose expressions: instead of saying “Table 7.3 clearly shows that vitamin B12 levels are low in T2DM patients with metformin”, say “T2DM patients on metformin had low vitamin B12 levels” (Table 7.3)

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## Case Scenario

You have been asked to review an article by an editor of a reputed journal. One of the tables presented in the article is given below:

No.	Lipid profile	Control	Case	“p” values
		mean $\pm$ SD	mean $\pm$ SD	
1	Cholesterol (mg/dL)	175 $\pm$ 16	228 $\pm$ 32	<0.001
2	Triglycerides (mg/dL)	166 $\pm$ 21	190 $\pm$ 20	<0.001
3	HDL (mg/dL)	53 $\pm$ 18	38 $\pm$ 9	<0.001
4	LDL(mg/dL)	94 $\pm$ 21	152 $\pm$ 18	<0.001

- (a) As a reviewer would you accept the above table as such without any modifications?
- (b) If not what would be your comments on the table?
- (c) What should the author do to improve the table?

---

## Suggested References for Further Reading

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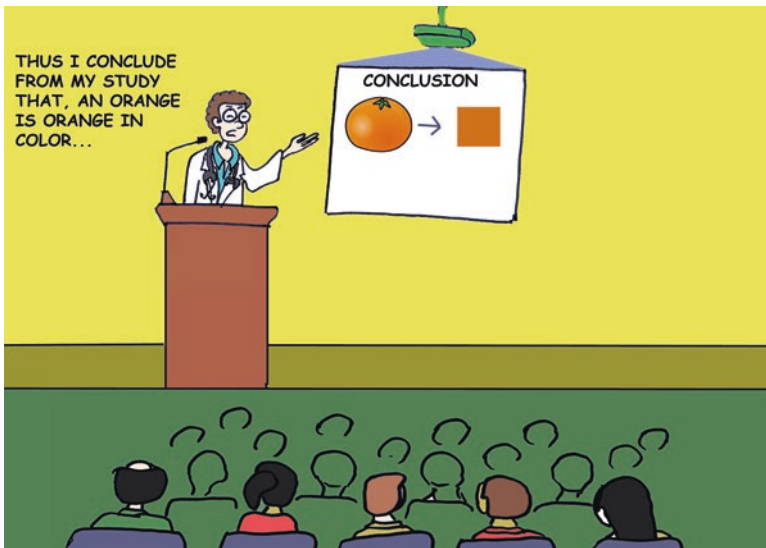
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# Discussion and Conclusion

# 8

Zubair H. Aghai and David Carola

*The point of a discussion, in my view, is to transcend “just the facts,” and engage in productive speculation. –Stephen Hinshaw*



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S.C. Parija, V. Kate (eds.), *Writing and Publishing a Scientific Research Paper*,  
DOI 10.1007/978-981-10-4720-6\_8

## Key Points

- The discussion section should be a concise analysis and explanation of your results that convinces the reader of the importance of your findings.
- The first paragraph should summarize the results of the study while reminding the reader of the question that the study is trying to answer.
- The knowledge gap filled by the manuscript should be thoroughly and explicitly outlined and addressed.
- Place your manuscript in the context of other studies of the same topic to both highlight relevant differences and bolster similar findings.
- Investigate unexpected findings rigorously.
- Highlight how your study may be used to influence the design of future studies, change clinical practice, and/or lead to guideline or policy development or change.
- All studies have limitations. Be sure to acknowledge them and suggest how they can be addressed.
- The conclusion should be your final paragraph, which provides a well-thought-out, take-home message for the reader.
- Avoid repeating your introduction section, reporting new data, and/or exaggerating your findings.

The discussion section is the most important and challenging component to write in a scientific manuscript. This section is used to analyze and explain the meaning of the results. This part of the manuscript describes the new information generated by the study, explains the significance and clinical implications of the knowledge gained, and provides recommendations for future research. This chapter will provide guidelines to assist in writing the discussion and conclusion section of a scientific paper.

According to Thomas Annesley, there are many similarities between the discussion section of a scientific paper and the closing argument a lawyer makes in a courtroom [1]. Just as in a closing argument, you need to make your discussion interesting and convince the readers and reviewers that your paper is important enough to have a significant contribution to the advancement of your field. The discussion section should be written as if you are telling a story to the reader. Keep it short, concise, and pertinent. Five to seven paragraphs is a typical length, and ideally, it will span between one-third and one-half of the total manuscript. The author can express opinions and interpretations of the results, but the focus should be on any innovative findings in your work and their implications for clinical practice and future research. The essential components of the discussion section can be seen in Table 8.1.

**Table 8.1** The essential components of the discussion

First paragraph	Summary of results
Second to fifth paragraph	Knowledge gap
	Explanation of results
	How the results fill the knowledge gap
	Unexpected results and plausibility
	Clinical implications
	Future direction
Sixth paragraph	Strength
Seventh paragraph	Weakness
Last paragraph	Conclusion

## 8.1 First Paragraph

The first paragraph of the discussion summarizes the results of the study. This paragraph should be unambiguous and concise. It can start with a few introductory sentences to restate the rationale of the study, but then subsequent sentences should focus on whether the question asked in the introductory section is answered by the results.

In a recent publication, we investigated gastroesophageal reflux (GER) in pre-term infants. We started the discussion section by emphasizing that GER is a common diagnosis during infancy and that a variety of signs and symptoms seen during infancy are attributed to GER [2]. Our subsequent sentences summarized the results of our study. We discussed that the true prevalence of gastroesophageal reflux disease (GERD) seen on an MII-pH (multichannel intraluminal impedance-pH) study was low in babies suspected clinically of having reflux. Most importantly, we highlighted that the behaviors usually attributed to GER did not correlate with reflux events [2].

In another study, we compared two modes of respiratory support in premature neonates with respiratory failure [3]. We hypothesized that when continuous positive airway pressure (CPAP) is used successfully in very low birth weight babies on the first day of life in lieu of mechanical ventilation, we would see lower rates of bronchopulmonary dysplasia (BPD) or death. Again, our first paragraph was used to restate the rationale for the study. We wrote of the persistent difficulty in reducing the incidence of BPD despite so many advances in neonatology. Further, we included that lung injury due to ventilator use is an important factor in the development of BPD, but ventilator-avoiding strategies such as CPAP had not been shown to affect BPD prior to our study [3]. This was followed by reinforcing how our results answered the question raised in our introduction. We highlighted that babies in our study who were on CPAP on day of life 1 had a lower risk of BPD or death, severe intraventricular hemorrhage, patent ductus arteriosus (PDA) needing surgical closure, and of discharge home still requiring oxygen [3].

## 8.2 Subsequent Paragraphs [2–5]

In subsequent paragraphs, authors should interpret their results for the reader and express their opinions. Be sure to explicitly outline the knowledge gap that your research fills and explain how your results fill that gap. It is also a good idea to discuss whether your results support or contrast the findings from similar studies. If the results are not similar, be sure to offer an explanation for why this might be. Finally, the clinical implication of the findings and suggestions for future research are also discussed in these paragraphs.

### 8.2.1 Knowledge Gap

A knowledge gap is briefly discussed in the introduction section to justify your study. This gap is elaborated upon in more detail in the discussion section to set the stage for introducing your results and findings. This section can be started by explaining the results from similar studies in the past. You can also discuss the unanswered questions from previous studies. This is demonstrated nicely in a large randomized controlled trial from the *New England Journal of Medicine* that compared outcomes for two different therapies for carotid artery stenosis in asymptomatic patients [4]. In their discussion section, they reinforced the knowledge gap that they were targeting by stating that previous studies have shown conflicting results and that none of the research available prior to their study includes asymptomatic patients [4].

### 8.2.2 Explanation of Results

In a study comparing high-flow nasal cannula (HFNC) and CPAP in preterm infants, we found that using HFNC was associated with increased respiratory morbidities and length of hospital stay [5]. We offered a few possible explanations for the results in our discussion section including the following: (1) The differences may have been due to chance, but this is unlikely because the strength of the association was so strong. (2) There may have been a difference that we didn't account for in the baseline characteristics of the two groups; however, we used regression analysis to adjust for any differences that we found. We, therefore, concluded that it was highly likely that the adverse outcomes seen were due to HFNC use and not the two explanations above [5].

Compare your results and findings with similar studies performed by others. If your results contrast the findings from previous studies, explain your understanding of the reason for your results. In our study on the use of HFNC and CPAP in preterm infants, we found increased respiratory morbidities with the use of HFNC, in contrast to two other studies [5]. In our discussion, we made sure to highlight the differences between our results and those of the two other studies, and we included an explanation for why we thought the differences in study outcome exist. We also

used an additional study to help bolster our findings. We wrote that a study by Collins et al. showed no difference in extubation failure between CPAP and HFNC in babies <32 weeks of gestation but that the study was underpowered to detect this difference. Next, we discussed a study that we felt differed from ours because it targeted a different population and the overall use of respiratory support was short. For comparison, we talked of another study enrolling 303 babies that showed a trend toward our same findings of the inferiority of HFNC compared to CPAP [5].

It is not uncommon to find a result which is statistically significant but may not be clinically significant. This can also be explained in the discussion section. For example, imagine you are conducting a large clinical trial comparing the low-density lipoprotein (LDL) lowering abilities of two statin medications. A known side effect of statin use is the elevation in blood glucose, so you also measure fasting blood glucose in your patients. You found that both statins worked well to lower LDL cholesterol, but one statin led to an average increase in fasting blood glucose of 1 mg/dL higher than the other medicine. You had a large enough sample size that this was a statistically significant difference with a p-value <0.05. This result, despite being statistically significant, would probably not compel a physician to use one drug over the other because a difference of 1 mg/dL in fasting blood glucose is probably not clinically significant. Findings such as this should be explained in your discussion section.

### 8.2.3 Unexpected Results and Plausibility

Our study on HFNC and CPAP showed unexpected findings of prolonged oral feeding and increased the length of hospitalization [5]. We explain this unexpected finding in the discussion section by stating that caregivers may view HFNC and CPAP as equivalent methods of noninvasive ventilation. This view may lead to avoidance of PO feeding while on HFNC, leading to a delay in initiation of oral feeds and ultimately a delay in attaining full oral feeds [5].

We also found unexpected results when we evaluated the use of fluconazole for preventing fungal infection in preterm neonates. We reported an unexpected finding of increased direct bilirubin (cholestasis) with the use of fluconazole, so we explicitly addressed this in our discussion [6]. We explained that most other studies solely used transaminase elevation as a marker of hepatotoxicity. In those studies and ours, transaminase elevation was not found; however, when we evaluated direct bilirubin levels, we found an elevation. This indicated that the other studies were perhaps underestimating the hepatotoxicity by failing to measure the direct bilirubin [6].

### 8.2.4 Clinical Implications

In the medical field, research is performed to improve the care and outcomes of patients. It is extremely important to discuss the potential clinical implications of your research. How will the new information from your research change clinical

practice? How can your findings be incorporated into current clinical practices? Is there a need for policy change based on your study?

The studies that develop a new technique or the clinical trials that test an intervention are more likely to have a significant clinical impact than an observational, retrospective, or basic science study. The data generated from an observational study or basic science research, however, may lay the foundation for future clinical trials and indirectly impact the clinical practice. For example, in 2006 a retrospective study published in *Pediatrics* analyzed data from the National Institute of Child Health and Human Development Neonatal Research Network and found an association between treatment with H2 blockers for gastric acid suppression and the development of necrotizing enterocolitis [7]. This was an observational study, but the gravity of the findings led the authors to suggest in their discussion section that avoiding prophylactic use of H2 blockers was advisable until randomized, controlled trials could evaluate this association further. As a result, the use of H2 blockers in the care of preterm neonates has markedly decreased.

If your research is innovative and/or your data is strong, you can even make a suggestion for guidelines or policy change. In a study on the management of neonates exposed to chorioamnionitis, we argue against the recommendation of the Committee on Fetus and Neonates (COFN) [8]. The COFN recommended prolonging the duration of antibiotics in neonates exposed to chorioamnionitis with abnormal laboratory results and negative blood culture [9]. We wrote in our discussion and conclusion that managing babies exposed to chorioamnionitis using the guidelines given by the COFN led to prolonged exposure to antibiotics and the associated adverse effects. In addition we challenged that the guidelines subjected these babies to unnecessary invasive procedures such as IV placement and spinal taps, prolonged hospital stays, and separation from their mother during an important time of bonding. Lastly, we noted that these guidelines also drove up healthcare costs. We used these reasons in our discussion section to make the recommendation that the COFN reconsider their guideline to extend the antibiotic course solely for abnormal laboratory data. As a result, the COFN revised their statement to say that treatment should not be extended based on lab tests if infants are clinically well at 48–72 h [10].

### **8.2.5 Future Direction**

It is important to have a section in your discussion where you state the implications of your research for future work in the field. You should make recommendations to advance the field based on your results. Your findings may lead to the development of new methods, lend to the design for a future study, show a novel way to analyze data, or identify new areas of research. Basic science research (animal or cell culture studies) leads to suggestions for human clinical studies. This can be seen in the course of research for the development of therapeutic hypothermia for newborn babies with hypoxic-ischemic injury to their brains. It was reported by Gunn et al. in 1997 in their discussion section that selective head cooling may benefit infants afflicted by moderate to severe hypoxic-ischemic encephalopathy because the



neural outcome for fetal sheep exposed to ischemic brain injury improved with moderate cerebral hypothermia [11]. Similarly, findings from retrospective or observational studies can lead to suggestions for randomized, controlled clinical trials.

---

### 8.3 Strength of the Study

It is important to emphasize the strength of your study. It is easy to argue for your study if it is a well-designed, randomized, double-blinded, multicenter clinical trial. But even a retrospective study can have strength if it has a large sample size and the outcomes are reported for the first time. We used these facts to our advantage in the discussion section of our study of HFNC and CPAP in ELBW infants. We highlighted that ours was the first study to compare these two types of support with BPD or death as a primary outcome. We also noted that our sample size was 2487 babies and the data was taken from 466 NICUs across the nation, making the results generalizable [5].

---

### 8.4 Limitations of the Study

The value of the manuscript is enhanced by showing the weaknesses of the study. Every study has limitations. Address the major limitations of the study and implications of those limitations. It is much better for the author to acknowledge the weaknesses and limitations of their research than for the reviewers or readers to expose them after submission. Inform the readers about the limitations and give suggestions for modifications of your research design or methodology for future research.

Firstly, and perhaps most obviously, basic science research always has the limitation of being performed in a lab under circumstances that are unlikely to be exactly replicated in the real world. This research can include work that takes place in an animal or animal tissue other than a human, in human tissue that has been removed from its host, or in a human but under circumstances that are different than those under which you wish to show your ultimate effect. These limitations need to be addressed in your discussion section with an explanation of how your results will ultimately contribute to researching your idea in a real world, in vivo scenario.

All retrospective studies are limited by that fact that they can only show an association between an intervention and an outcome without guaranteeing a causal relationship. These types of studies simply cannot control for every variable between groups that may have influenced the outcome, and this should be noted in your discussion section. We expound on this fact in our study comparing HFNC to CPAP by frankly stating that we know there are limitations to our study. In addition to many other points, we note the retrospective nature of the study, the lack of randomization, and the fact that we cannot determine the liter flow of HFNC or the pressure of CPAP from the database we used for the study. We do attempt to balance these limitations by pointing out some of the baseline similarities between the groups and

identifying that the data collectors are trained health professionals experienced with caring for neonates [5].

Finally, even a well-designed randomized controlled trial (RCT) published in a reputed journal can have limitations. This can be seen in the Total Body Hypothermia for Neonatal Encephalopathy Trial (TOBY), which studied the effects of therapeutic hypothermia on death and severe neurodevelopmental disability in babies with ischemic injury to the brain around the time of delivery [12]. They noted in their discussion that the decision to withdrawal care from babies with HIE varies significantly based on local practices, and this could have affected the outcome of their study [12]. If this same trial was carried out in a different area of the world, some babies that were withdrawn from life support may have lived and vice versa.

---

## 8.5 Conclusion

This is the last paragraph of the discussion section of a scientific manuscript. For a majority of the journals, this is included in the discussion section; however, there are a few journals that require a separate conclusion section. This paragraph should provide a “take home message” to the readers in three to four sentences [13]. You can also suggest a future experiment or practice change in the conclusion. For example, the conclusion section from our study of HFNC and CPAP emphasized that ELBW infants were more likely to develop BPD or die if they received HFNC instead of CPAP. We also stressed that babies who had more HFNC use than CPAP use were delayed in establishing oral feeds, had increased use of postnatal steroids, required longer treatment with oxygen, and stayed longer in the hospital. Finally, we made a recommendation for a randomized controlled trial to evaluate this relationship in a prospective manner [5]. Figure 8.1 shows the contents and sequence of how the discussion is covered.

---

## 8.6 Common Errors

We have discussed several common errors in writing your discussion section throughout this chapter, but this last section will hopefully provide a quick reference to remind you what to avoid during your writing. Firstly, resist the urge to repeat your introduction section verbatim. Highlight a few key points and then move on. Also, this section should not introduce any information that isn't explicitly related to the objective of your study. Once you begin the discussion of your results, do not continue to report data and especially do not report new data. This should have already been done in your results section, and it can distract from the interpretation of your findings and any argument that you make for the significance of your research. The purpose of your manuscript is to present your work to the world and argue strongly for its significance among the overwhelming weight of research being reported on a daily basis. Do what you can to make your research stand out over the rest, but don't exaggerate your findings.

**Fig. 8.1** Contents and sequence of how discussion is covered



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## Case Scenario

In a study comparing the use of fluconazole in preventing fungal sepsis in neonates, you found an unexpected finding of high direct bilirubin (cholestasis) with the use of fluconazole. No other previous studies have reported similar findings. You should:

- (a) Ignore this finding as no one has seen this in previous studies
- (b) Mention this finding in the results only
- (c) Disregard this because the higher incidence of cholestasis seen with the use of fluconazole could be due to chance
- (d) Discuss this unexpected finding and biological plausibility of fluconazole causing cholestasis in the discussion section of the manuscript

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*References may be used as the ultimate authority upon which to base arguments. Alternatively, they may be a temporary authority whose validity you intend to challenge or they may be considered as obviously wrong – Taylor*



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## Key Points

- The accuracy of cited references is the prime responsibility of the authors of the manuscript.
  - Authors must check journal guidelines for style before preparing the reference list.
  - Original source must be referred to while preparing references.
  - Do not rely on the accuracy of cross-references.
  - Remember to revise the reference citation style in the text and reference list before submitting a rejected manuscript to another journal.
  - Avoid duplication of references.
- 

## 9.1 Introduction

A well-conducted scientific study needs to be supported with reference to the previously published literature on the subject or the related material. This is provided in the form of references or bibliography in the manuscript. Authors of manuscripts submitted for publications in medical or other scientific journals are expected to provide the readers with accurate references. In addition these also need to be cited in the text in a format desired by the journal under consideration. Figure 9.1 illustrates how to organise the references.

Most medical journals require the authors to follow the “Uniform Requirements for Manuscripts Submitted to Biomedical Journals” [1], which follow the Vancouver style for formatting references. Some variations in the format may be there from journal to journal. It is specified that authors are expected to check the accuracy of references against the original article. Correctly cited references allow the reader to locate related literature relevant to the subject easily, while incorrect references may make the task time-consuming, frustrating, or impossible. Many studies have found errors in citations and reference lists of journals across the specialties [2–5].

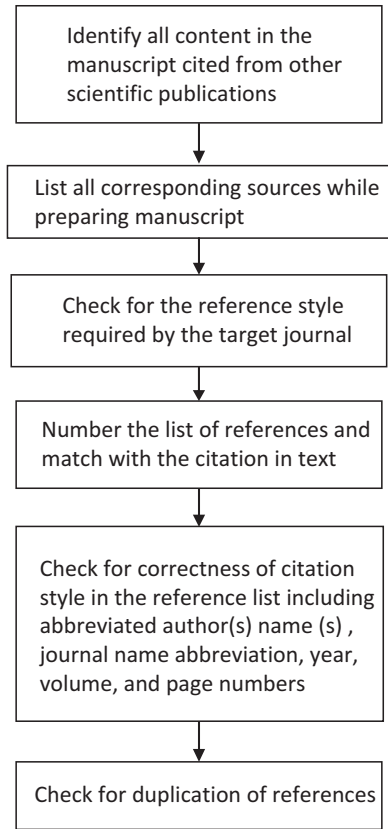
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## 9.2 Bibliography and References

**Bibliography:** The term bibliography is used to refer to all the resources that the researcher has referred to while performing, analyzing, or preparing the manuscript. This may include journals, books, Internet resources, or any other source even though any of these is not cited in the text of the manuscript.

**References:** List of references appended to the text of the manuscript in the desired format includes only the sources of scientific literature which have been cited in the text.

**Fig. 9.1** How to organize the references



### 9.3 Referencing Styles

In an attempt to make the list of the references and in-text citation uniform across the journals, many referencing styles are available for use, but the author should follow the format advised by the target journal or book where it is intended to submit the manuscript. Most medical journals or books follow the Vancouver style of referencing, but many basic science journals follow the Harvard style. Individual journal guidelines may require specific style of certain components for which the author may refer to the journal website or print copy.

Common styles for referencing are:

- Vancouver style [6]. The references are numbered in the sequence in which they are cited in the manuscript. List of references is prepared in the same sequence.
- American Psychological Association (APA). APA uses the author-date method of citation. The last name of the author and the date of publication are inserted in the text. In the reference list, the author(s) (names), publication date, title, and publication information including the issue number and pagination are inserted.

Some journals recommend Digital Object Identifier (DOI) for electronic references.

- Modern Language Association (MLA). MLA is most often applied by the arts and humanities.
- Harvard style [7]. Harvard is very similar to APA. Where APA is primarily used in the USA, Harvard referencing is the most commonly style in the UK and Australia and is encouraged for use with the humanities.
- Chicago and Turabian style. These are two separate styles and are widely used for history and economics.

---

## 9.4 Vancouver Style

Any reference that is cited in a scientific communication is identified at two places, i.e., text of the manuscript and the reference list:

### (a) *In-text citation*

- (i) The references are cited and are identified by numbers in the sequence of citation.
- (ii) If a source has been cited and identified by a number, the same number should be used consecutively throughout the manuscript if the same source is cited again. This avoids duplication of references.
- (iii) Consecutive numbers are given to references cited in tables or figures which may be embedded in the text of the manuscript.
- (iv) If two or more sources are cited simultaneously, they should be identified in chronological order according to their date of publication by numbers separated by a comma.
- (v) Identifying numbers are placed after punctuation marks like full stops or commas and before colons and semicolons [6]. However, variations can be there in different journals.
- (vi) Numbers may be placed in parentheses or superscript in accordance with the Journal Policy which needs to be followed.
- (vii) If several consecutively numbered sources are cited, a hyphen may be used instead of comma, e.g., [4–9] instead of [4, 5, 6, 7, 8, 9].
- (viii) Author(s) names in the text should be identified by surname only and initials should be avoided.

### (b) *Reference list*

A well-prepared reference list provides information for identification and search of the cited literature:

- (i) The reference list is prepared in sequentially numbered order in which the source has been cited in the manuscript. Citation number in the text and the list should be the same.
- (ii) The last name of the authors is written first followed by the initials. If there are six or fewer authors, names of all the authors are included. In case there are more than six authors, names of first six authors are listed



- followed by et al. Some journals advise to place et al. after three authors, and thus journal guidelines should be followed.
- (iii) The first letter of each author's last name and initials should be in capital letters without any intervening full stops. Capital letters should also be used for the first letter of the publication title, the first letters of all main words in the title of a journal, and all first letters of a place name and publisher.
  - (iv) Most journal guidelines require the authors to mention the abbreviated names of the cited journal. However, some journals prefer that full name of the journal should be mentioned. Abbreviated names of the most medical journals are available in PubMed's Journal Database available at <http://www.ncbi.nlm.nih.gov/nlmcatalog/journals>. Authors can refer to journal websites or other databases in case of journals not indexed on PubMed.
  - (v) Some components of references like issue number and month of publication can be omitted.
  - (vi) First and last page numbers of the source should be given. Style of pagination should be according to journal guidelines.

Table 9.1 gives the examples of references as per the Vancouver style of common sources of literature. A comprehensive guide to citing literature in the manuscript is available at National Library of Medicine [8].

**Table 9.1** Examples of references as per Vancouver style

Source	Format
Journal single author	Author (Last name, Initials). Title of the paper. Journal name (abbreviated). Year of publication; Volume number: inclusive page numbers
Journal (six or less than six authors)	Author 1 (Last name, Initials), Author 2 (Last name, Initials),..., Author 6 (Last name, Initials). Title of the paper. Journal name (abbreviated). Year of publication; Volume number: inclusive page numbers
Journal (more than six authors)	Author 1 (Last name, Initials), Author 2 (Last name, Initials),..., Author 6 (Last name, Initials), et al. Title of the paper. Journal name (abbreviated) Year of publication; Volume number: inclusive page numbers
Book	Author (Last name, Initials). Title of the book. # edition (if not first). Place of publication: publisher. Year of publication
Book chapter	Author 1, Author 2. Title of chapter. In Editor 1, Editor 2, editors. Title of book. # edition. Place of publication: publisher. Year of publication. p. [page numbers of chapter]
Electronic journal article	Author 1, Author 2. Title of article. Abbreviated title of Journal [Internet]. Date of publication YYYY MM [cited YYYY Mon DD]; volume number (issue number): page numbers. Available from: URL Accessed on.....
Web page	Author/organization's name. Title of the page [Internet]. Place of publication: publisher's name; date or year of publication [updated year month day; cited year month day]. Available from: URL Accessed on.....

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## 9.5 Difference Between Vancouver Style and Harvard Style

Vancouver style advocates sequential in-text citation which is identified by an Arabic number placed in parentheses or as superscript at the end of the line. The reference list is prepared in the sequence in order of citation in the text.

On the other hand, Harvard style, the citation in the text is identified by the name of the author and the year of publication, and the page numbers may be included for being more specific. The reference list is prepared in alphabetical order irrespective of the order of citation in the text of the manuscript.

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## 9.6 Electronic Sources

An electronic source is any source that exists primarily in electronic form and is accessed primarily through the Internet. These include websites, online journals and books, blogs and postings, etc. However, there is a difference between electronic sources and sources that are accessed electronically. A journal may be printed primarily and then the articles may be made available online. On the other hand, a journal may be published simultaneously online and in print version. It is important to cite the exact source, i.e., print or online, while citing the source.

When citing an online source, elements of the citation include (a) the author or editor, (b) the title of the text, (c) the name of the website, (d) the name of the associated institution or organization, (e) the date site was accessed, and (f) the electronic address (URL). It is important to mention the date on which the source was accessed as online resources are likely to be edited or deleted and may become inaccessible on a later date [9].

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## 9.7 The Number Game

It is mandatory to give citation wherever the author has used the idea, process, data, figures, or diagrams from previously published literature. This could be in any of the sections of the manuscript, i.e., Introduction, Methodology, Tables, Figures, and Discussion. Generally, Abstract and Results sections do not need any references. It is essential to include key references relevant to the study. Not giving credit to consulted literature wherever necessary may amount to plagiarism and may attract sanctions from the Journal.

The number of the references to be cited should be in accordance with the author guidelines issued by the target journal. Most journals do not prescribe any limit of references for the research or review papers but do have limits for certain sections like Case Reports, Correspondence, and Images due to limited print space.

It is advisable to use only the most relevant and recent references. Very old references and cross-references should be avoided as they may not be retrievable for reviewers and readers. It is advisable to try to keep the number of references below maximum limit and not aim to exhaust the available limit.

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## 9.8 Organization of the Reference List

References should be collected as and when the source has been used for conducting the study along with the rationale for using the reference [10]. When the authors prepare the manuscript, relevant reference can be retrieved from the list and cited in the text. It allows the author to:

- (i) Identify which previously published article can be best cited in the manuscript and avoid less relevant sources
- (ii) Avoid bias toward one kind of viewpoint and give a balanced literature in support and against the study
- (iii) Limit the number of references to meet the requirements of the target journal

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## 9.9 Special Considerations

As references form an important component of the manuscript, it is necessary that attention is paid to prepare the list and cite the same appropriately in the text.

- (a) References should be prepared in the format recommended by the author guidelines [11]. It saves the time of the editor to modify the same if the manuscript is accepted. It also instills confidence in the editor about the sincerity of the author to follow journal guidelines. Some editors and reviewers may take serious note of errors in the references.
- (b) The number of the references should be well within the prescribed limit. Authors may be asked by the editor to reduce the number which may become difficult and time-consuming exercise.
- (c) The reference list should be prepared after reading the original article and not as a cross-reference from some other publication. This reduces the chances of errors in references. Otherwise, there is a possibility of perpetuating an error committed in a previous manuscript. This error could be in any of the components of the reference, i.e., author name(s), title, journal name and abbreviation, publication year, volume number, and pagination. Although online scientific databases are very helpful in literature search, errors have been found even in these databases [12].
- (d) Special attention should be given to author names. Most author names are easy to abbreviate in the surname and initials format, but some names are difficult to abbreviate as clarity about the first name and last name is not clear. This occurs specially where the author is not familiar with the names of Chinese or South Indian authors [13, 14]. It would be appropriate to refer to original articles where journal may guide how to abbreviate and cite the article. Otherwise, help of the electronic databases like PubMed, Scopus, etc. may be used.
- (e) If a manuscript is planned to be submitted to another journal after it has been once rejected, references should be revised according to requirements of the

target journal. Many times, authors submit the manuscript without any revisions again which may have a negative impact on the editor or reviewer.

- (f) There are many online software available that can help the authors to prepare reference lists according to a particular format [10]. Commonly used software include EndNote and Reference Manager by Thomson Reuters, Papers and ReadCube by Labvita, and Mendeley by Elsevier. Care should be taken as the results may not exactly meet the requirements of the journal.
- (g) Many manuscript submission software prompt the authors to submit the references for online validation at the time of submission of the manuscript. Any reference that is not validated needs to be rechecked, or proof needs to be submitted in support of its accuracy.

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## Case Scenario

A manuscript is received with a following reference in the text and reference list. The journal accepts references in Vancouver style. Give your comments and rectify the errors.

Text:

In a case-control study, it was found that the compliance with immunization schedule was lower in children from families of lower socioeconomic strata (Gupta et al. 2010). This was in contrast to reports from the western countries [4].

References:

Gupta S, Sharma GK, Rana P, et al. Compliance with immunization schedule. *Indian Pediatr.* 2010; 43: 145–156.

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*Illustrations are the glue that can hold the attention of the reader.*



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## Key Points

- Tables, illustrations, and graphs represent data in a format that is easy to understand and grasp at a glance.
- They are a substitute for, and not an addition to, voluminous descriptions in the body of the article.
- They can be used in all sections of the article, not just for results.
- All tables, illustrations, and graphs must be appropriately labeled and referenced in the text.
- Tables are best when there is more text to display and the data is qualitative. They organize data into understandable classifications.
- The commonest used charts are bar charts, pie charts, histograms, line charts, and scatter diagrams.
- Charts are especially useful when the relationship between data sets is more important than the actual numbers.
- Flow charts help to depict the overall scheme of methodology.
- Illustrations may take the form of photographs or line diagrams and are usually used to support clinical presentations, operative findings, or investigation findings.

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## 10.1 Introduction

The successful outcome of research projects is the publication of a research paper. Although different journals have different style requirements for submissions, most papers will contain tables, figures, or graphs. The design and content of tables and figures may become critical to the acceptance and readership of the paper.

Tables and graphs represent data in a format that is easy to understand, and it is best to use them when different data sets are being compared with each other. These are typically used in the results section. However, there is an important place for the judicious use of tables and graphs in other sections of the paper too—literature review, methodology, and discussion. For example, in the literature review, it is helpful to depict data from different articles as tables to help in comparing them. Between tables and graphs, choose tables, except when you feel that the relationship is more important than the actual numbers [1].

Flow charts help to depict the overall scheme of methodology. Journals are increasingly demanding flow charts, either under methods or under results, to show how many subjects entered the study and how they were handled.

Illustrations may take the form of photographs or line diagrams. They are required in a relatively small fraction of papers but can serve an important purpose. Photographs are usually used to support clinical presentations, operative findings, or investigation findings. When the information can be effectively conveyed without the picture, most journals will prefer to avoid them: they cost money (especially colored ones). On the other hand, a journal may reject a paper that lacks an illustration if it is really needed, as, for example, an X-ray.

Given that almost all papers nowadays use one or more of these illustrating modalities, the decision for the author is not whether or not to use text, tables, and graphs, but rather how best to use them. The aim is that the reader must understand the message and must not struggle to interpret the data. The text must refer to the table and must alert the reader about its content. Also, the data in the tables (or graphs) must not be repeated in the text.

## 10.2 Tables Versus Charts

Tables are best when there is more text to display and the data is qualitative. Tables allow for the display of much more information than figures, for example, significance calculation, etc. Though this can be done with figures as well, it tends to make figures very messy. Hence when there are many data sets to display, choose tables, especially if there is a lot of text involved, as usually happens in qualitative comparisons. When the data sets are few, or we want to display trends, or where data patterns are more important than the data itself, figures are the way to go.

## 10.3 Tables

Tables organize data into understandable classifications. They are probably the best, and certainly the most frequently used, visual supports for text. They, therefore, should be used properly.

Tables present parallel descriptions very well. You can easily compare a variable's behavior in different groups. For example, how weight changes with the age group. Or, how weight changes with age group for males and for females. In such situations, it is a great idea to put in a table.

Tables may be “word tables” or “numerical tables.”

Word tables consist of descriptions (Table 10.1). Typically, the tabs will be left-aligned.

Numerical tables contain numbers (Table 10.2). Typically, the data tabs will be center-aligned.

The information in the two tables below **can** be presented in the text. For example, the word table could be rewritten “The capitals of Algeria, Saudi Arabia, and

**Table 10.1** Capitals and leaders of some countries

Country	Capital	Leader
Algeria	Algiers	President
Saudi Arabia	Riyadh	King
United Kingdom	London	Prime minister <sup>a</sup>

<sup>a</sup>Technically, the leader is the queen, but political power lies with the prime minister



**Table 10.2** IQ of students in selected colleges

College	Average IQ	Range
College A	112	98–136
College B	104	97–139
College C	121	101–151

the United Kingdom and Algiers, London, and Riyadh respectively, and they are led by their President, King, and Prime Minister.” However, the tabulated form makes the understanding much easier. A crude guide is: if you wish to present more than three sets of data, use a table [1].

### 10.3.1 The Anatomy of a Table

Tables must have a text reference, such as the words “Table 1” written in the proper place in the text. Every table must have a title. The column headings are collectively called the “box heading.” In Table 10.1 the words “Capital” and “Country” constitute the box heading. The row headings are collectively called the “stub”. In Table 10.1, Algeria, Saudi Arabia, and the United Kingdom constitute the stub. The “fields” contain the data. Together, the box heading, the stub, and the fields make up the body of the table—the other two parts are the title (always) and the footnotes (optional) [1, 2]. In general, the independent variables are represented column-wise, and the dependent variables presented in rows. However, a lot will depend on the target journal. If the journal prints in two columns, it may try to fit the table into a column. In that case, the box heading should be short, and the stub longer. If the journal prints its content in a single column, it will prefer a broader table to a longer one.

### 10.3.2 Good and Not So Good Tables

Tables will go wrong if there are too many. We have actually seen papers submitted for publication, with the entire results section written “Results: see Tables 1–12”! The table is intended to make data easy to understand. Excessive data defeats this purpose and therefore, logically, the author must avoid excessive data. The best way of doing this is to ruthlessly throw out less relevant data. The second-best way of dealing with excessive data is to create an additional table. Have a central idea for each table. It is better to use different tables for different data.

A good table has a clear title: it depicts the content of the table. Avoid cryptic titles which are not descriptive of the content of the table. At the same time, do not make the titles too long. Ideally, they should not exceed one line of text.

Tables should be numbered sequentially according to their appearance in the text, with appropriate cross-referencing in the text.

Most scientific tables will be formatted to include some horizontal lines, but no vertical lines. A typical table carries three horizontal lines: a line above and below the box heading and a line at the end of a table. Footnotes are placed below this latter line [1].

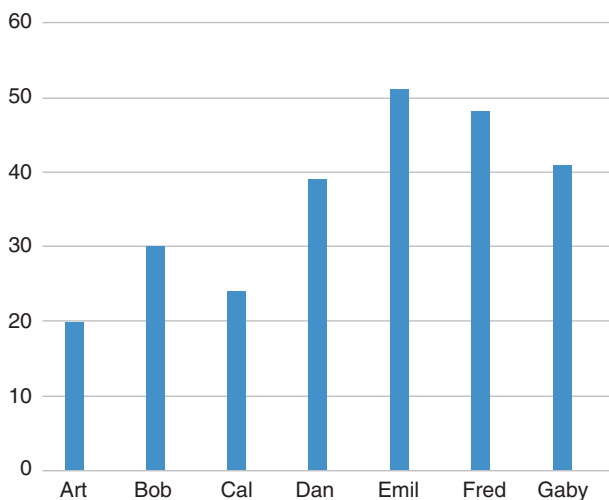
Finally, of course, one must follow the instructions of the journal.

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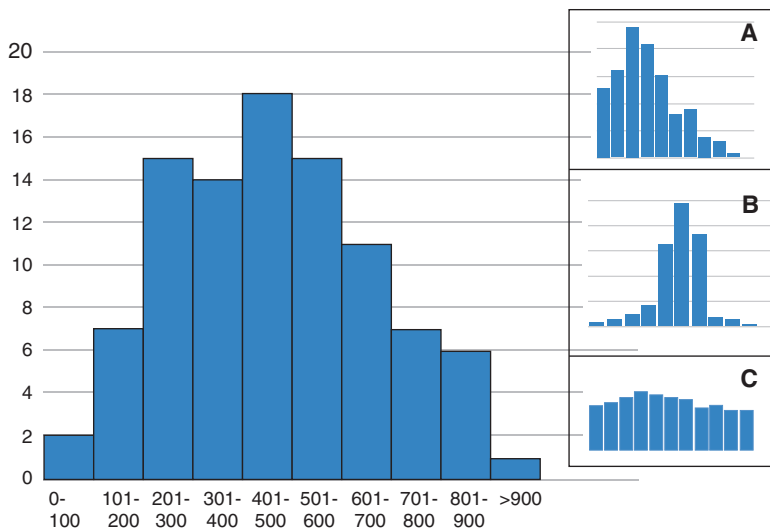
## 10.4 Graphs/Charts

Graphs and charts are used interchangeably and mean the same thing. In this text, we will stick to “charts” to avoid confusion. Charts can be of various types. The commonest used are bar charts, pie charts, histograms, line charts, and scatter diagrams. Bar charts and histograms may look similar, but they are not at all the same thing. Bar charts usually represent categorical data on the x-axis and their numerical value on the y-axis. The bars on a bar chart can be rearranged without affecting the chart. There is a gap between bars, and the bars are often colored differently (Fig. 10.1).

Histograms (Fig. 10.2), on the other hand, represent numerical group values, also known as “bins,” on the x-axis. The y-axis represents the frequencies. (In the histogram shown, the bins represent the groups Rs 0–100, 101–200, and so on. The y-axis represents the frequency with which individuals earn that amount.) As these are continuous variables, there is usually no gap between bars in a histogram unless one of the values is 0. The area of each bar in the histogram represents the total frequency of that variable. Histograms can indicate skew. Three types of skew are



**Fig. 10.1** A bar chart comparing ages of various individuals



**Fig. 10.2** A histogram depicting frequency of daily income of individuals

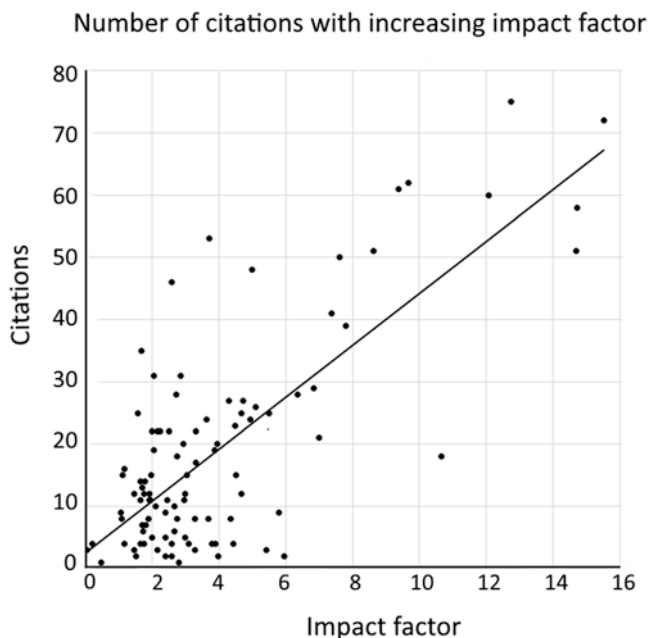
also shown in the insets: a right or “positive” skew (A), an upward peak or arch (leptokurtosis) (B), and a flatter distribution (platykurtosis) (C).

Pie charts, as the name implies, represent data as slices of a pie. They are very good pictorial representations of comparisons between sizes of different variables. It is better to use pie charts when the number of variables is small, as making pie charts with too many data sets may make comparisons difficult and defeat the very purpose of these charts. For smaller data sets (containing less than four data sets only), pie charts are good.

Line charts elegantly demonstrate changes in variables, usually over time. Each data set is represented by one line, and a line chart may have several lines to represent different data sets.

Scatter diagrams or scatter plots (Fig. 10.3) compare pairs of numerical data for the same subject to see the nature of the relationship between the two. This type of diagram requires a large number of pairs to be statistically valid: usually, 50–100 pairs is the generally accepted figure. The best fit line or curve can then be drawn using linear regression. For scatter diagrams and for line charts, the x-axis always takes the independent data. The dependent data goes to the y-axis. A good scatter diagram has a title and both axes are labeled. Both scales extend only as far as the data values and not much farther. The axes are black and at least 0.25 point in thickness [2].

There should be very few indications for charts with 3-D effects, and it is better to avoid them [3]. Use colors to highlight different data sets. However, do not color to beautify: the colors must not take attention away from the information [4]. Remember that most journals charge extra to reproduce color prints; hence different types of shading may be a cheaper way of contrasting data.



**Fig. 10.3** Scatter plot showing relationship of an article’s future citations with the journal’s current impact factor

## 10.5 Explanatory Artwork

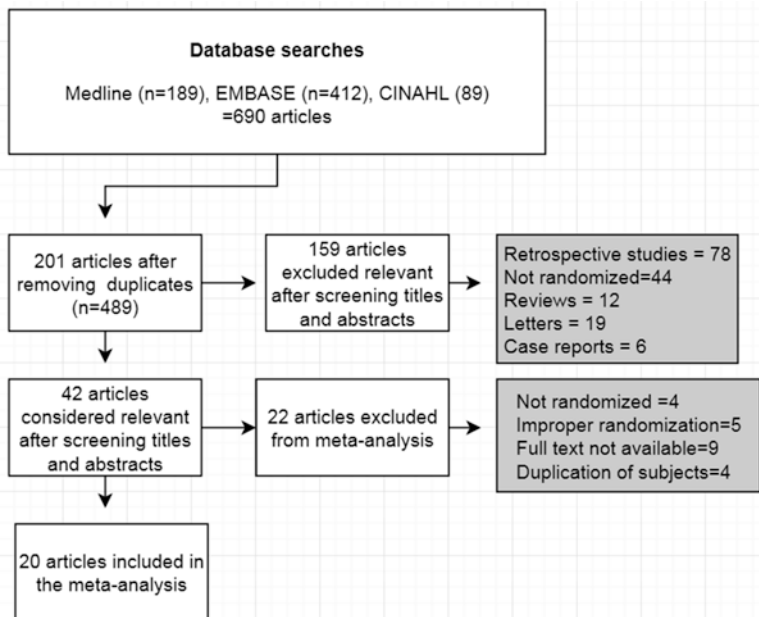
Explanatory figures (“block diagrams,” “gazintas,” “flow diagrams,” algorithms) are excellent for showing the progression of your work and have value in both the methods section and in the results. Some journals will demand to know how you reached your final sample.

There may be several variants of artwork, and which one to use depends on the purpose being served by the diagram. Flow diagrams are almost mandatory in systematic reviews (Fig. 10.4).

MS Word offers very helpful inserts with different uses: hierarchies, lists, organization charts, processes, pyramids, and others. Some online software is even more versatile. The flow diagram shown here was drawn on <https://www.draw.io>.

## 10.6 Photographs and Line Drawings

Illustrations such as photographs or line diagrams are required in a relatively small fraction of papers but can serve an important purpose. One picture is, after all, worth a thousand words. When the information can be effectively conveyed without the picture, most journals will prefer to avoid them: they cost money (especially colored ones). On the other hand, a journal may reject a paper that lacks an illustration if it



**Fig. 10.4** Flow diagram for a systematic review and meta-analysis

is really needed, as, for example, an X-ray, since the photograph provides the most compelling form of evidence.

The first step is, of course, to take a good picture. Where possible, use a professional photographer. Use a camera, not a cellphone. Dedicated cameras have better lenses and size of the sensor and better flash power: these factors have a major impact on the picture quality [5]. Use adequate light, preferably natural light. Take multiple shots [1]. Keep the background clean (not soaked in blood, for example). Dry the specimen to prevent glare from light bouncing off secretions. And, where indicated, place a scale over a specimen to provide an accurate indication of the size.

For publication, you may wish to use a (digitized) picture that you have just presented at a conference. However, remember that at the conference you were able to point out the areas of interest. This is not possible in a printed photograph; therefore, it is important to provide labels. The best way to do this is by using proper editing software (Photoshop or one of the free but excellent alternatives: GIMP, [Paint.net](http://Paint.net)). Point to the areas of interest with arrows. The labels for the arrows can themselves be placed over the picture or in a separate legend for the illustration (depending on the space available). Be sure to select the color properly: a black arrow or label will not show up well on a dark background. Use the “layers” function for the labels or arrows. Sometimes the publisher may reduce the dimensions of your photograph, and, in the process, will render your labeling unreadable. If so, you can always redo the labeling by simply enlarging the font in the appropriate layer.

Most of the rules for tables apply to illustrations as well. The photograph must be referenced in the text, e.g., “The swelling was large and regular (Fig. 10.1).” It must bear a title (legend), which, as for a table’s title, should be descriptive but usually not more than 12 words. Most publications prefer to place the legend below the figure rather than above it [6]. However, this should usually not be a concern to an author, since the illustrations and the legends should be sent separately from the paper itself.

### 10.6.1 Ethical Considerations

If you have obtained your illustration from someone else’s publication or web page, be sure to take permission. State the source clearly in the legend [6]. And never forget to de-identify clinical illustrations: the reader must not be able to identify the patient [2]!

### 10.6.2 Formatting

How should you format your picture? This will depend on your target journal. If the journal publishes in two columns, it will often try to fit the picture to a column. For such journals, send them a photograph in a portrait orientation. Journals that publish in a single column have more left-to-right space and will find it easier to print a picture that has a landscape orientation. Keep figures clear and easy to interpret, and avoid cluttering, too many lines, and needless embellishments [3].

### 10.6.3 Color or Monochrome?

Most print journals will want monochrome pictures: color is expensive. Online publications do not have these constraints. Thus the decision depends on your target journal.

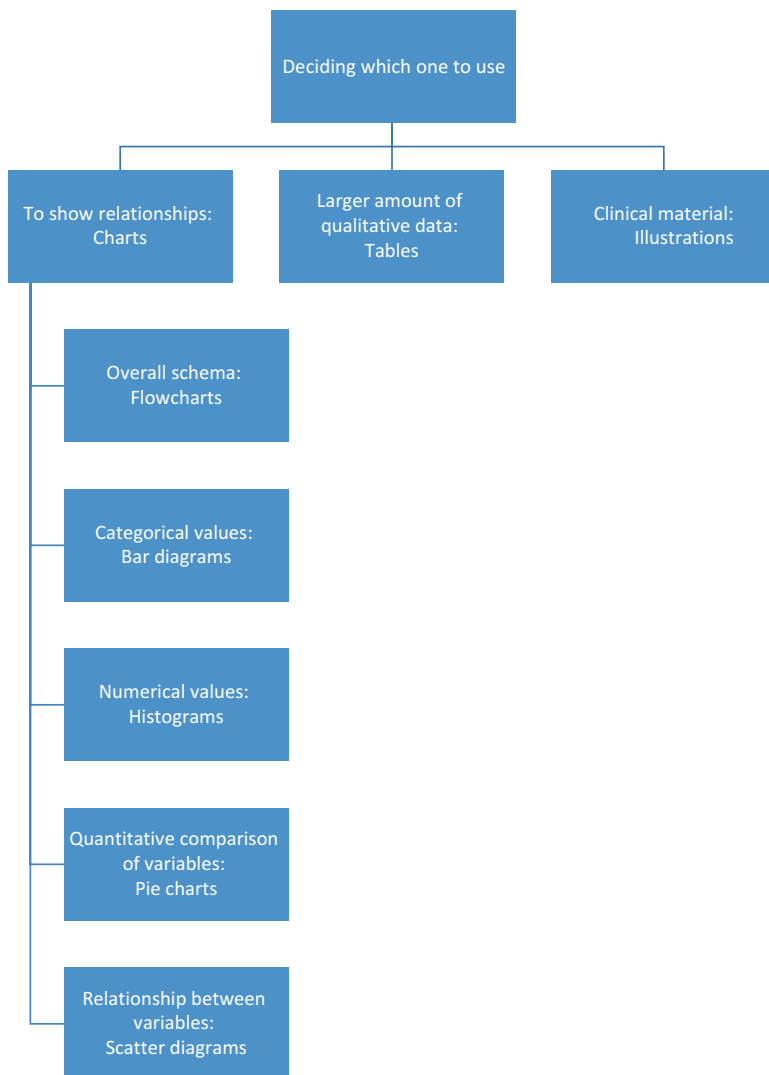
### 10.6.4 Sending Your Illustration

Virtually all publishers will want you to send the illustrations in a separate .jpeg or .tiff file, never in the Word file that contains the text of the paper. Send high resolution and size: 600 dpi, 15 cm is usually a good choice [2]. Text editors like MS Word will typically decrease the quality of the picture.

## 10.7 Using EndNote for Tables and Figures

EndNote is referencing software, originally designed to help organize bibliographies. It is such an efficient method of referencing that now one wonders how one managed in the past!

Current versions of EndNote can, in addition to references, organize tables and figures. Some large publications (such as systematic reviews and theses) may contain so many tables or figures that managing them becomes almost impossible.



**Fig. 10.5** Choosing between tables, charts and illustrations to enhance a paper

Moving a table from one place to another, and changing the table number or figure number, involves changing all subsequent numbers. Authors would do well to familiarize themselves with the use of this software [7].

In conclusion, tables, charts, and illustrations are used to enhance a paper by providing information in an easy-to-understand and easy-to-visualize format. To get the best out of these embellishments, one must use them appropriately, judiciously, and within a set of acceptable rules. Figure 10.5 shows when to use tables, charts, and illustrations which are used to enhance a paper.

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## Part II

# Publishing a Scientific Research Paper

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# Choosing a Journal for Paper Submission and Methods of Submission

# 11

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and Subhash Chandra Parija

*If it wasn't published, it wasn't done. – E.H. Miller 1993*



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## Key Points

- Submitting the manuscript to the most appropriate journal increases the likelihood of getting it published in a shorter time frame and avoids multiple rejections.
- Indexing in recognized database gives assertion of quality, reputation and reliability of journal and has more potential to reach the researchers and clinicians.
- Publishing in high-impact journal and open access extends the readership beyond the subspecialty and increases citations for the article.
- Digital object identifier (DOI) makes the article more stable and easy to find in the search engines, and publishing in journals that provide DOI increases visibility.
- Submission to potential, possible, or probable predatory scholarly open-access journals from questionable open-access standalone publishers is to be avoided.
- Preparing manuscript as per instruction to author and familiarizing with Manuscript Submission Process and Manuscript Tracking System will help in publishing the research work in a shorter time frame.

Journals serve as a formal information channel to communicate and disseminate the scientific knowledge [1, 2]. To ensure the scientific quality of the content, almost all the journals execute a peer-review system so that the correct information is provided to the target audience at the right time [3]. It is estimated that only half of the clinical trials carried out in the USA are published [4]. Choosing the appropriate journal is a proficiency that all the authors should develop. Selection of suitable journal is of vital importance due to the following reasons [5–8]:

1. Research content of the scientific manuscript is best delivered to the target audience when it gets published in an appropriate journal.
2. Submitting the manuscript to the most appropriate journal increases the likelihood of it getting published.
3. It avoids the possibility of rejection due to avoidable reasons such as not falling within the scope of the journal/not accepting the particular type of manuscript such as case reports.
4. It saves time by reducing the time delay that occurs by multiple rejections.
5. Last but not the least, the journal where the research gets published will directly or indirectly influence the career progression like promotion, research work opportunity, future funding and reputation among the colleagues of your profession.

To understand how the manuscript is handled by the journals, a comprehensive flow diagram of the manuscript processing cycle is provided below (Fig. 11.1).

Attention to following details while choosing the journal will help in identifying the appropriate journal for the manuscript.

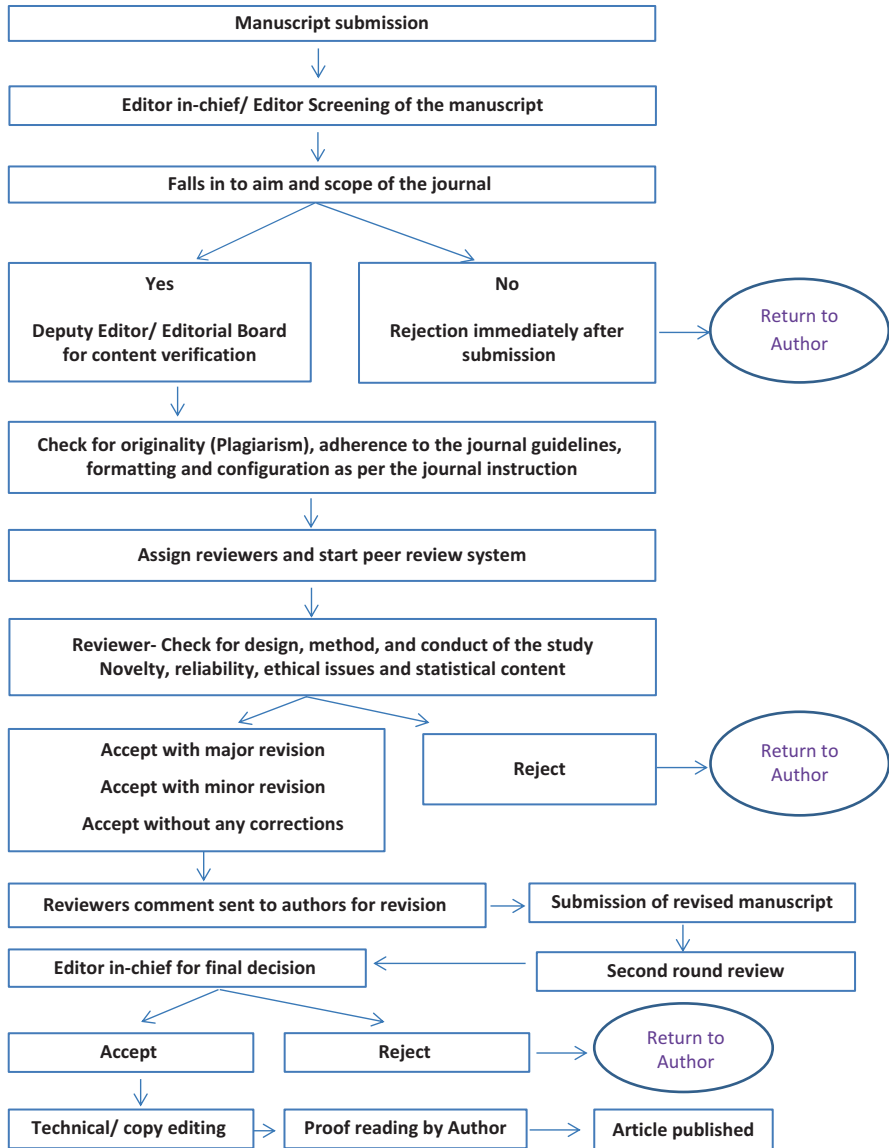


Fig. 11.1 Manuscript processing cycle

## 11.1 Aim and Scope of the Journal

Every journal in their home page describes the aim and scope of the journal which includes the thrust area of research, specialty of interest, article types they accept, readership expectation, etc. Understanding the aim and scope of the journal will help in deciding whether to consider the journal for submission [8]. Article which falls out of the aim and scope is likely to be rejected by the journal [7]. Editors always evaluate the content of the manuscript to assess the adherence to the scope of the journal before starting the peer-review process.

If the scientific content of the manuscript is a novel concept or theory, the journals which aim at bringing out the innovative ideas such as *Journal of Theoretical Biology* and *Acta Biotheoretica* can be selected for submission. Some journals publish only the basic research such as *BMC Genomics*, *the Journal of Gene Medicine*, *Molecular Oncology*, etc. Some journals publish both basic and applied research works such as *Oncotarget*, *International Journal of Cancer*, *BMC Cancer*, etc. A simpler way of selecting the journal which matches the scientific content of the article is by identifying the journals from the references used to prepare the manuscript. If a journal appears in the references cited more than once in the article, then it is likely to report the similar research works and can be considered for the manuscript submission.

The keywords also can be used to search the suitable journal in comprehensive search engines like PubMed using *Medical Subject Headings (MeSH)*, which lists the similar research titles in an alphabetical order. Selecting the journal, which appears more frequently in the PubMed, implies a potential journal for submission. Online free software like *eTBLSAT* can also be used to search the journal, which publishes similar research work.

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## 11.2 Specialty/Multidisciplinary

Some reputed journals publish multidisciplinary research works including medical, surgical and other health-related research like *New England Journal of Medicine* and *Lancet*. Journals run by society like *Journal of Royal College of Surgeons* and *Indian Journal of Surgery* from Association of Surgeons of India are broad specialty journals which accept research works from any surgical specialties. Some journals focus on specific subspecialty like *Journal of Gastroenterology and Hepatology* and *Journal of Pancreas*. Selecting the journal according to the research specialty of the scientific work increases the chances of consideration for publication by the particular journal [9]. It also serves the purpose of delivering the scientific content to the target audience for whom the finding/content of the scientific manuscript will be of maximum benefit [10].

Submission of manuscript which focuses on a subspecialty work to a multidisciplinary journal may not get a significant number of citations and may have an impact lesser than expected among the target audience as the type of readership for the majority of multidisciplinary journals are mostly non-specialist. However, a few reputed journals such as *New England Journal of Medicine (NEJM)* or *Lancet* are

exceptions. A simple way of selecting the specialty journal is to see how popular the journal is among the peers.

Talking to the seniors, colleagues and established professionals in the field as to what journal they read may help in selecting the specialty journal for submission. Available journal in a particular specialty can also be searched with help of search engines like <https://www.biomedcentral.com/journals>. [11].

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### 11.3 Type of Manuscript: Original Research/Case Report/ Review/Letter to Editor

Many high-impact journals do not publish the case reports and case series. Submission of such manuscript to these journals not only leads to rejection but leads to a considerable time delay in the subsequent submission. Type of manuscript accepted by the journal can be made out from the scope of the journal and the instruction to authors' page. Besides, PubMed provides various limitation criteria for search which can assist in identifying a journal in which similar types of manuscripts have been published earlier.

The journal name with case reports such as Case Reports in Gastrointestinal Medicine, BMC Case Reports, etc. will accept case reports and case series. *Letter to Editor* is a brief communication of scientific finding or a query posed on an original article published in that journal. Many a time the editor provides an option of converting the manuscript to short communication or a letter to the editor when the article does not qualify for full publication but has an interesting message or content. *Short communication* and *Letter to Editor* in a reputed journal also has a wide readership and may receive a good number of citations as well [12]. However, a *Letter to Editor* conventionally does not have an abstract and hence may not be able to provide the gist of the article which may be necessary. Review articles are usually written by a faculty with expertise in a particular area on the request from the editor.

---

### 11.4 Regional/International

Publication in an international journal makes the research widely visible and reaches more target audience. It also has high chances of being cited frequently [13]. It also increases the reputation of authors among the peers and chances of getting the funding for future research work. Nonetheless, research conducted on an area related to regional issue can be submitted in regional journals as the scientific content of the regional area may not be of an interest to the global readers. Adding the word "International" does not make the journal achieve global status. Similarly many regional journals have wider readership outside the country. As the indexing and citation are considered better indices to evaluate the quality of the journal, differentiating them into regional or international journals carries less value in the present day [14, 15].

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## 11.5 Indexed/Non-indexed

Inclusion in a recognized database and indexing is used as a surrogacy for the quality of the journal. The aim of every author is that their research should be easy to find by other researchers so that the scientific content reaches maximum readers. Visibility of the journal plays an important role in serving the above objective. Indexed journals are more likely to be found by the researchers and clinicians as the indexing in a recognized database gives the assertion of the quality of the journal, reputation and its reliability. However, indexing in a particular database does not guarantee from the potentially predatory journal. For example, many journals and its publishers indexed by the index Copernicus have been listed in the Beall's blog as potential predatory journals [16–18]. The recognized indexing databases for the purpose of journal selection include:

1. Medline (Index Medicus)
2. PubMed Central
3. Science Citation Index
4. Embase/Excerpta Medica
5. Scopus
6. IndMED

PubMed serves as a search engine to identify an indexed journal as it searches various databases including Medline and PubMed Central and is freely accessible. Other free search engines include Google Scholar and Scirus supported by Elsevier can also be used for checking the indexing of the journal. Though the journal home page provides the information on their indexing, it is prudent to confirm the same with the above search engines.

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## 11.6 Journal Impact Factor (JIF) and Citation Index (CI)

Journal impact factor (JIF) introduced by Garfield in 1955 is still considered an important measure of the quality of the journal [19]. It shows an average number of citations per paper published in the journal in the last two years. More citation indicates that the article has influenced more researchers and considered to have a better scientific content [20]. Publishing in high-impact journal increases the chance of getting more citations for the article. The impact factors can be found on the journal home page which can be confirmed by using journal citation report (JCR) before the submission of the manuscript as falsified impact factors are projected by few journals [21–23].

H-index (HI) introduced by Hirsch et al., an author-level metric which measures both scientific productivity and the citation impact of the published articles, can also be used to assess the overall impact of the journal [24]. The HI and Science Citation Index (SCI) can be accessed through *Web Of Science (WOS)*, *Scopus* or *Google*

*Scholar*. The latest addition to impact assessment is the *SCImago*, the resource which uses the Scopus database to measure the journal impact and new ranking.

High-impact journal usually has a high rejection rate due to the larger number of submissions and stringent review criteria. Nevertheless, publishing in such journal definitely improves the visibility of the manuscript and earns a higher number of citations.

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## 11.7 Language of the Journal

Most of the scientific research works are published in English. Though the impact of the language of the journal other than English will be constrained due to a limited readership in the regional level, other language journals including French, Chinese, German, Korean, Italian, etc. may be considered for publishing the research content pertaining to regional issues. Many journals allow publication of the manuscript in two languages after due consideration of ethical and legal issues which make the manuscript visible widely among the researches.

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## 11.8 Online vs. Print and Number of Issues

The majority of the journal in the recent days has both online and print versions. Online format has many advantages including online first copy avoiding time delay in print, rapid search facility, easy to retrieve information, wider reach around the world, lesser or no charges for colour illustrations and no need for limitation of word count, etc. [25]. However, researchers around the globe who are from different academic backgrounds may still be more comfortable with the print version. It is also used for the purpose of copying and archiving. Submission in the hybrid journal which has both print and online version increases the visibility of the manuscript.

The journal which has more issues such as weekly and fortnightly is likely to publish more research articles than the one which has only biannual or annual issues. Few journals have more online issues and limited print issues. Choosing the journal with monthly, fortnightly or weekly issues will increase the chance for manuscript publication compared to the one with limited issue annually.

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## 11.9 Open Access

An open-access journal provides the readers full-text accessibility including all its contents. Open access extends the readership beyond the subspecialty and increases the chances of getting higher citation by wider visibility. However, most of the open-access journal charges a fee from authors to make their content accessible online to everyone. By choosing the open access, the author can keep the copyright of the manuscript. The majority of the journals give an option for the author to choose open access. The fee charged by different journals may vary as per the type of manuscript ranging from 100 USD for case reports to 1500 USD for original articles.



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### 11.10 Quality of Peer Reviewing and Acceptance Rate

The quality of the peer-reviewing process can be assessed by calculating the duration between the first submission and the date of acceptance which is usually mentioned in the first page of the manuscript. Longer than 3–4-month duration indicates the poor peer-review system and warns the author about the considerable delay in the decision making on the manuscript. On the contrary, if the peer-review process is very short, it may indicate again a poor review system with low quality. Few journals provide fast-track article processing including rapid peer-review system provided the justification for such fast-track review is explained by the authors. Some journal requests the author to suggest the potential reviewer in the field of the scientific research to shorten the review process [12].

The manuscript acceptance rate is usually mentioned on the journal homepage. Some of the high-impact journals like NEJM has a low acceptance of 5% indicating that the article submitted should be of high-quality scientific content for publication. The acceptance rate of more than 50% for an individual is generally considered as reasonable for publishing the good quality research.

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### 11.11 Prestige and Stability

The longer the duration of publication the more stable and prestigious the journal is. However, the experienced journal which is indexed in many databases and having a short article processing cycle may have a higher rejection rate. On the other hand, the journal started in the recent past may have a higher acceptance rate; however, the stability and prestige of such journal could be less, leading to limited readership and low visibility for the published article. The reputation of the publisher, academic honours and credentials of the editor-in-chief and editorial board and experience of the reviewers in the field are considered when evaluating the prestige of the journal.

*Digital object identifier (DOI)* is a unique identity number provided for each manuscript published. Providing DOI makes the article more stable and easy to find in the search engines. Publishers and journals that provide DOI are considered stable and can be better considered for manuscript submission. Indexing agencies also provide identity like *PMID (PubMed Identifier)*, which serves equally as DOI. Journal indexed in such database is also considered stable for article submission.

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### 11.12 Ethical and Legal Issue

Informative and user-friendly journal website makes the submission easier. It is necessary to read the copyright transfer documents, conflict of interest and funding disclosure policy of the journal carefully. It is also mandatory to check the journal

policy on confidentiality, publication ethics and medical ethics. Most of the reputed journals have an established policy on the above issues and explicitly provide adequate information in the journal website [26]. Submission to any new journal needs scrutinizing of the ethical and legal issues to avoid rejection of manuscript or retraction after submission.

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### 11.13 Potential, Possible or Probable Predatory Open-Access Journals

The authors should be careful in avoiding submission in potential, possible or probable predatory scholarly open-access journals. These journals are from questionable scholarly open-access standalone publishers where the sole motive of the journal is to exploit an open-access platform by charging a publication fee without providing the legitimate service including editorial and publishing services [27]. Identification of such journals can be made by the following characteristics:

- Accepting manuscript immediately with little or no peer-review or quality assessment
- Not disclosing the article processing fee till the paper gets accepted
- Aggressive campaigning to submit manuscripts or to serve as editorial board member
- Listing the renowned academicians as the members of editorial boards without their knowledge/not permitting them to resign from the editorial board
- Appointing fake academics to editorial boards
- Mimicking the name or website style with little change or addition of more established journals
- False declaration regarding the publisher location and address
- Improper use of *ISSNs*, *fake* or non-existent *impact factors*

Jeffrey Beall critically analysed the scholarly open-access publishing and provided the comprehensive list of potential, possible or probable predatory scholarly open-access journals in “<https://scholarlyoa.com>” [17].

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### 11.14 Author Guidelines

Each journal provides author guidelines and insists on reading and following the guidelines before submission. The author guidelines include the format of the manuscript to be submitted, the number of words for each category of manuscript (word count limit), the information necessary for the title page, the specific requirement for the journal, etc. Reading the guidelines fully and preparing the manuscript as per the instruction will avoid delay in the initial manuscript processing. It also indicates on submission that the author has understood the policy of the journal and has taken

**Table 11.1** Checklist for manuscript submission

The general checklist include	Additional requirements in few journals
Cover letter	Study highlights
Title page	Data sharing statement
Main text (manuscript without revealing the identity of authors/institution)	Institute review board/ethics committee approval certificate
Tables	Consent form
Figures	Biostatistics statement
Supporting document/material	Audio/video cap
Signed copyright assignment form	Justification for fast-track review
Conflict of interest statement/financial disclosure statement	Language editing certificate/plagiarism certificate

necessary efforts to prepare the manuscript adhering to the guidelines which increase the chances of rapid processing. Instruction to author also includes the checklist for manuscript submission that lists the documents needed for submission. The absence of any of these documents during the online submission leads to interruption and multiple attempts at submission. Table 11.1 provides the checklist for manuscript submission in a journal.

### 11.15 Advantages of Online Manuscript Submission (OMS)

Generally, there are two types of manuscript submission. In the online submission system, the manuscripts are submitted through the journals' website in predefined and predetermined steps as per the requirements. The second form is submission through snail mail where the manuscript and the related materials are printed and mailed to the editorial office address and the communications will be sent back by mail. In the present era, submitting a manuscript by mailing the document to the journal's office has been literally become non-existent and has been largely replaced by the online manuscript submission. The online manuscript processing has several advantages which include:

1. Fast-track manuscript processing as the delay due to mail submission can be avoided
2. Less expensive as there is no need to print the documents and mailing expenses are reduced
3. Avoids time delay for communication, revision and resubmission
4. Final decision in a reasonable time and intimation to the authors at earlier stage and hence reduces time of manuscript processing cycle and enables authors to submit in another journal in case of rejection in a shorter period of time

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### **11.16 Conflict of Interest and Financial Disclosure**

All the authors of the manuscript are expected to sign the potential or real conflict of interest statement available from the journal website which should be uploaded during the manuscript submission process. Any financial grant and funding from intramural and extramural funding sources/agencies also should be explicitly mentioned in the statement as part of the requirement of the international standard of publication ethics. Subsequent detection of any conflict may lead to untoward consequences by retracting the manuscript or legal proceeding against the authors.

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### **11.17 Copyright Transfer Agreement**

Copyright form is a legal document which transfers all the copyright ownership for printing, reprinting, republishing, etc. Each journal has their own copyright form which needs to be signed by all the authors and submitted before acceptance of the article. The copyright assignment form should clearly state the title of the manuscript, names of the all authors and their affiliation and contact details of the corresponding authors.

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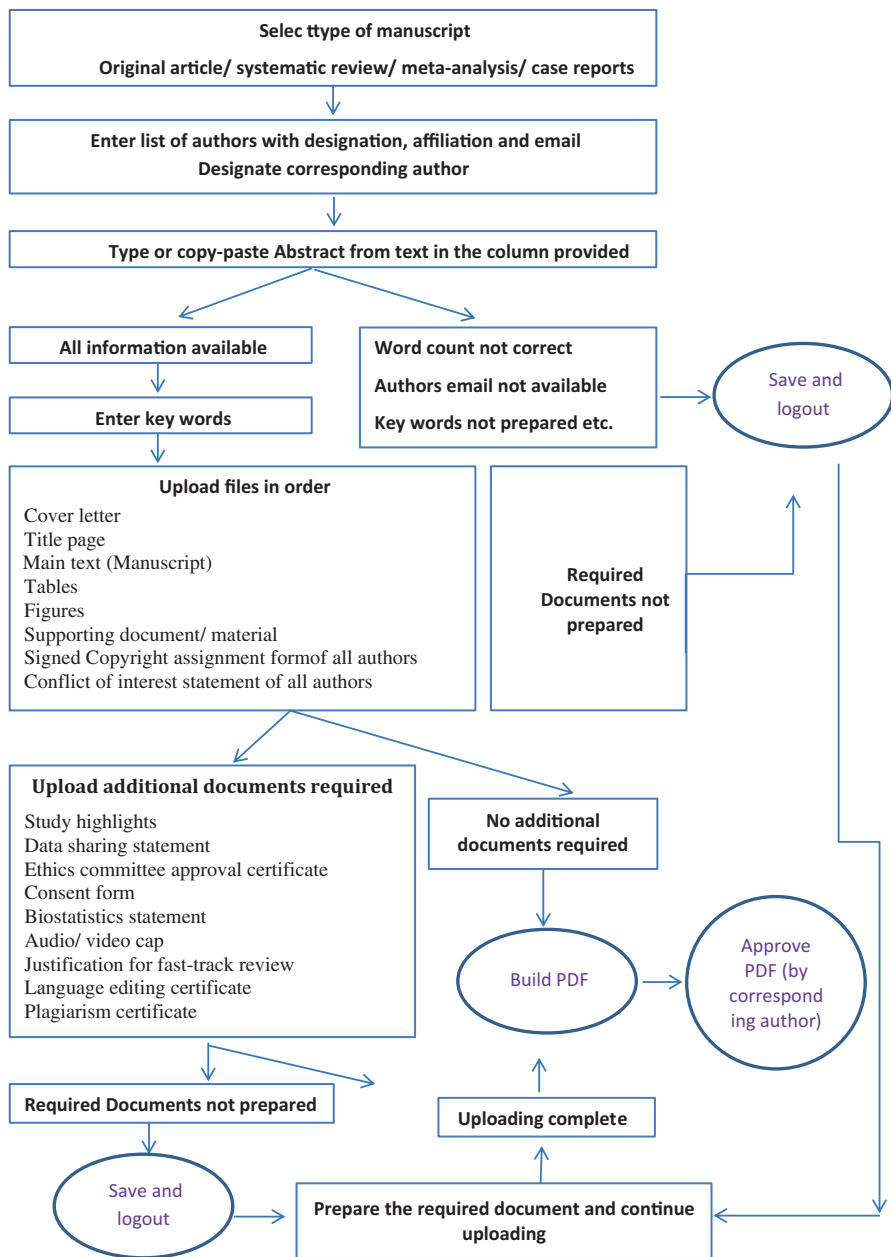
### **11.18 Manuscript Submission Process**

Each journal requires registration on their home page using a user id and password. Logging in with an author role takes the web page to the submission process. Since the documents need to be uploaded in sequence, any deficiency realized during the submission mandates stopping of the submission process. Author can log out after saving the submission process done so far. Once the required document is ready, the author can log in again and continue the submission process. The online submission process for an article is shown in Fig. 11.2. Once all the required documents are uploaded, the PDF will be built. Checking the PDF for any error is very vital as once approved, the PDF cannot be changed. The authorization for PDF approval in most of the journal is restricted to only the corresponding author. Figure 11.2 illustrates the submission process of a manuscript (Fig. 11.2: Manuscript submission flowchart).

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### **11.19 Manuscript Tracking System**

Most of the journals use a common online manuscript submission and tracking system like Manuscript Central (ScholarOne). After the initial screening for matching of manuscript content and the scope of the journal, a reference number (ID) is generated. The confirmation of receipt of the manuscript with the manuscript reference ID will be mailed to all the authors. The manuscript processing cycle with timeline can be traced with the reference ID on the journal web page. Subsequent correspondence regarding the review/revision/decision, etc. will be made through email to the corresponding author.



**Fig. 11.2** Manuscript submission flow diagram

## 11.20 Withdrawal of the Manuscript and Its Consequences

“Withdrawal” of manuscript is considered when there is serious concern about the data and the results which may lead to publication ethics misconduct. Request for withdrawal of the article can be made by the corresponding author after the consensus with other authors. The request should be addressed to the editor stating clearly the reason for the withdrawal. When the manuscript is in the review process before the final publication, the editor has the final say regarding the withdrawal. If the withdrawal is done following publication, it will be mentioned as “retracted publication” on the journal website and the search engines.

Withdrawal or retraction raises the adverse opinions about the authors among the scientific society. This may have adverse consequences, especially for young authors who are starting their research career [28]. Journals also impose certain disincentive sanctions including monetary penalty and rejection of manuscript from all the authors for a certain period of time. The related journals from the publisher may blacklist the authors which may adversely affect them. It is essential that all authors of the manuscript should be aware of the international standard of publication ethics published by the Committee of Publication Ethics (COPE) which has been followed by all reputed journals [29].

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### Scenario

1. While submitting a manuscript to an indexed journal, you find that the PDF of the article is not built and the web page requests you to upload all the mandatory files before building the PDF. Which of the following is the appropriate step?
  - (a) Change the name of the manuscript and upload title page and main text separately.
  - (b) Upload study highlights and data sharing statement.
  - (c) Upload consent form and copyright transfer form.
  - (d) Check the instructions to the author of that journal for mandatory files that need to be uploaded.

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# Revision of an Article and How to Deal with the Rejected Manuscript

# 12

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*Rejection is nothing more than a necessary step in the pursuit of success. – Bo Bennet*



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## Key Points

- Not following the instructions to authors of a journal is a fundamental mistake and one of the common reasons for revision of the submitted manuscript.
  - It is important not to disagree with the reviewer's comments unless the change suggested by the reviewer can negatively influence the content of your manuscript.
  - Never forget to incorporate relevant responses to reviewer's comments in the revised manuscript.
  - Resubmission of the rejected manuscript to the same journal is the least favored option and should be used only in exceptional circumstances.
  - Choosing a correct journal and incorporating the changes suggested by the reviewers will improve the chance of acceptance of rejected manuscript in a different journal.
- 

## 12.1 Introduction

Revision of the submitted paper is a critical step in the process of peer review and getting your article published. Researchers especially those who are in the early part of the career should learn the art of responding to reviewer's comments effectively and submit an impactful revised manuscript to enhance the chance of getting their revised manuscript published. Most of the young researchers learn the art of paper writing under the guidance of senior investigators. In common practice, the young researcher during the residency period gets the full guidance and support of the senior investigator at the time of writing the original manuscript. Unfortunately, they don't get enough guidance on how to respond to reviewer's comments as the senior researcher who is the corresponding author mostly does it, and the young investigator would have already completed his course and left the institute. This chapter focusses on how to write an effective response to reviewer's comments with tips and practical examples. Also, various options to deal with your rejected article are discussed in this chapter.

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## 12.2 Editorial Decision on Paper: Types

An article submitted for publication in a journal will be reviewed by the reviewers, and based on their comments the editor takes one of the following four decisions [1]:

- Accept without any changes
- Accept with minor revision
- Resubmit after major revision
- Reject

In the current era, it is exceedingly rare for a manuscript to be accepted without any modifications. If the editorial decision is a minor revision, it is likely that the manuscript will be accepted once the requested minor changes are done. Usually, the editor takes the final decision himself without sending the manuscript for peer review again. Most of the well-written manuscripts with novel conclusions are accepted with minor revision. When major changes are requested then, the article has to be resubmitted with revision, and it goes through the process of peer review again by the same or different reviewers. Authors need to follow the guidelines elaborated in subsequent sections of this chapter to improve the quality of revised manuscript.

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### 12.3 Avoid Basic Mistakes

One of the most common reasons for revision is not following the instructions to authors of a particular journal. *Read* it carefully, as these are fundamental mistakes that leave a wrong opinion about the article. Most of the high-impact journals even don't send the articles for peer review if the article is not formatted as per journal requirements. Some of the key areas that one should focus while reading the journal's author instructions are:

- Font type, font size, line spacing, and page margins
- Order of the contents of the manuscript and how to number the pages
- Word limit for abstract and manuscript
- Maximum permitted number of illustrations and references
- Accepted image and video format for illustrations like pictures and videos

Another common mistake that should be avoided is grammatical errors in the article. If the reviewer points out that there are multiple grammatical errors in the article, apologize for the mistakes and take the assistance of English writing enhancement software and grammar check software to correct them. If English is not your native language, before submission of the manuscript, it is advisable to upload your article in one of the grammar check software for grammatical errors.

Begin your response to reviewer's comments with a brief covering letter addressed to the editor thanking the reviewers for their valuable comments and how you have replied and updated the revised manuscript.

#### Example of a Covering Letter

*Dear Editor,*

*We thank you for your decision letter on our manuscript entitled "..... manuscript name...." We have taken into account the reviewer's comments and provide a point-by-point answer to each of them. Changes in the revised version of the manuscript are highlighted. We do realize that the comments of the reviewers have helped improve this manuscript. We do hope that you will find this revised version suitable for publication.*

*With kind regards,*

*Authors*

## 12.4 Respond to All Comments

One of the common mistakes made by authors is the failure to respond to all the comments of the reviewers. The simplest way to ensure that it does not happen is to copy and paste all reviewer comments in the Word document and type your response below it. Another mistake commonly done by the authors is to respond to all comments but forget to update the changes in the revised manuscript. Failure to incorporate the changes in the revised article will delay the acceptance of your manuscript. When the corrections are updated in the original article, make sure you follow the instructions of the journal. Some journals would require using track change mode, while others might need the corrections to be highlighted in different color. It is advisable to mention the page and line number where the corrections are made in the manuscript.

### Example

*Reviewer's comment: The authors do not mention anything about the need for bile duct resection and reconstruction in their operations for either GB cancer or XGC. Has this never been necessary?*

*Authors reply: Common bile duct excision was selectively performed when there was direct infiltration or extensive nodal disease in the hepatoduodenal ligament (to facilitate lymphadenectomy) or in patients with an underlying choledochal cyst. Three patients in Group A and 41 patients in Group B underwent CBD excision. The indications for CBD excision added in the methods section on page 7, lines 7–11 of the revised manuscript and the data of patients who underwent CBD excision is given in the revised table.*

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## 12.5 Can Authors Disagree with Reviewer's Comments?

A researcher who spends a lot of time in doing a scientific research and writing a manuscript can easily get offended when they read reviewer's comments especially when the comments are a bit harsh. It is easy to get carried away and give inappropriate remarks like the reviewer doesn't have any knowledge about the study and use apolitical words. However, it is important to realize that it is imperative to explain in detail why what the reviewer is thinking may not be appropriate or correct. The author should understand that the reviewer spends the time to read your paper to facilitate the publication of your article. The analysis of the reviewer's comments by the authors should always begin by assuming that the reviewer may be correct and that the proposed change will improve the paper. Approaching reviewer's comments with a nihilistic attitude usually do not aid in achieving the goal of getting your work published. Before disagreeing with reviewer's comments, ask the following questions to yourself and act accordingly:

- Does the change suggested by the reviewer an improvement? If the answer is yes, make the change proposed by the reviewer.

- Does the change suggested by the reviewer not much of an improvement but do no harm? If the answer is yes, still make the change proposed by the reviewer, as it is not going to alter the meaning of your article.
- Does the change suggested by the reviewer negatively influence the content of your manuscript? If the answer is yes, then you can politely disagree with the reviewer's comment.

However, scientific evidence rather than vague statements should back your disagreement. Your defense should be scientifically sound so that the editor understands your point of view and make an informed decision about your paper. If an adverse comment of the reviewer is secondary to the misunderstanding of the facts already given in the manuscript, make necessary changes in the text to make the points explicit.

Examples of response to reviewer's comments when authors do not agree with reviewer's comments:

- *Reviewer's comment: The recurrence rates in Group B are more – whereas we would expect them to be less if not equal to the Lap-group. It reflects the advanced stage IIIB in group B.*
- *Author's reply: While the number of patients with recurrence was more in Group B compared to Group A there was no significant difference in the proportion of patients with recurrence [1/24 (0.04%) vs 3/46 (0.06%),  $p = 1.00$ , Fisher's exact test].*
- *Reviewer's comment: So the groups are not strictly comparable.*
- *Author's reply: The groups were similar for the preoperative findings. On final histopathological examination (HPE) the proportion of patients with the stage IIIB disease was more in Group B although the difference was not statistically significant. The two Groups were comparable for demographic and clinical variables. However, we agree with the reviewer's comments that the groups were not randomized.*
- *Reviewer's comment: The conclusions of this study are not novel.*
- *Author's reply: The data regarding LRC is limited in the literature. While few studies have shown the feasibility of LRC, the majority of these series had either a small number of patients or did not have a control arm to compare the results. While the results of the present study are not novel to the conclusions derived from the previous studies, the present study is the largest LRC series to report the feasibility and early oncological outcomes of this approach compared to ORC from a high volume center. The results of this nonrandomized comparative study will form the basis for future randomized trials.*

---

## 12.6 How to Deal with the Rejected Manuscript

Rejection of a submitted manuscript is a common phenomenon in every scientific researcher's career. It is important to understand the common causes of rejection of article to minimize the possibility of your article getting rejected. Of the multiple reasons summarized in Table 12.1, improper study design is one of the most

**Table 12.1** Common reasons for rejection of the submitted manuscript in a journal

S.No	Reason	Comments
1	Relevance of the topic	Unimportant topic or research question with little clinical relevance, lack of novelty
2	Poor study design	Flaws in methodology with inadequate description, biased protocol, inappropriate statistical tests
3	Improper manuscript writing	Poor organization, grammatical and spelling errors, use of inappropriate acronyms or terminology
4	Lack of interpretations	Interpretation not concordant with the data and erroneous conclusions
5	Wrong selection of journal	Submitted manuscript beyond the scope of the journal
6	Noncompliance of the author	Not following the instructions to authors of a particular journal
7	Plagiarism	Articles are rejected even before sending for a peer review
8	Blacklisted author	For scientific misconduct

common causes for rejection of the manuscript [2, 3]. Since rejection is inevitable even for senior researchers, one should be aware of available options after rejection [4]. Every author has some choices after a manuscript is rejected by a journal. Broadly they can be classified as:

- Appeal the rejection and resubmit it to the same journal.
- Submit it to another journal.
- File the manuscript without resubmission.

## 12.7 Appeal the Rejection and Resubmit It to the Same Journal

This option is not recommended as it has the least success rate. If the editor of the journal is interested in publishing your manuscript, he would have asked you to resubmit it after major corrections. As an author, you have every right to appeal the rejection. However, the appeal should be backed by strong scientific reasons and not emotional factors. The success of resubmission to the same journal depends on the cause for rejection. The appeal is unlikely to succeed if the article is rejected for the following reasons:

- The article is beyond the scope of the journal.
- Lack of novelty or originality of the research unless the reviewer has misunderstood the novel findings.
- Flaw in the study design as it cannot be modified after completion of the study.

Also, if the journal had rejected your article without sending for peer review or informed you that they are not interested in accepting any future versions of the manuscript, respect their decision and submit it to a different journal. However, resubmission to the same journal can sometimes be successful. In the author's experience, one of the high-impact surgery journals had initially rejected an article on corrosive stricture esophagus because the disease condition is not of interest to its readers. However, with proper reasoning, the article was considered for publication in the same journal. The comment is given below with slight modifications as an example:

*Reviewer's comment: Your manuscript entitled "...manuscript name." was reviewed by three reviewers. Overall, the comments were favourable. However, the corrosive esophagogastric injury is not common in this part of the world and hence your article may not be of interest to the potential readers of this journal. We regret to inform that your article cannot be considered for publication in "... Journal name..."*

*Author's reply: We thank you for your decision letter on our manuscript entitled "... manuscript title". While we agree that the given disease condition is not common in the West, the reader profile of your esteemed journal is not restricted to the West but many Asian countries. Since the current series is the largest series published yet in the field of corrosive esophagogastric injury, publication of our article in your esteemed journal would help clinicians to manage these complex problem. Considering the favorable comments of the reviewers, we request you to reconsider your decision to reject our manuscript for publication in your esteemed journal.*

Whenever an appeal is made to the same journal, it is important to be polite with your comments and not to belittle the reviewers with harsh comments.

---

## 12.8 Submit It to a Different Journal

It is the best option to choose for your rejected manuscript. It is important to understand that 70% of all manuscripts that are rejected are eventually published in another journal [5]. Submission can be done to a different journal without making any changes to the original manuscript or after revision. Resubmission without any correction is easy, but it is not usually recommended. There is every chance that your article might go to the same reviewers through the different journal, and it significantly reduces your chance of acceptance. This option is recommended only when the manuscript was rejected because it was submitted to a wrong journal.

Article rejected after peer review is an excellent opportunity to improve your manuscript. The reviewer's comments are valuable suggestions to make critical

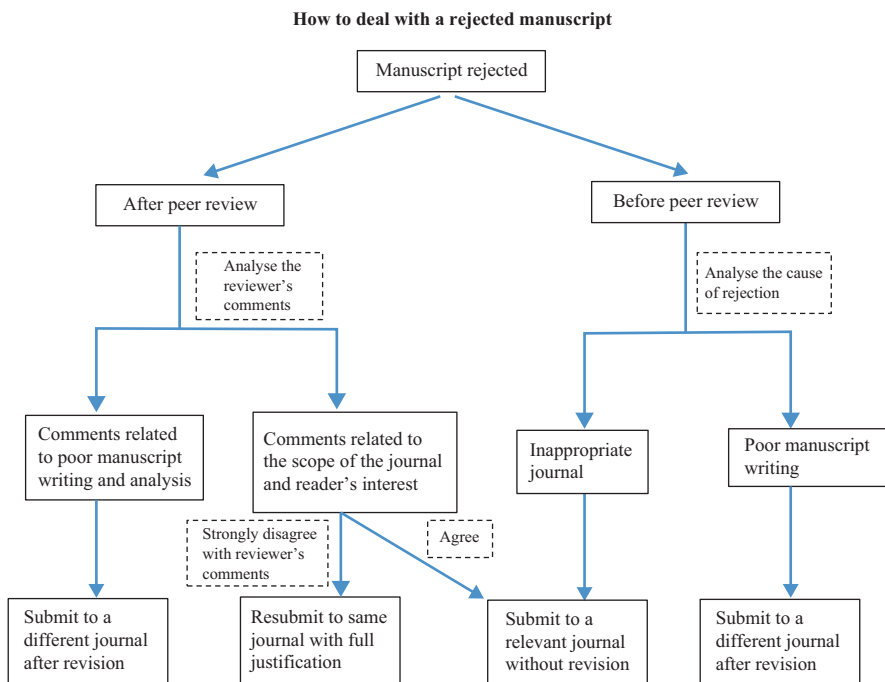
changes in your article. New reviewers are likely to identify the same mistakes pointed out by the original reviewer and rejection after peer review gives you a chance to address those issues before submission. Careful attention should be paid to the reviewer's comments to improve your manuscript. Whenever the article is rejected for poor writing, identify the mistakes. Examples of poor manuscript writing are the use of clinical slang, jargons, and local terminology in the article. Any data that reveal patient information should be strictly avoided. Before resubmission to a new journal, make sure that the details like the cover letter, reference format, and other contents of the manuscript are modified as per new journal's instructions.

When you resubmit, you should choose an appropriate journal. For example, if you want to present a rare presentation of a common tumor given its advanced stage, you should select a journal published from a country where such presentation is not common. For example, "*a case report of advanced gallbladder cancer presenting with cholecystocutaneous fistula*" or a "*case report of advanced gastric cancer presenting with inguinal node metastasis*" is more likely to get published in a Western journal compared to a tropical journal where these presentations are not uncommon [6].

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## 12.9 Filing the Manuscript Without Resubmission

If the article is rejected in two or more journals, it is easy to get frustrated and feel that your paper is not worthy for resubmission in any journal. Filing the manuscript without resubmission is an easy decision to take; however, it is not recommended as you are dumping your scientific research. The failure to publish the results and outcome of any original scientific is a loss to the scientific community. Your results might be precious to other investigators by providing the missing link to a research question or to head off fruitless avenues of research. Keep improving the quality of your manuscript based on the reviewer's comments. If one journal rejects your article, try another one and another one and yet another one till you find the ideal match for your manuscript. If you are not sure which journal to select for your article, choose a journal with broad scope and low selectivity. If the results of your study are not novel, select journals which do not give importance to the novelty of research but to the methodology and data analysis. Open access journals are an option; however, financial constraints might be a limiting factor. The last option is to upload your research paper in online digital repository sites like Figshare. The articles uploaded in these sites will be citable and freely accessible (Fig. 12.1).



**Fig. 12.1** Shows an algorithmic approach to deal with a rejected manuscript

## 12.10 Conclusion

Responding to reviewer's comments is an art that every investigator needs to master. An article sent for revision should be viewed positively as it indicates that the editor is still interested in considering your manuscript for publication in their journal. Following the guidelines and practical tips on how to respond to reviewer's comments elaborated in this chapter can enhance the chance of getting your article accepted for publication. Rejection of an article is an inevitable outcome even for reputed researchers. However, rejection is not the end of the world for a manuscript. Understanding the common causes of rejection of an article and relentless efforts to convert your article into a luminary manuscript can help achieve the ultimate goal of publication in a reputed journal.

## Case Scenario

An original article entitled "Modified Frey's procedure versus standard Frey's procedure for chronic pancreatitis – a randomized controlled trial" was submitted to the "Journal of Chronic Pancreatitis." After peer review, the editorial decision on paper



was to resubmit after major changes with point-to-point response to comments of the reviewers.

Which of the following is true or false?

1. Can I selectively respond to only reviewer's comments that I feel relevant?
2. Can I disagree with reviewer's comments?
3. Will the editor update the manuscript with changes based on my response to reviewer's comments?
4. Will my revised manuscript be subjected to peer review again?

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Akash Shukla and Avinash Supe

*If you haven't done the work, don't put your name on it.  
If you put your name on the paper, then you are stuck with it.  
– CF Wooley*



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## Key Points

- Authorship should be considered if one has made substantial contributions to the conception, acquisition, analysis, or interpretation of data, drafted or revised the work, approved the final manuscript, and willingness to take responsibility (ICMJE criteria).
- Authorship is attractive as it helps in professional growth and leads to respect from the peers. It also makes people susceptible to potential malpractices to get authorship.
- Authorship comes with important responsibilities like honesty, transparency, and ensuring originality of work.
- The sequence of authors is decided by quantum and importance of their contributions.
- An individual having a role in the research is eligible to be considered as a contributor. The role of all contributors must be mentioned in the publication.
- People helping only in data collection, performing statistics, technical contributions, and data entry, or those who have obtained grants or head of the department should be all acknowledged but cannot be considered as authors unless they fulfill the ICMJE criteria.
- Gift authorship or honorary authorship is to bestow authorship upon an individual when that individual does not fulfill the criteria for authorship.
- Ghost authorship is the absence of the name of an individual as an author, despite making a substantial contribution to the article and fulfilling ICMJE criteria. It is especially prevalent in industry-initiated or industry-sponsored trials.
- Plagiarism is an act of using another person's words or ideas without giving credit to that person and is common in medical literature. Anti-plagiarism software are now available to check this menace at least partially.

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## 13.1 Introduction and Definition

The word author has its origin from Old French “autor” (a person who invents or causes something) or from Latin “augere” (increase, originate, promote). The spelling was modified probably due to the influence of word authentic to strongly convey the meaning. Merriam-Webster dictionary provides a simple definition of an author as a person who has written something, especially, a person who has written a book or who writes many books or a person who starts or creates something (such as a plan or idea). It is this simple definition of the author that is often confused with the term author as used in the scientific literature where it is much more than just giving an idea, planning a research, or merely writing a paper.

The International Committee of Medical Journal Editors (ICMJE) has recommended that authorship should be considered only on fulfilling all the following four criteria [1]:

1. Substantial contributions to the conception or design of the work or the acquisition, analysis, or interpretation of data for the work
2. Drafting the work or revising it critically for important intellectual content
3. Final approval of the version to be published
4. Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

The fourth criterion was actually added later in 2014 to ensure accountability of author(s) and integrity of the scientific work. Only those who fulfill all four criteria can be considered as authors, while those who have made contributions but do not satisfy all four criteria must be acknowledged and their roles mentioned. Ideally, if someone is satisfying the first criterion, then he/she deserves a chance to satisfy the other three. Providing technical support, assisting data collection, reviewing the manuscript, or being the head of the department alone is not sufficient to become an author.

---

## 13.2 Importance of Authorship

The author gets the credit for the article and has the satisfaction of spreading the newly acquired knowledge to his peers. There is also a sense of fulfillment of contributing to the progress of society in general by making a difference. Other benefits include getting respect from the peers, better standing in the scientific communities, and fame. Authorship may help in promotions in academic positions. It helps in acquiring credibility to get funding for other research projects. It also leads to getting invitations as faculty/speaker in conferences or institutes. This makes authorship attractive, and this tempts individuals to succumb to potential malpractices to get authorship. There are responsibilities for authorship as well. The fourth criterion of ICMJE mentions accountability and integrity [1]. All authors should be able and willing to take public accountability of the published work. Only those individuals willing to take both credit and public responsibility of the work should claim authorship.

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## 13.3 Accountability and Duties of Author(s)

In order to maintain the faith of readers and the society, it is important that the authors realize their responsibilities and do their duties diligently. Detailed international guidelines have been suggested by the Committee on Publication Ethics (COPE) on standards and responsibilities of authors [2]. In-depth discussion of this subject is beyond the scope of this chapter, and readers are requested to refer to these guidelines for the same. Some of the key responsibilities of the authors are discussed here [2, 3]:

1. *Originality*. The idea on which the work is done has to be original, and if not so, then the source of the idea must be acknowledged and presented in the paper. The work should not be submitted to multiple journals simultaneously. There should be complete respect for and adherence to copyright laws. Adequate permissions must be taken before reproducing any article or its part thereof. Salami publications and overlapping publications should be avoided or must be declared to the authors and readers.
2. *Conflict of interest*. Conflict of interest refers to a situation where there is a potential of personal or professional interest influencing the research outcomes or publication. These may include but are not restricted to financial interests with the pharmaceutical industry (consultancy, shares, employment, etc.), personal rivalry, professional rivalry, and patents. Some of these may be subtle (like rivalries, not always subtle, though!), while some are obvious (such as employment). It is important that the conflicts of interest are disclosed to the editors and the readers who can then have their own interpretations and judge it for themselves.
3. *Honesty and transparency*. The authors should ensure that the data and its interpretation are presented honestly and without fabrication or manipulations. It is not uncommon to conceal findings which cannot be explained or which differ from other findings of the paper. This is strongly discouraged. All the findings must be presented, and if a finding cannot be explained, then the same must be stated. All sources of funding must be revealed and also the role of such sponsor(s). It is also the duty of the author to make sure that contributions are duly acknowledged. And only those individuals who fulfill criteria are authors.
4. *Responsibility*. The authors have to ensure that they are willing to take complete public responsibility of the authenticity of their paper. They have to also ensure that due permissions are taken and registrations are done for the research project. Authors must comply with standard and statutory ethics throughout the study and publication.

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## 13.4 Authorship Policy

All contributors deserving authorship by virtue of fulfilling ICJME criteria must be listed as authors. Nobody who does not fulfill the criteria should be an author. The authorship is best decided at the time of the starting of the project to avoid conflicts later. The roles of each author must be predefined at the time of formulation of the project. Once the paper is being published, the contribution of each of the author should be revealed to the editor. The journal may then decide to publish the same. Each part of the paper, which presents the key conclusions of the study, must be the responsibility of at least one author [3]. At the same time, each author must approve each component individually and independently.

### 13.4.1 Order of Authors

There are varied differences in the practice of orders of authors. The author contributing the maximum and writing the first draft of the manuscript is usually the principal or the first author. The order of remaining authors is decided by the importance of their contributions [4]. The last author is usually the senior-most author or head of the group. Some large multiauthor groups designate authorship by a group name, with or without the names of individuals. In multicenter studies, the first author is the one who writes the first draft, and the rest may be listed in an alphabetical author or based on the descending number of patients contributed.

### 13.4.2 Corresponding Author

The author who takes primary responsibility for communication during the entire publication process is the corresponding author [5]. He has to ensure compliance with administrative requirements of the journal. He may delegate the work to one or more coauthors but takes responsibility for the same. The corresponding author should be available throughout the publication process to respond to editorial queries in a timely way. The ICMJE recommends that editors send copies of all correspondence to all listed authors [1].

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## 13.5 Contributorship

An individual having a role in the research is eligible to be a contributor. Contributorship includes authorship as well as those contributions, which do not qualify as authorship. There are problems with the concept of authorship, which has led to this broad concept of contributorship. The definition of authorship is not uniformly accepted and varies among fields with different conventions. The relationship between contributors and the research can be very complex, and many individuals may have played a critical role but may not fulfill the strict criteria of authorship. Mentioning these names in acknowledgment section alone, which is often a small note at the end of the paper, may not be a fair representation of their contribution. Sometimes, their contribution may be vital and would then definitely deserve more attention/credit than a mere acknowledgment. Ignoring or undermining important contributions leads to disputes and has a damaging effect on the morale of researchers, the credibility of the research and authors, as well as the scientific community. Therefore, it is imperative that the exact contribution of each individual is described in detail whether it amounts to authorship or not. This avoids some of the problems mentioned above. Many journals have already started doing this. However, this may not be adequate, and better profiling methods are warranted. Software and digital libraries in the public domain carrying the detailed researcher-research relationships rather than author list can obviate many such issues.

### 13.6 Acknowledgments vs. Authorship

All people who have contributed to the research must be acknowledged in the paper. Their role must also be disclosed and acknowledged. If someone has reviewed the manuscript and given critical input and suggested changes but has not been involved otherwise, it should be considered for acknowledgment and not authorship. Sometimes, one of the senior members gets the research grant but does not contribute subsequently claims authorship by virtue of obtaining the grant. This however amounts to acknowledgment only, and the person should not be considered as an author. Similarly, head of departments often claims authorship because they have allowed the research and often reviewed the manuscript. However, the same should be acknowledged, and such head of department should be made an author only if he fulfills ICMJE guidelines. People helping in data collection, performing statistics, technical contributions, and data entry, should be all acknowledged but cannot be considered as authors unless they fulfill ICMJE criteria. Referral of patients, writing assistance, and general supervision should be acknowledged but not considered for authorship. Some believe that those who have contributed by taking over clinical duties so that the researcher can carry out his research must be made authors [6]. This is strongly discouraged and the same may be acknowledged in the final paper. When a book is written, the author often thanks the spouse and family for allowing him to spend time writing the book and sometimes for inspiring and giving unconditional love. He/she doesn't make him/her coauthors! Another situation arises when a trainee or a fellow finishes his research/dissertation but does not prepare the manuscript. The senior guide usually asks another person to write the manuscript. Often, the person writing the manuscript becomes an author, and the person who had carried out the original work is omitted as an author. In such cases, every attempt should be made to contact the original researcher and invite him to be an author by ensuring that he fulfills the criteria. Should the same not be possible, then his work should be acknowledged only. The person who has written the manuscript in such case cannot claim authorship as he has not been involved in the planning, execution of research, and data analysis. His role in writing manuscripts also merits acknowledgment alone. The National Institutes of Health states that the privilege of authorship should be based on a significant contribution to the conceptualization, design, execution, or interpretation of the research as well as to the drafting or substantively reviewing or revising the research article [7]. Authorship also conveys responsibility for the study. Individuals who do not meet these criteria and have assisted the research in the form of encouragement and advice or by providing space, finance, reagents, occasional analyses, or patient material should be acknowledged in the paper but should not be included as authors.

## 13.7 Gift Authorship

It is a common practice to bestow authorship upon an individual when that individual does not fulfill the criteria for authorship. This is sometimes also referred as honorary authorship. It is based at best on a tenuous association with the study. The prevalence of honorary authorship has been estimated to be more than 30%. Another study has suggested that the presence of six or more authors is more likely to have gift authorship as compared to those with three or less [8]. The common types of gift authorship handed over are under following circumstances:

1. *Departmental head.* It is not unusual for the department head's name to be included in the research paper. This may be due to respect for the head or recognizing the fact that the head has facilitated the research. It is often for the purpose of self-preservation that is to be in a favorable position and avoid being in bad books of the department head.
2. *Junior colleagues.* It is also a common practice to bestow authorship upon junior colleagues. This may be done because they have fewer publications, to boost their CV and encourage them for research, or sometimes as a reward for good clinical work and sincerity. However, this is unethical and must be strongly discouraged.
3. *Colleagues.* Colleagues who have handled clinical work or surgery while the investigators were doing the research are sometimes made authors to respect their indirect contribution. This may also happen for a mutual arrangement of being bestowed authorship in each other's papers. This is unethical.
4. *Scientists of repute.* Name of a person with a good reputation is included in the author list without significant contribution by the scientist. This is often done to increase the chances of the publication of the paper or improve the status of paper after publication. This is also referred to as "guest authorship."

All these practices are unethical and discouraged. Sometimes, the gift authorship may be coercive in nature where the senior researcher or departmental head forces a junior colleague to include his/her name in list of authors. It becomes an ethical dilemma for the junior researcher. Unfortunately, there are no objective safeguards regarding the same due to the subjective interpretation/nature of the guidelines and vulnerability of the juniors.

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## 13.8 Ghost Authorship

Ghost authorship is the absence of the name of an individual as an author, despite making a substantial contribution to the article and fulfilling ICMJE criteria. It is especially prevalent in industry-initiated or industry-sponsored trials where the sponsors hire a professional agency/individual or their own employee(s) to carry out the duties of an author. Their name doesn't appear in the author list. This makes him and the sponsor nonaccountable. This also conceals the bias that invariably creeps in. The worst



scenario is when a research is carried out and written by a pharmaceutical company but published in the name of a scientist of eminence who has not carried out the research.

The prevalence of ghost authorship was found to be 11% in 1996 and 9% in Cochrane libraries in 1999 [9, 10]. In the study published in BMJ in 2011, ghost authors were present in 49/622(7.9%) articles across six journals ranging from 2.1% to 11% [11]. In a study published in PLoS Med, 33/44(75%) of industry-initiated trials had ghost authorship. Prevalence increased to 40/44(91%) when those whose names were included in acknowledgment rather than as authors were included as ghost authors for analysis [12]. In a recent study published in 2015, 10/168 (6%) randomized drug/device trials were found to have primary ghost authorship [13]. It was found in those trials which had industry funding and collaboration. Such menace needs to be curbed immediately and effectively.

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### 13.9 Plagiarism

The Latin word “plaga” means a hunter’s net and the Latin word “plagiare” refers to kidnap. The Merriam-Webster dictionary defines plagiarism as the act of using another person’s words or ideas without giving credit to that person. It is a fraudulent act since it amounts to a violation of intellectual property rights. Some common forms of plagiarism are copying sentences from someone’s paper without mentioning the source, claiming other’s ideas as own, using images or videos without permission, failing to give the correct reference(s), etc.; if majority of work or idea is copied from somewhere, it amounts to plagiarism, even if due acknowledgments are made. Mosaic plagiarism refers to using other’s ideas and phrases and mixing them with some ideas and phrases of self. This is done without giving credit to the former. This may be very difficult to detect. Copying one’s own previous works also amount to plagiarism. Plagiarism is not uncommon and often goes unnoticed/unpunished, although there have been instances where the article has been retracted after publication and the author reprimanded. Anti-plagiarism software are now available and increasingly used. It is the duty of authors, reviewers, editors, and publishers to ensure that no plagiarized work is published.

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### 13.10 Summary

Authorship is prestigious and gives a sense of fulfillment, respect by peers, and fame. ICMJE has given four criteria for authorship and has recommended that authorship should be considered only on fulfilling all the criteria. Contributions not amounting to authorship must be duly acknowledged and the details of such contributions provided. The role of each author and contributor should be made available honestly and publicly. Issues of gift authorship and ghost authorship have emerged as threats to the credibility of the scientific community. The scientific community is rising to meet these challenges, and control measures have been formulated and implemented. The current control measures need to be strengthened and

implemented more vigorously and meticulously to fight this menace. Plagiarism is common and often unnoticed. It is the joint duty of authors, reviewers, editors, and publishers to maintain the sanctity of scientific publications and research to maintain credibility and retain the faith of the society in this fast-developing field.

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## Case Scenario

A PhD student has done the thesis under the guidance of associate professor in the department. They conceived the study, wrote the protocol, did the research, and wrote the manuscript. The head of the department helped by permitting the research and providing space and equipment. A senior professor got the funding for the project. Another PhD student helped in the collection of data for 3 months when the researcher was on maternity leave. Who will all be authors in the manuscript?

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*As far as he can achieve it, readability is as important for the scientific writer as it is for the novelist. – Donald O. Hebb*



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## Key Points

- It is important for budding medical writers to familiarize themselves with the various types of medical manuscripts.
- Brief correspondences or letters to editors are usually about a published article, a letter about a point of view or a description of a surgical technique.
- Case reports are descriptions of a rare case or a new treatment method with a brief review of literature.
- Case series are a series of similar cases, which are either rare, or where a new treatment method has been used.
- Original articles or scientific papers are either a lab-based experiment, a case-controlled study, a randomized controlled trial or a cohort study.
- The CONSORT (CONsolidated Reporting of Clinical trials) statement consists of a 25-point checklist and a flow diagram which authors can use to ensure that the article is in keeping with the guidelines for publishing clinical trials.
- It is important to register clinical trials in a registry. Most countries have their own trials registry.
- The Helsinki declaration gives guidelines about the ethical principles to be adhered to, whilst conducting trials.
- Review articles provide comprehensive knowledge about a topic and range from descriptive reviews, qualitative reviews and quantitative reviews (meta-analyses).

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## 14.1 Introduction

The Royal Society of London is probably the first scientific body to start publishing scientific articles. It started publishing '*Philosophical transactions*' a scientific periodical, in 1665, and published news, reports and letters of scientific research without a specific format. As scientific methods for evaluating a theory or an experiment had not evolved, most published articles relied on first-person accounts written in great detail with linguistic skills and rhetoric employed to emphasize a theory. There were no means of testing the veracity of many of the articles published by distant authors, and peer review process did not exist. The articles published were on scientific topics but not related to medicine. Medical articles made their entry into the journal by the early eighteenth century. In 1731, Edinburgh Medical School started publishing *Medical Essays and Observations* which later became the *Edinburgh Medical Journal*. It had a peer review process dating from 1733. *Lancet* started as an international medical journal in 1823 followed by *British Medical Journal* in 1857. The twentieth century saw most significant changes in medical literature writing. From the personal narrative of single cases, there were case series and research articles published more frequently. After the Second World War, the format of introduction, methods, results and discussion (IMRAD) was recommended by most journal editors. In 1978, the International Committee of Biomedical

Journal Editors formed the Vancouver group and recommended the IMRAD style as the standard for publications. It subsequently underwent several revisions and is followed even today [1].

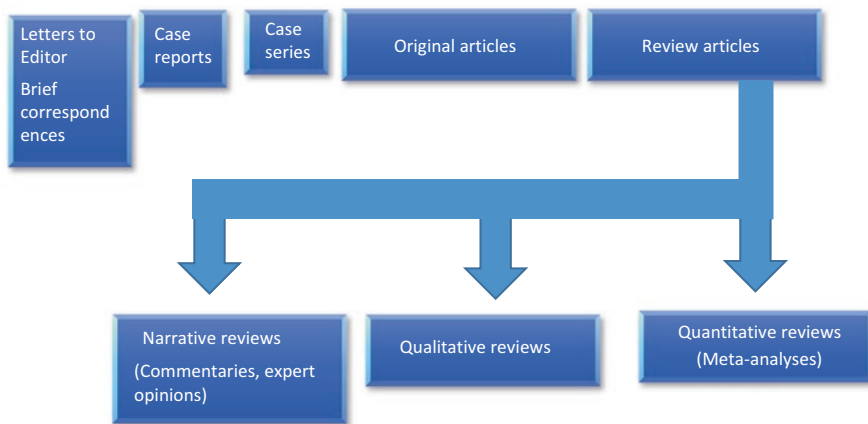
Medical publication formats vary widely and range from letters to editor to meta-analyses. Some journals are choosy about the types of articles they accept and make it clear in their guidelines for submission. Many journals use non-scientific articles as fillers in the journal, and this is common practice in general interest journals.

This article is meant to give the readers an overview of the various types of medical manuscripts. This description is not comprehensive, and several subcategories of manuscripts exist. With regard to the writing styles for each category, the readers are advised to consult individual journal’s instructions to authors’ page.

The most common types of scientific manuscripts are [2]:

- Letters to editor/brief correspondences
- Case reports
- Case series
- Original articles
- Review articles
  - Narrative reviews(commentaries, expert opinions)
  - Qualitative reviews
  - Quantitative reviews (meta-analyses)

Figure 14.1 shows the types of medical manuscripts.



**Fig. 14.1** Types of manuscripts

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## 14.2 Letter to Editor/Brief Correspondences

These are the simplest forms of scientific publication. They are easier to get published and often the type of publication which authors in their early phase of the career aim for, to enhance their CVs. Most journals have this section towards the last few pages of the journal. Letters can be about published articles in the past issues or about any other topic which may be of interest to the readers. If it is about a published article, usually the editor publishes it alongside a response from the authors of the article. They do not conform to the usual structure of scientific articles which take the format of introduction, methods, results and discussion (IMRAD).

They are usually in the format as below.

*Dear Sir*

*We read with interest the article published by.....in your esteemed journal. Whilst it makes useful reading, we have the following comments about the article.....*

Sometimes the letters are not about any particular article but a topic of interest or a scientific technique. Some surgical journals, however, have a separate section for contributions in the field of surgical technique/innovations in surgery. Some of the journals under this section accept abridged versions of an original article or other short communications which may include reports of rare cases/limited case series. The journal instructions under this section usually have restrictions on word count, tables and figures submitted with the manuscript. Some of the authors prefer to have an abridged original article as a letter to editor in a journal with higher impact factor rather than a full article in a journal with relatively lower impact factor (Pagadala NNB, Parija SC, Kate V. *Helicobacter pylori* in alcohol-induced acute pancreatitis. *Pancreas* 2014;43:970).

Though they are viewed as minor publications, letters and brief correspondences can be powerful means of getting a short message across.

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## 14.3 Case Reports

Case reports are one of the early forms of medical literature. Like letters and brief correspondences, they are often starting points for academic writing for doctors in the early phase of their career. Case reports can be about a new and rare clinical condition, a rare presentation of a case, an unusual complication of a drug or treatment or a new technique for treating a condition.

Whilst publishing case reports, it is important to do a detailed literature search to check for other similar cases in the literature and highlight the reasons why the case is unique. The rarity of the topic has to be emphasized in the introduction based on the previously documented evidence. The validity of the case report can be enhanced by the use of photographs supporting the novelty of the case. The discussion needs to highlight the uniqueness of the published case as well as details of any similar cases

published in the literature. The format of a case report is abstract, introduction, case report, discussion followed by references. The abstract should summarize the case, its key findings and the message from the case report. Case report includes a description of the clinical details such as history, examination findings, investigations and treatment outcome. The discussion should be brief and lucidly compare the case being reported with previous reports in terms of its uniqueness and the valid learning points. Conclusion should precisely emphasize the key learning points from the article in one or two lines. It should provide the reader an explicit core tip [3].

Some journals such as the British Medical Journal use a shortened format wherein a clinical photograph is published with a brief description.

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## 14.4 Case Series

A case series includes a group of similar cases with a similar theme. They can be relating to a rare condition or a specific treatment used. Case series often include a limited number of patients, conventionally ranging up to ten. If there are a large number of patients where statistical tests can be employed, it is better to adopt the style for an original article with the format of introduction, methods, results and discussion. The manuscript of the case series is similar to that of a case report. The format can be described as introduction, case summary, discussion and references. However, when there are a limited number of cases ranging up to five, detailed summary of individual cases can be provided separately. In instances where there are a larger number of cases, summary of few cases can be combined with each other.

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## 14.5 Original Articles/Scientific Articles

These are publications of a scientific study undertaken by the authors. The study can be a lab-based experiment, a case-controlled study, a randomized controlled trial or a cohort study. These articles are highly valued and often undergo a more stringent peer review process.

The format for these articles is in the form of abstract, introduction, methods, results, discussion and conclusion (IMRAD format).

The abstract gives the summary of the whole article in a condensed form and can either be a paragraph or subdivided into sections as introduction, methods, results and discussion. Abstracts are freely available online for readers if the journal is indexed in PubMed or a similar resource.

The introduction gives the background of the study in a few paragraphs including information on the history of the clinical problem or the scientific experiment, mentioning articles published earlier.

Methods detail the way the experiment was conducted including the technical details or in the case of a clinical trial, details of recruitment and statistical methods used for the study. If it is a human trial or trial involving animals, it is important to highlight that ethical clearance was obtained.

The results are summarized in the text as well as illustrated in tables and graphs. Details of the statistical tests are given in the results section.

The discussion explains the relevance of the results, any unexpected findings and details the literature on this topic. This is often the largest section of the article.

The conclusion is usually a short paragraph enabling the reader to focus on the key points from the article [4].

### 14.5.1 Publishing Clinical Trials

Accurate reporting of clinical trials is extremely important for the progress of medicine. Historically several shortfalls have been reported in the documentation of clinical trials. In 1996, a group of journal editors and scientists developed a document called CONSORT (CONsolidated Reporting of Clinical trials) to improve the reporting of clinical trials and to enable transparency [5]. CONSORT statement underwent revisions in 2001 and 2010. The latter is the most up-to-date statement which is available free to download from their website [www.consort-statement.org](http://www.consort-statement.org). The CONSORT statement consists of a 25-point checklist and a flow diagram which authors can use to ensure that the article is keeping with the guidelines for publishing trials. The checklist pertains to the contents of the introduction, methods, results and discussion. The flowchart illustrates the passage of patients through the trials including enrolment, intervention, allocation, follow-up and interpretation [6].

Another important aspect of clinical trials is registration of clinical trials. In 2004, the International Committee of Journal Editors (ICJME) decided that they will accept clinical trials for publication only if they were registered before the first patient was enrolled [7]. Clinical [trial.gov](http://clinicaltrials.gov) is the first clinical trials registry that was established and is part of the United States National Library of Medicine. It is one of the most widely used registries today. International Standard Randomised Controlled Trial Number Register (ISRCTN) is an international non-profit organization which lists numerically all the trials registered with it. The top registries in the world are Clinical [trial.gov](http://clinicaltrials.gov), EU Register, Japan Registries network, ISRCTN and Australia and New Zealand Network. WHO maintains an international portal for trials registry at <http://apps.who.int/trialsearch>.

India's registry is called Clinical Trials Registry-India (CTRI) and was established in 2007 and functions from Indian Council for Medical Research's National Institute of Medical Statistics. Their website can be accessed at <http://ctri.nic.in>.

### 14.5.2 Helsinki Declaration and Human Trials

The declaration of Helsinki is a code of ethical principles developed regarding human experimentation. It was developed by World Medical Association and is considered one of the pillars of ethics in human experimentation. It was first adopted in 1964 at a meeting in Helsinki and has subsequently undergone seven modifications, the latest of which was in 2013. The underlying principle of the Helsinki



declaration is that it is the moral responsibility of physicians to ensure the wellbeing of his patients who are taking part in medical research. The declaration is morally binding on physicians though it is not enforceable under the international law. Whilst publishing articles involving human trials, it is important to write about the ethical approval for the study from the local body and adherence to the latest version of the Helsinki declaration. The latest version of the Helsinki declaration can be downloaded from the website of World Medical Association ([www.wma.net](http://www.wma.net)) [8].

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## 14.6 Review Articles

Review articles provide a comprehensive knowledge on a topic and therefore are useful resources for young physicians as an educational tool as well as for senior academics who are planning research projects. These articles are frequently downloaded and therefore increase the impact factor of the journals. Journals often solicit review articles from experts in a field. Most journals also accept unsolicited review articles.

These can be of the following subtypes

- Narrative reviews: These can be editorials, commentaries, narrative nonsystematic reviews or invited experts reviews
- Qualitative systematic reviews
- Quantitative systematic reviews (meta-analysis)

Editorials are narrative articles by the editor of the journal or an invited author. They can be about the current issue of the journal or any other topical subject. They may be based on a small group of focused articles.

Commentaries are usually written by an expert and are narrative reviews. They provide the expert's view on a particular topic and help to stimulate academic research.

Narrative nonsystematic reviews are a review of previously published articles in a condensed format. The authors are usually experts in a field. The bibliographic research methodology may or may not be described. The information from the retrieved articles can be summarized as bibliographic cards. Tables and figures help the reader understand the articles better [9].

Invited review articles are from experts in an area. These articles are long descriptive articles and do not have any specified format. They usually start with an introduction of the topic, historical details, review of the literature and the current best practice based on author's experience. There is an inherent bias in these articles towards a method of treatment or technique developed by the author, and the readers are usually conscious of it.

Qualitative reviews use strict bibliographic criteria to collect articles on a focused topic. They analyse the results of the studies by writing a summary and critique of the studies. They are called qualitative studies as the results are not statistically combined. Certain studies may be excluded if they do not fit the criteria for analysis [10].

A quantitative review or meta-analysis is a systematic review of the highest order wherein studies are analysed by pooling the patient data and analysing those using statistical tests. These reviews are powerful in providing strong evidence in medical literature. One of the drawbacks is that the studies are heterogeneous, and combining them may be difficult. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement helps to improve reporting, focusing on systematic reviews of randomized controlled trials by providing a checklist of 27 essential items for transparent reporting. Cochrane, previously known as Cochrane Collaboration, is another non-profit scientific body which publishes quantitative reviews on various topics. They are published in Cochrane library which is a subscription based database.

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## 14.7 Levels of Evidence

In Medical parlance, it is common to speak of evidence for a practice. This usually means the evidence available from medical literature to justify a practice.

The type of article also constitutes the level of evidence it provides.

The Oxford Centre for Evidence-Based Medicine classifies these as follows:

- 1a: Systematic reviews (with homogeneity) of randomized controlled trials
- 1b: Individual randomized controlled trials (with narrow confidence interval)
- 1c: All or none randomized controlled trials
- 2a: Systematic reviews (with homogeneity) of cohort studies
- 2b: Individual cohort study or low-quality randomized controlled trials (e.g. <80% follow-up)
- 2c: “Outcomes” research; ecological studies
- 3a: Systematic review (with homogeneity) of case-control studies
- 3b: Individual case-control study
- 4: Case series (and poor-quality cohort and case-control studies)
- 5: Expert opinion without explicit critical appraisal or based on physiology, bench research or “first principles”

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## 14.8 Non-scientific Articles

Several journals accept non-scientific articles. These may be light-hearted articles about a particular topic, biography of a scientist, a poem about a clinical condition or the representation of a clinical condition in stamps or literature. Christmas edition of British Medical Journal is almost exclusively dedicated to light-hearted articles.

It is important that young physicians and scientists embarking on their first publication familiarize themselves with the types and styles of scientific manuscripts. The choice of manuscript is dictated often by the type of study or information to be

conveyed. Websites of journals give detailed information about the types of manuscripts they accept as well as the format for writing them.

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## Scenario

1. You are planning to publish the results of an animal experiment you conducted.
  - (a) What is the standard format for publishing a scientific paper?
  - (b) Considering it is an animal experiment, what declaration should be made in the section on methodology?

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# What Does a Reviewer Look into a Manuscript

# 15

Devinder Mohan Thappa and Malathi Munisamy

*Science has a culture that is inherently cautious and that is normally not a bad thing. You could even say conservative, because of the peer review process and because the scientific method prizes uncertainty and penalises anyone who goes out on any sort of a limb that is not held in place by abundant and well-documented evidence. – Al Gore*



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## Key Points

- Scientific integrity and consensus rely on the peer review process which is the cornerstone of scientific publications
- Major areas of concern for the reviewers – relevance and importance of the scientific content with regard to the mission of the journal: novelty, originality, and external and internal validity of the study.
- Major causes of rejection – flawed study design and methodology, poor discussions and unsupported conclusions, unoriginal, predictable or trivial results, inappropriate data presentation, and poorly organized manuscript.
- Collective efforts and responsibility of all players of the system – authors, reviewers, and editors in improving the quality of submitted manuscripts.

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## 15.1 Introduction

Scientific integrity and consensus rely on the “peer review process,” the cornerstone of scientific publications, which dates back to as early as the early eighteenth century. Its importance in the furthering of science cannot be overstated [1, 2]. The purpose of a review is not only to help the editor take a decision regarding the publication of a manuscript but also to provide feedbacks to the authors to improve their scientific process and communicate it appropriately resulting in the publication of high-quality science.

Hence, in the current “publish or perish” ethos, it is essential for the authors to have a thorough understanding of the review criteria that are evaluated during the peer-review process so as to take adequate measures during preparation and submission of the manuscript. This would enable them to prepare a systematic and well-organized manuscript which can easily impress upon the reviewers and editors, thereby increasing the chances of their manuscript getting accepted for publication and finally be able to communicate their ideas better to the scientific community.

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## 15.2 The Review Process

Once a manuscript is submitted to a journal, it undergoes an initial screening process by editors to see if it meets the standards for the journal, and if the standards are met, the manuscript is screened if all instructions to authors have been adhered to, and if not, it is sent back to the authors for technical modifications. If no technical modifications are required or once the manuscript is submitted after making the instructed technical modifications, it is subjected to in-depth assessment by peer reviewers.

There are two types of reviews based on who conducts the review, namely, the “internal review” if the review is conducted by members of the editorial board and “external review” when it is done by experts in the field. For external peer review, the reviewers are selected by the editors based on their area of expertise according to the focus of the manuscript. Some journals may ask the authors to suggest potential reviewers during submission in which case the authors are expected to suggest independent reviewers who are experts in the topic of interest and not their friends

and colleagues. But the final choice of reviewers will be based on the editors' decision [3–5]. Blinding is an area of contention in the peer-review process, and there are three types of peer review based on blinding, and each type has its own advantages and limitations. If only the authors are blinded and do not know who the reviewers are but reviewers know who the authors are, it is a single-blind review. If both authors and reviewers are blinded to each other, it is a double-blind review. On the contrary, when both authors and reviewers are not blinded to each other, it is an open review [6].

Once sent for peer review, the articles are scrutinized by reviewers conforming to the standards of Committee on Publication Ethics (COPE) ethical guidelines for peer reviewers [7], and they follow standard review criteria, the intricate details of which will be discussed in the next section.

Once the review is done, the reviewers provide their comments, suggestions, and queries to the authors and give their opinion regarding the manuscript to the editor in confidence. Once all the reviews from all the reviewers have been submitted, the editor reads the reviews and the manuscript and makes a collective decision to accept or reject the manuscript outright or encourage resubmission or withhold judgment pending major or minor revisions based on his discretion and opinion from all reviewers. The reviewers' comments and editors' comments and decisions are then sent to the corresponding author. The authors are requested to address all concerns raised by reviewers and editors and make a satisfactory revision of the manuscript and submit it providing a point-to-point reply to all the recommendations mentioning the changes made in detail. Once submitted, the manuscript will

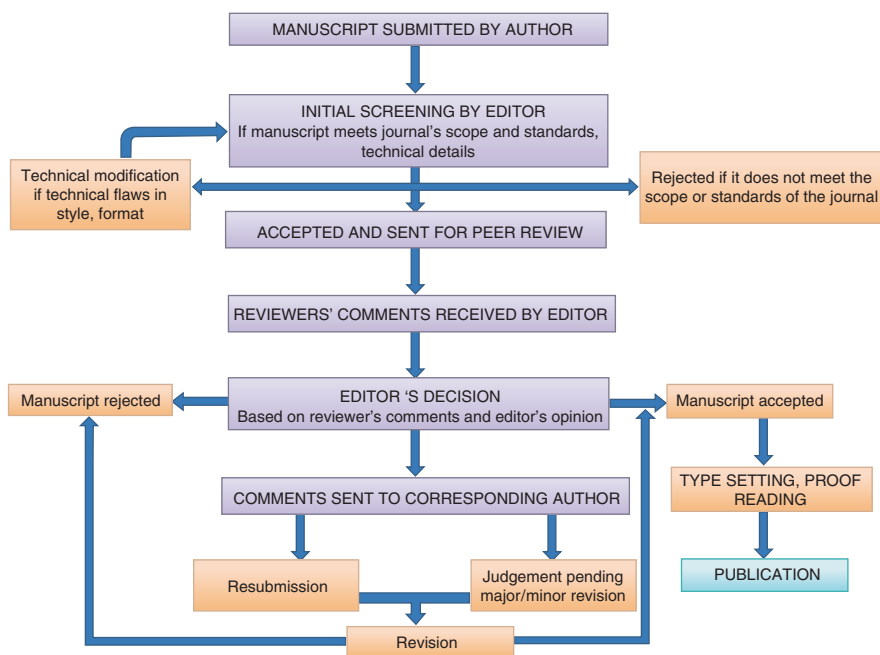


Fig. 15.1 The review process

again go through some or all the above mentioned stages, and finally, when it has been revised satisfactorily to meet the standards, it will be accepted and put into the production process to be prepared for publication. Though the process seems to be apparently simple, the actual steps involved are quite complex and elaborate involving a number of people and alternative procedures thus justifying the substantial time factor involved in the review process [3–5]. The entire review process is outlined in Fig. 15.1.

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### 15.3 What Does a Reviewer See in a Manuscript?

The manuscript reviewing process from the editors' and reviewers' perspective shall be discussed under three sections: general considerations, specific considerations related to the scientific merits of the manuscript, and finally the organization and presentation of the manuscript.

#### 15.3.1 General Considerations

The first and foremost concern of the editor and reviewer of the journal is the *relevance* and *importance* of the scientific content of the manuscript with regard to the mission of the journal and its readership irrespective of the inherent merit and quality of the manuscript. While *relevance* refers to judgment about the propriety of the manuscript for the journal, *importance* refers to the judgment about the priority or magnitude of the area of interest of the journal. In addition, they also assess whether the research question is significant enough to be worth asking which is based on the importance of the topic and if the question has been adequately and appropriately addressed based on the execution of the study [2, 8].

The next concern is the *novelty and originality* of the study wherein the reviewers ensure that the manuscript answers novel research questions which could be highlighting something previously unknown which could be new data or ideas or methods or could be contradicting to an existing notion or might provide insights for understanding a theory or could generate additional research that would advance their field or be relevant to the community [2, 9]. In the case of previously addressed questions, they check if there is enough new information to justify publication.

The *validity* of the study is the next important factor taken into consideration. The validity of quantitative studies is assessed by its generalizability based on the selection of participants, sample size, setting, intervention, and materials. For qualitative studies, it is assessed based on the generalizability or transferability of the concepts or theories provided by the study to other contexts or people [8, 9].

As discussed in the review process, the editors also look into the suitability of the format, style, and length of the manuscript for their journal.

## 15.3.2 Specific Considerations Related to the Scientific Merits of the Manuscript

In this section, we shall discuss the review criteria which the reviewers use to assess each component of the scientific contents of the manuscript.

### 15.3.2.1 Title and Abstract

The reviewer assesses if the title is clear, informative, and representative of the scientific content. The abstract is checked if it accurately reflects the manuscript as a whole especially the salient findings and contains all essential details. The consistency in the details among abstract, text, tables, and figures is thoroughly evaluated with special attention to the conclusion of the abstract whether it is justified by the information provided in the abstract and text [2, 10, 11].

### 15.3.2.2 Introduction

The introduction section is evaluated to see if the authors have provided an adequate map for guiding the reader to the justifications that their study is necessary, relevant, and novel. For this, the reviewers assess if the problem statement, the context for the problem statement, and the conceptual framework with the research question with its justification, rationality, and novelty are clearly stated and well articulated. They also look into if the constructs being investigated are clearly identified and presented. In addition they scrutinize if the literature review in the introduction is comprehensive, well analyzed, and critically appraised with an inclusion of up-to-date, classical, and highly relevant empirical studies [2, 9, 10, 12, 13].

### 15.3.2.3 Methods

The methods section is the most critical part of the manuscript, and major flaws in this section would result in outright rejection of the manuscript. Thus, this is the most critically reviewed section to evaluate if the authors have clearly described the blueprint for answering the question described in the introduction. First and foremost, the reviewers analyze if the study design and data analytic techniques are appropriate for meaningful assessment of the research question. Next, they determine if the methods are clearly described in sufficient details with transparency so as to enable replication of the study by other researchers. They analyze how well the authors have accounted for the chosen study design's strengths and limitations in their specific research context. They evaluate if sample size calculation for the study has been clearly mentioned and is adequate enough to answer the research question. They check if details about institute review board (IRB) approval and informed consent and ethical considerations have been mentioned [2, 9, 10].

For quantitative study, they assess if the study design has "internal validity" (which refers to "integrity or credibility") and "external validity" (which refers to "generalizability") of the study to answer the research question. The internal validity is assessed taking into consideration if all potential sources of bias especially selection and measurement bias, confounding variables, attrition of research participants, the strength and integrity of any interventions, reactive effects, and study management are clearly mentioned in detail. The external validity is assessed taking into consideration if the



participants, settings, and conditions of the study are representative of the population, and the results of the study can be applied beyond the research setting. For the qualitative study, they look into the techniques employed to assess the trustworthiness of the data. For interventional studies, they focus on every minute detail of the intervention which includes objectives, activities, time allocation, and training to assess if the intervention was good enough to provide the desired effects and if the details are clear enough to enable replication of the study by the readers [14, 15].

Next, the reviewers evaluate the measurement and operationalization of the constructs, that is, if the appropriate instruments were selected for data collection, if the scoring methods are clearly defined, if the tools were administered properly, and the outcomes that are going to be reported are mentioned. Finally, they assess if data quality control has been adequately described and if any secondary data that has been used is defined [2, 16].

#### **15.3.2.4 Data Analysis and Statistics**

The reviewers and statistical consultants for the journal check if the data analysis procedures conform to the study design and are appropriate to answer the research question and are described in sufficient detail. They evaluate if appropriate statistical tests have been used and if power calculation, effect size or functional significance, multiple tests or comparisons, and adjustment of significance level for chance outcomes, missing data analysis, etc., are provided in detail [2, 9, 17, 18].

#### **15.3.2.5 Results**

The results section is the next most important component of the manuscript. The reviewers evaluate if all results both primary and secondary results and not only the significant findings are presented in a logical and consistent order with actual data than percentages or summary statements conforming to the methods and research questions. If tables, graphs, or figures are used to represent data, they are assessed if they agree with the text and are self-explanatory and are judiciously used without being a mere replication of data provided in the text. They assess if tables and figures improve the readability of the manuscript and accessibility of complex constructs and data presentation to readers. They check if the titles for tables and legends to the figures and images are provided and are cited in the text. Images are assessed for their clarity, focus, resolution, and masking of patient's identity [2, 9, 10, 19].

#### **15.3.2.6 Discussion**

The reviewers focus if the organization of the discussion matches the structure of the results and methods with a coherent interpretation of methods and results. The reviewer determines if the discussion is clearly written relating to the problem statement and research question and is justified by the results illustrating the key points. They then evaluate if the authors have described how their study results relate to other research in the field and how it fits in the context of relevant literature. They assess if the authors have provided plausible alternative interpretations and practical and theoretical implications of their findings and if they have discussed the strengths and limitations in the design, procedures, and analyses of their study [2, 10, 20].

### 15.3.2.7 Conclusion

The reviewers evaluate if the conclusions are clearly stated projecting the key findings, based on reasonable interpretation of results mentioning the relevance of their study in expanding the existing knowledge in the field with suggestions to guide future research [2, 9, 10, 20].

### 15.3.2.8 References

The reviewers assess if all facts are backed up by references and if the citations reflect current knowledge with all the recent, important, and relevant papers in the area cited. They finally check if all references are complete in the standard style as per the journal's guidelines.

### 15.3.2.9 Standardized Checklist

The reviewers assess the overall quality of the manuscript based on standard guidelines for different study designs, and authors are required to submit these standardized checklists. The standard guidelines for various study designs are provided in Table 15.1.

**Table 15.1** Standard reporting guidelines for various study designs [21]

S.No	Study design	Reporting guidelines
1.	Randomized controlled trials	Consolidated Standards of Reporting Trials (CONSORT)
2.	Non-randomized clinical trials	Transparent Reporting of Evaluations with Non-randomized Designs (TREND) [22]
3.	Observational studies – cross-sectional, case control, and cohort studies	Strengthening the Reporting of Observational Studies in Epidemiology (STROBE)
4.	Systematic reviews and meta-analyses	Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)
5.	Case reports	CASE REport (CARE)
6.	Qualitative research	Standards for Reporting Qualitative Research (SRQR) Consolidated criteria for reporting qualitative research (COREQ)
7.	Diagnostic/prognostic studies	Standards for Reporting Diagnostic Accuracy (STARD) Transparent reporting of a multivariable prediction model for individual prognosis or diagnosis (TRIPOD)
8.	Quality improvement studies in health care	Standards for QUality Improvement Reporting Excellence (SQUIRE)
9.	Economic evaluations of health interventions	Consolidated Health Economic Evaluation Reporting Standards (CHEERS)
10.	Animal preclinical studies	Animal Research: Reporting of In Vivo Experiments (ARRIVE)
11.	Study protocols for clinical trials	Standard Protocol Items: Recommendations for Interventional Trials (SPIRIT)
12.	Systematic review and meta-analysis protocols	Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P)

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### 15.3.3 Organization and Presentation of the Manuscript

Finally, the reviewers assess the how well all components of the authors' ideas, observations, and interpretations are effectively organized and presented with clarity to communicate it coherently to the readers. They check if the manuscript is structured appropriately with no interchange of segments and if there is the correct balance between text, tables, and figures which should be cited appropriately in the text. They look if any discrepancies exist between the abstract and the main text. In the main text, they evaluate if the authors have followed the required general **IMRaD** (Introduction, Methods, Results, and Discussion) format with a logical progression of the sentences and paragraphs complementing each other. The reviewers also consider if the text is simple, well written in a flow which is easy to follow, and comprehensible to the readers without grammatical errors and spelling mistakes [2, 10, 23].

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### 15.4 Tips to Survive a Peer Review

Studies have reported the most common reasons for rejection of manuscripts to be flaws in study design, inadequate details in methods, weak discussions and conclusions unsupported by data, unoriginal, predictable or trivial results, inadequate or inappropriate presentation of data, and verbiage with poor flow of ideas [24–26]. Elaborating the middle two sections (methods and results) of the manuscript with shortening of the two sections at the ends (introduction and discussion) could significantly improve the quality of the manuscript and minimize their chances of rejection [24]. We hereby provide a summary of the common mistakes likely to be committed by the authors which increase the chances of rejection of their manuscript and tips to overcome these so as to impress the reviewers and editors to increase the chances of acceptance of their manuscript making the journey to scientific publication a pleasurable experience. (Table 15.2).

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### 15.5 Conclusion

It is thus the collective efforts and responsibility of all the players of the system including the authors, the reviewers, and the editors in improving the quality of the manuscripts submitted to a journal. This will result in a good quality scientific publication with well-documented evidence in which a well-conducted peer-review process plays the critical role. Hence with an adequate knowledge about the review process and the assessment criteria used for review, authors could improve the odds of publishing their research papers in reputed journals by anticipating and rectifying the common flaws by investing time in planning and writing their research with good scientific quality.

**Table 15.2** Tips to survive a peer review [2, 10, 27–30]

S.No	Common mistakes committed	Tips to overcome
<i>General</i>		
1.	Scientific content inappropriate for the journal	Examine the scope of the journal and description of its contents before submitting
2.	Inappropriate type or format or length of the manuscript	Reading thoroughly the instructions to authors section of the journal for the journal style guidelines
3.	Omissions of components in the submission checklist	Check for all items required and gather them before submission. These include the following: IRB or ethics committee approval, written informed consent, clinical trial registration number, reporting guidelines appropriate for the study, full names, qualifications and affiliations of all authors and full contact details of corresponding author, authors' signatures and statement of contributorship, copyright form, consent to reproduce copyright material or patients' photographs or medical details, signed agreement from anyone mentioned in the acknowledgments sometimes required in few journals, conflict of interest form, documentation of "personal communications," and evidence of "in-press" citations
4.	Writing just a bland covering letter with only the routine formal contents	Prepare a properly addressed covering letter mentioning one or two sentences describing the novelty of your finding, its "newsworthiness factor," and why it would be appropriate for the journal in addition to the routine formal contents
<i>Manuscript</i>		
5.	Lack of novelty, originality, and presentation of obsolete study	Conduct research which would really move the field forward with a view to ultimate publication and hence not to waste time conducting series of studies with minor variations in study design, only to have to go back to make the required number of repetitions of an experiment to allow for statistical analysis
6.	Title not clear or suggests a relationship among constructs that was not found in the data	The title should accurately reflect the manuscript as a whole, in particular, the findings mentioning the most salient key words If clever title is used, a subtitle should indicate the actual subject matter of the manuscript
7.	Poorly written abstract not following the journal's requirements	The abstract should be succinct, accurate and focused and as per the journal's style Should describe the context, objective, methods, results, and conclusion reflecting information presented in the body of the paper Should not be a copy of the verbiage of the paper Structured/ unstructured as per journal style and format

(continued)

**Table 15.2** (continued)

S.No	Common mistakes committed	Tips to overcome
8.	A theoretical introduction not mentioning the background and rationality clearly with no mention of research hypothesis	The objective of doing research to be emphasized with proper justifications, backed by sufficient data
		The literature review should reflect the collective information but need not cite every study on a topic to date. But, classical and/or highly relevant empirical studies should be included
		Gaps in literature should be identified as basis of study
		Citing systematic reviews and meta-analyses, when available, can help in keeping the introduction concise
		Research hypotheses, if stated, should follow logically from the literature review and be clearly stated and be testable
9.	Inadequate description of the methods with failure to include enough detail on what was done Poor study design to answer the research hypothesis	Better to put too much information into the methods section than to be too brief with a detailed description of study design, apparatus used, procedures followed, technique used, protocol followed, units of measurements, drug brand names, companies names, survey instruments used, etc.
		Appropriately designed study design and methodology that should reasonably allow the hypothesis to be tested
		Participants, sample size, inclusion and exclusion criteria, data collection methods, setting of the study, and statistical methods used should be mentioned in detail with justification for the choices of techniques, analytical tools, and statistical methods
11.	Misinterpretation of p values	Should not test hypotheses for statistical significance alone and avoid clinical significance
		Should not over test data with multiple testing to try and find anything that is statistically significant which would result in increased type 1 error
		Power analysis should be done and mentioned
12.	Sub-reporting of results Inconsistency in reporting of results Interpretive comments are included in the results section	The results should be presented in a logical, consistent order consistent with the methods
		Results should contain actual data rather than percentages, summary statements, or generalizations with straightforward documentation of what was found
		Numbers should be accurate and should “add up”
		Results should be reported for every aspect of the study described in the methods, even if no significant differences were found or measurements could not be obtained
		Large numbers of individual measurements should be carefully grouped to convey the overall results without overwhelming the reader with details
		If tables and figures are used, the text should summarize and not repeat the data in the tables and figures

(continued)

**Table 15.2** (continued)

S.No	Common mistakes committed	Tips to overcome
13.	Tables and figures are a mere visual representation of information already found in the text and are inappropriate and not labeled	Tables and figures should be clear and concise and accurately reflect the findings presented in the text
	Tables and figures not cited in text	Arrows need to be added to depict important or subtle findings
	Numbering, formatting, and quality of tables and figures not adequate and consistent	Figure legends should provide a clear explanation that allows the figures and graphs to be understood without referring to the remainder of the manuscript All tables and figures should be cited in the text
14.	Erroneous misinterpretation of findings in the discussion	Should not be a mere review of the literature and be concise
	Uncritical acceptance of statistical results	Discuss if the hypothesis was verified and what questions were answered and why the findings are important, and discuss these findings as they relate to published literature
	Interpreting the findings in a manner not concordant with data reported	Should not include irrelevant and redundant material
	Elaborate discussion	Except for explaining how they fit in with previous work, pointing out their limitations, and speculating cautiously about how they may extend current understanding, the author should let the data speak for themselves than trumpeting or marketing their findings overzealously
	Failure to consider alternative explanations for the results	
	Limitations of study not mentioned	
15.	Conclusions not supported by data	Conclusions should be justified by the results found in the study and should state the primary findings of the study relating to the previously stated objective of the study
	Drawing conclusions disproportionate to the results	Should not overstate or expand beyond results
		Makes suggestions for future studies
16.	Incomplete and inappropriate references ignoring the journals' format with no recent or relevant references; misquoting of references	All statements of fact must be backed up by primary references reflecting the current knowledge
		All key references in the area should be cited
		References should be complete in numbering and format conforming to the standard style of the journal
		No unnecessary references should be included

(continued)

**Table 15.2** (continued)

S.No	Common mistakes committed	Tips to overcome
<i>Presentation</i>		
17.	Poorly organized, lengthy, ponderous and wordy style, stilted, flowery, or deliberately complicated writing or ambiguous writing with failure to communicate clearly, use of multisyllabic words, redundancy, excessive abstraction, etc.	<p>Say what you mean don't use big words as with scientific writing; the simplest and most direct statement of the intended message is always best</p> <p>Clinical slang, clichés, purely local terminology, pejoratives, and unnecessary personal information about patients should be omitted from the manuscript</p> <p>Abbreviations and acronyms should be used as sparingly as possible and avoid coining new acronyms and labels</p>
18.	Poor grammar, syntax, or spelling and poor formatting and spacing	<p>Take help from a native English-speaking colleague to assist with the preparation of manuscripts if English is not the first language</p> <p>Read the manuscript carefully prior to submission, and preferably ask a number of individuals to check the typescript for errors as familiarity breeds "typo-blindness"</p>

*Even if individual researchers are prone to falling in love with their own theories, the broader process of peer review and institutionalized skepticism are designed to ensure that, eventually, the best ideas prevail.* (Chris Mooney)

## Scenario

*Reviewers reviewed your manuscript and they have pointed out major deficiencies in your study to be taken care of. These major revisions relate to:*

1. Title not appropriate
2. Aims and objectives not clear
3. Methodology not clearly mentioned
4. Poorly organized flow of presentation of data
5. Tables and graphs inadequate or inappropriate
6. Weak discussion
7. Recent and relevant references not included and not cited in text

*How do I go about doing major revisions and resubmission?*

- (a) Agree to all the points raised by reviewers and highlight the changes and resubmit.

- (b) Agree to some of the points and aggressively put forth your point of view and resubmit.
- (c) Don't agree to their point of view and submit the article to another journal.
- (d) Don't agree to their point of view and resubmit to the same journal.
- (e) Politely discuss the points you may agree or may not agree and resubmit the revision.

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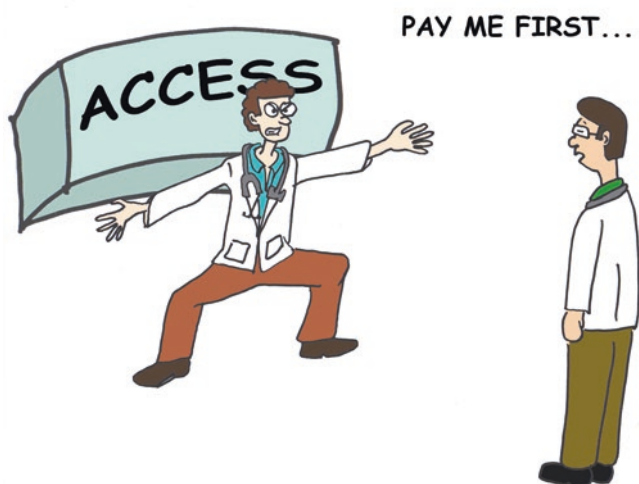
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Savio George Barreto

*Science should not be a luxury and knowledge should not be a commodity, it should be a basic human right – Jack Andraka*



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## Key Points

- Open access (OA) is the unrestricted online accessibility of articles published in scholarly journals to readers and libraries.
- Currently, available models of OA include immediate OA and delayed or hybrid access.
- The three principal charges associated with OA are submission/publication charge, fixed-price scheme and variable price scheme.
- Authors from developing countries included under the broad banner of the Research4Life initiative or countries classified by the World Bank as low-income economies or lower-middle-income economies may be automatically granted a waiver of fees linked to OA.
- Authors incapable of financing their OA publication have the option to seek a waiver of article processing charges from the editorial team before submission. The grant of such a waiver is at the discretion of the journal.
- Copyright ownership in OA journals may be either based on the application of a Creative Commons Attribution licence, which gives the author the right to use their own work (without plagiarism), or the US Fair Use guidelines, Title 17, section 107, US Code.
- Authors must be aware of predatory publishers OA journals wherein the publishers of such journals are solely after the economic gains associated with publishing with no regard for science or its advancement.
- Authors must be aware of the laws linked to self-archiving before making their publications available on their personal websites or websites facilitating authors making the PDFs of their publications available online.
- The gap in the scientific impact of OA as opposed to traditional non-OA journals is steadily being narrowed.
- The choice to publish in an OA or non-OA journal remains the prerogative of the researcher depending on the availability of funds to pay the fees associated with OA as well as what the author desires from the publication.

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## 16.1 Introduction

Traditionally, scientific publications were restricted to paper journal issues, the access to which was restricted to those individuals or libraries who would have to pay a subscription to the journal or the publisher. To the young scientific fraternity, this implied frequent trips to the library archives, reliance on the actual availability of the journal issue when one visited the library and having to make notes or photocopy pages of interest. To the libraries, however, the implications were more significant. The foremost problem faced was that of 'serials crisis' or the budgetary pressures due to increased costs for maintaining a collection of a particular journal [1]. With journal list prices rising faster than inflation [2], the entry of new journals, the availability of print and electronic versions, libraries were faced with tough decisions to either increase budgets to increase subscriptions or simply cancel

subscriptions owing to budget cuts as an offshoot of economic challenges [3]. This was threatening to become detrimental to young scientists/clinicians who were then left at the mercy of the library deciding what journals would fit their budget.

A reaction to the ‘serials crisis’ and the emergence of the World Wide Web have partly been credited with the emergence of open access (OA) in the late 1990s [4]. OA is the unrestricted (without charge) online accessibility of articles published in scholarly journals to readers and libraries. Some believe that OA has revolutionised scientific publishing by not only increasing the possibilities of disseminating an author’s work but also enabling access to the work of others [5]. OA is the result of scholars who drew inspiration from the success achieved by open-source software and Wikipedia [6]. Over the years it has achieved global consensus [7, 8].

This chapter will provide the reader with an insight into what is truly meant by OA, including its implications to the author and the fate of the manuscript, thereby giving the reader the information required to make an informed decision when submitting a manuscript for publication – OA or otherwise.

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## 16.2 How Does OA Compare to Other Publishing Models?

To date there exist various publishing models to disseminate scholarly work [9]. Broadly these can be classified into OA and non-OA. Non-OA is the traditional subscription-based access where the consumers (individual or library) pay a fee to access the publication. OA, on the other hand, includes three subtypes, as follows:

- (a) Hybrid access – As the name suggests, here the journal charges a subscription for access. However, the publishing author may opt to pay processing charges making his/her manuscript OA.
- (b) Delayed OA – Subscription-based articles are made OA (or deposited in OA repositories) after completion of a period of embargo (which may vary from a few weeks to a year).
- (c) OA – Access to the online version is immediately upon publication.

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## 16.3 The Cost of OA

In OA, there exist three principle charges for the processing of a manuscript [6] including:

- (a) Submission/publication charge – These are not the same. The former is the situation when the author is directed to pay a nonrefundable fee upfront at the time of submission of the manuscript towards the processing of the manuscript (including managing peer review). It is ironic that such fees can be charged considering that peer review is an honorary process with no fee ever being paid to a reviewer/referee. The payment of this fee does not in any way guarantee publication. Publication charge, on the other hand, is the fee paid once the

manuscript is accepted for publication to cover the costs towards making the manuscript OA.

- (b) Fixed-price scheme – This is the most common pricing principle adopted in current OA journals being employed by more than 70% of journals. Herein, the publisher levies a fixed charge for any manuscript in any of the journals it publishes.
- (c) Variable price scheme – These may be further subdivided into:
  - (i) Article dependent – Here the variability is based on the length or format of the manuscript (linear or multi-tier). Charges in this category may vary depending on the layout of the manuscript or the cost for colour or extra images. Some journals may levy extra charges for expediting the review of publication processing.
  - (ii) Author dependent – Most journals/publishers that offer OA appreciate the fact that authors from low- and middle-income countries may not possess the capability of funding their publications and thus may give a discount or consider a part or full waiver of the fees involved in the publication process [10].

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## 16.4 Specific Aspects of OA

### A. *Waiver of article processing charges (APC)*

As an example, Wiley OA journals may offer an automatic waiver or a 50% discount on article publication charges to authors from developing countries included under the broad banner of the Research4Life initiative. Similarly, BioMed Central and Springer, too, offer an automatic waiver to authors from countries classified by the World Bank as low-income economies or lower-middle-income economies as of September 2015, which have a 2014 gross domestic product of less than 200 billion US dollars.

In addition to the above, fee waivers are also offered by journals to authors whose parent institutes are members (complete waiver) or support members (a percentage discount on the article processing charges) of programmes such as the Membership Program offered by BioMed Central and SpringerOpen. Quite uncommonly, an individual journal may offer a waiver to the charges on a case-by-case basis. In this situation, the request for waiver by the author must be made prior to completing the manuscript submission process by directly contacting the editor or journal office citing reasons for the request.

The reader must be aware though that there is evidence to indicate that grant of a waiver does not decide the manner in which the manuscript will be handled. In the case of for-profit OA journals, there is no sense of priority in terms of acceptance or processing when manuscripts from automatic waiver countries were compared to those from non-waiver countries [11].

## B. *Copyright*

In subscription journals, copyright is owned by the publisher once the agreement has been signed prior to publication leaving the author with practically no rights to use the paper beyond some exceptions stated under the copyright law. Some journals may allow the author the right to self-archiving (see below) a strategy termed ‘green’ OA of a version of the accepted manuscript but not the final version after a period of embargo. In OA journals, the general trend is for the journal to get a non-exclusive licence with the author without necessarily assigning copyright to the journal, thereby leaving the author as the owner of the paper with the attendant rights to use the paper. The model used is the application of a Creative Commons Attribution licence which gives the author the right to use their own work (without plagiarism) and also decide how they wish their work to be used. While this model is used by the vast majority of OA repositories or publishers including Directory of Open Access Journals (DOAJ), Public Library of Science (PLoS), BioMed Central (BMC), etc., PubMed Central and eMedicine use another model – US Fair Use guidelines, Title 17, section 107, US Code [9].

## C. *Predatory publishers*

The term coined by Jeffery Beall [12] refers to OA journals wherein the publishers of such journals are solely after the economic gains associated with publishing with no regard for science or its advancement. Such publishers provide rapid publishing without a proper peer review process only with the aim to collect article processing charges. Such journals are often frequented by scientists or clinicians who solely desire publications for their resumes [13]. Based on an analysis carried out between 2010 and 2014, Shen and Bjork [13] determined that 39% of such publishers were located in Asia with India accounting for 35% of corresponding authors who published in such journals.

Such journals are undermining the reputation of the noble concept of OA publishing.

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## 16.5 Self-Archiving as Opposed to OA

The bottom line of OA is improving the visibility of one’s manuscript. An alternative to OA publishing includes the concept of ‘self-archiving’ [14] in which the author can archive the pre- or post-print of the manuscript in an open archive. However, self-archiving laws are not so straightforward and the extent to which an author may self-archive is restricted depending on the rules laid down by the journal. A simplistic approach to archiving models was presented by Jan Nick [9]. Journals are assigned a colour based on the level of freedom to which self-archiving of the manuscript is permitted ranging from the less restrictive gold and green journals through to blue and on to the more restrictive yellow and white journals.

Authors publishing in gold journals possess the right to self-archive preprints and post-prints as well as published PDFs, while green journals permit the authors to self-archive only preprints and post-prints. Blue journals permit the author to self-archive only post-prints, while yellow journal authors may only self-archive preprints. Authors publishing in white journals have no right to self-archive.

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## 16.6 Research Impact of OA

While initially ‘looked down’ upon in terms of prestige in academia and indexing, OA journals are steadily closing the gap on subscription journals in terms of two of the most important parameters that measure research credibility, namely, impact factor and citation. Bjork and Solomon noted that OA journals indexed in Web of Science and /or Scopus are steadily achieving the quality and impact in comparison to subscription journals [15].

OA has been appreciated to increase citation of the articles in fields other than medicine [16] [17]. In medicine, too, as in other sciences, OA articles are more easily recognised and tend to be twice as likely to be cited in the first 10 months after publication [18]. These findings have been confirmed in a more recent study from South Korea [19].

Thus, OA journals appear to be rapidly bridging ‘the gap’ with subscription journals in terms of research impact.

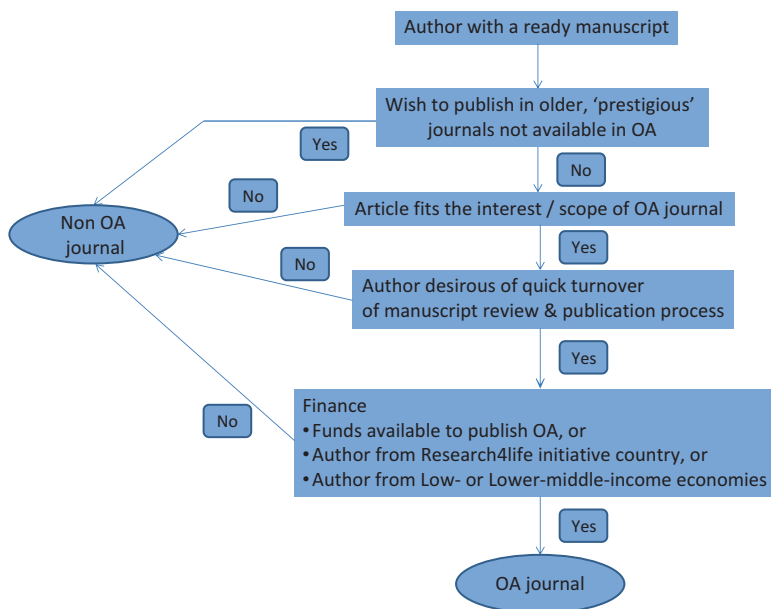
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## 16.7 Which Journal Would You Publish in?

Manuscripts published in OA journals have the advantages of making one’s research readily accessible to a wider audience, thereby increasing the chances of one’s article being read and even cited. For the reader, wider availability of OA articles strengthens one’s knowledge base, which in turn supports the development of research ideas.

On the flipside, OA journals are yet to acquire the ‘prestige’ linked to some of the older and more reputed subscription journals. While OA journals offer considerable rebates to low- to middle-income countries, the costs remain prohibitively high for authors from developing countries not included in this cohort. It is this factor that then leads authors towards ‘predatory’ publishers who tend to appear ‘more understanding’ in terms of granting waivers. The publications in these journals, however, lack scientific value. Besides, the variability in the charges of OA is significant [10].

Thus, when deciding in which journal to publish, the author must bear in mind the findings of a survey of 429 authors who had recently published in OA journals across various scientific subspecialties conducted by Solomon and Bjork [20]. They inferred that the three most pertinent factors considered by authors when choosing a journal for publication were (a) whether the article fitted the area of interest of the journal per se, (b) the impact factor of the journal and (c) the speed of the review process and subsequent publication once the manuscript was accepted. These would



**Fig. 16.1** Approach to choosing between OA and non-OA journals

certainly be the top three points to consider when submitting a manuscript. If the author found an OA journal that met these three criteria and additionally if the author had access to research funding to pay the article processing charges, then OA may be a valid option to consider. Figure 16.1 shows an approach to choosing between OA and non-OA journals.

## 16.8 Conclusion

‘The benefits of research are derived principally from access to research results’, and therefore ‘society as a whole is made worse off if access to scientific research results is restricted’. These statements from the UK Wellcome trust [21] aptly highlighted by Kate Worlock [22] summarise the essence of the drive towards OA publishing in science. The number of manuscripts being published as OA has significantly increased over the last couple of decades [2, 5]. The choice to publish in an OA or non-OA journal remains the prerogative of the researcher and what he/she desires from the publication.



## Scenario

Arjun has just published an article in the *Lancet Oncology*. He is very excited with his achievement. His manuscript draws considerable attention from the medical fraternity with multiple email requests for the portable document format (PDF) of the manuscript. Arjun receives an email from the archiving website ResearchGate to upload a PDF of the manuscript. What should Arjun do?

- (a) Upload the PDF immediately to ResearchGate.
- (b) Upload the prepublication PDF proof of the manuscript to ResearchGate.
- (c) Contact *Lancet Oncology* to enquire what his rights as an author are before taking any further action.
- (d) Upload the manuscript not only to ResearchGate but his own personal website, as well.

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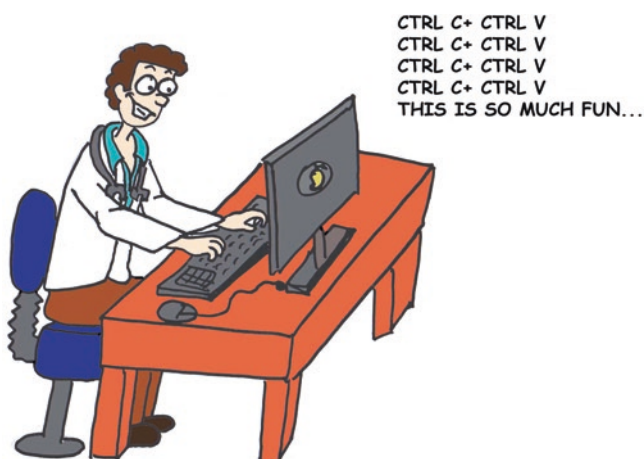
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# Publishing Misconduct Including Plagiarism and Permissions

# 17

C. Adithan and A. Surendiran

*Borrowed thoughts, like borrowed money, only show the poverty of the borrower – Lady Marguerite Blessington*



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## Key Points

- Plagiarism refers to the use of ideas, contents, or style of another person in your own manuscript and claiming it as your own.
- The quality of the content is as important as the quantity plagiarized. A single sentence describing the scientific implication of a significant finding is as important as a paragraph describing the epidemiology of the disease.
- Plagiarism is an ethical violation and involves rejection or retraction of the article. Copyright infringement is a violation of the law and involves penalty ranging from payment of fine to imprisonment.
- Fair use and fair dealing policies of the USA and India, respectively, allows the use of copyrighted content without the need to obtain copyright permission under specific conditions.
- It is always advisable to self-check the manuscript for unintentional plagiarism using softwares.
- Data fabrication and falsification are serious misconducts in the scientific community as they are both intentional.

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## 17.1 Introduction

The Latin word “plagiare” refers to the act of kidnapping [1]. Plagiarism refers to the act of creating a manuscript using the contents from an existing literature authored by a different individual without adequate reference to the original source, thus claiming it as one’s own. Plagiarism is one of the important unethical practices in the scientific community. In a study by Steen (2011) [2], between the years 2000 and 2010, 14.4% of retracted articles have plagiarism as one of the scientific misconducts, and 15.8% of retracted articles are due to duplicate publications, including self-plagiarism. However, plagiarism is not limited to the scientific field, and it has been found to be occurring in other sectors such as literature, entertainment industry, and art. In this chapter, we discuss the concept of plagiarism and issues related to the act of plagiarism with reference to medical community and scientific writing.

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## 17.2 Causes for Plagiarisms

Several factors are involved in instances of plagiarisms, which can be intentional or unintentional [3, 4]. Intentional plagiarisms can be attributed mainly to the pressure that a researcher faces in the scientific environment that demands publications, giving importance to the quantity of research papers published rather than the quality and outcome of research. Popularly termed as “Publish or Perish” [5], the academic competition for grants and jobs creates an unhealthy scientific environment which becomes a breeding ground for unethical practices such as intentional plagiarism. This effect is compounded by the lack of effective guidelines and operational

impotency in institutes, on the policy of handling cases of plagiarism among its students and faculty. This not only emboldens one to involve in the act of plagiarism but also promotes the same among the colleagues.

Unintentional plagiarists, on the other hand, are amenable to change with education and awareness. Young researchers should be guided by the faculty with close observation, identify the language difficulties, and remove misconceptions regarding ideas of plagiarism. In several occasions, a senior author can get tangled in accusations of plagiarism, when authorship has been given by a student for a publication that did not involve the active participation of the senior author [6]. It is unwise to accept such authorships for any research paper that has not be read and verified by self. Accepting a senior authorship in a paper and refuting accusations of plagiarism on grounds that act of plagiarism was done by a student is not acceptable.

Further, a general lackadaisical attitude toward the principles of research and a poor knowledge base in the area of research can make one to rely heavily on other published sources to construct even a simple manuscript. This is very often accompanied by a poor knowledge of good principles of scientific writing and publication ethics. Rarely, incorrect attitude and advice given by the supervisors regarding plagiarism can result in students unintentionally plagiarizing scientific manuscripts [7].

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## 17.3 Types of Plagiarisms

Plagiarism is not restricted to the copying of textual content but also includes the use of contents such as images, data, style, and idea, without due reference to the source. Plagiarism can occur in various forms.

### 17.3.1 Verbatim Copy of Contents

This type of plagiarism occurs where the author copies content from another source verbatim [4, 8]. Verbatim use of published information is acceptable in instances where definitions, criteria, classifications, and guidelines are described. The common error in such instances is a failure to indicate to the readers the nature and source of such content and failure to cite references. Further, content that is reproduced verbatim, such as definitions, is to be enclosed in quotes. Failure to do so can occur inadvertently due to oversight, which is still not a valid excuse for an instance of plagiarism. On rare instances, journal articles have been published and withdrawn where almost the entire manuscript had been plagiarized from a single source.

### 17.3.2 Mosaic Plagiarism

This is said to occur when the content from a source is merely reproduced in a manuscript with poor paraphrasing. The author may change a few words in each sentence or just change the voice from active to passive or a combination of the two.

Essentially the flow of content would be the same as the source article with no original thought or language contribution by the author. This may also be accompanied by inadequate reference to the original source [1, 3].

### **17.3.3 Style Plagiarism**

It frequently accompanies mosaic plagiarism. The quality of a published article is dependent partly on the style of writing by the author. The choice of headings, sub-headings, and the flow of ideas in the published article contributes to its quality. When another author adopts the choice of headings, subheadings, and construct from another published article in his own article, it is termed as style plagiarism [9]. This occurs usually while writing a review of literature or a review article using a larger review article as a source article. The construct is retained and paraphrasing is done for the entire article, making the review of literature or review article as a remodeled version of the previous publication with no original contribution by the student/author and inadequate acknowledgment of the original source.

### **17.3.4 Idea Plagiarism**

The credit for a novel idea that gets published for the first time belongs to the person who conceived it. When another person who reads the idea uses it in their own manuscript but fails to give due credit to the original source of the idea, it is termed as idea plagiarism. This can occur in the form of a novel interpretation of available information or a new concept for implementation where an author claims an idea as their own without disclosing to the readers the source of the idea [3]. It is difficult on certain occasions to identify plagiarism of ideas. A reviewer for a journal can plagiarize from a novel idea given in a manuscript that has come for peer review. In other instances, a scholar attending a conference can listen to a novel idea from a presentation which can be published later as one's own [1].

### **17.3.5 Metaphor Plagiarism**

The explanations for concepts are made easy to understand with the help of suitable metaphors. This aids the readers to understand the concept and also retain in memory for a longer time. The use of an appropriate metaphor is a reflection of the author's individual ability which can at times identify them as unique among a crowd. If the same metaphor is intended to be used in another manuscript by other authors, they must identify to the readers the original source of the metaphor and its author. Failure to do so would amount to plagiarism even if the manuscript has no textual similarity with the original source [9].

### 17.3.6 Self-Plagiarism or Auto-plagiarism

The definition of plagiarism indicates claiming the work of another individual as one's own without giving due credit to the original source. If an author uses content from his own published work in a newer manuscript but fails to indicate to the readers the earlier publication through citation, then it is considered as self- or auto-plagiarism [1, 3]. This is an often argued concept due to the fact that it is beyond the definition of plagiarism and no other author has been bereft of the credit that is due for them. However, in the scientific community, self- or auto-plagiarism is not accepted for two reasons – copyright violations and undue academic credit due to repeated publications. In most journals, the copyright of a manuscript after publication is with the publishers which prevent even the original authors from reusing contents from their previous publications.

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## 17.4 Copyright Protection

In the context of scientific research and publications, copyrights refer to the legal right owned by an individual or an organization over the scientific publication. Such a copyrighted content cannot be used by another individual in their manuscript without obtaining permission from the copyright holder. In several scientific journals, the copyrights for published articles are held by the publishers. Lack of awareness of copyright issues can lead to legal violations. In certain instances, authors have asked for permission to use copyrighted content from the author of the manuscript, who has responded positively for the same. However, such a permission does not hold well when the copyright is actually held by the publisher. It is necessary by an author to check the copyright details of a journal and its holder before attempting to seek permission. It is acceptable under certain conditions to use copyrighted content, without the need for obtaining permission. These are described under “fair use policy” in the USA [10] and “fair dealing policy” in India [11].

Fair use policy of copyright law in the USA [10] is applicable under specific conditions as given below:

- (a) Use of a short passage from a copyrighted content is acceptable in order to describe existing literature without an intent of financial gain. The larger the size of copyrighted content used, the less likely to fall under fair use policy.
- (b) Should not compete with the source in the market.
- (c) Intended to criticize, review, or make a parody of the copyrighted content.
- (d) Brings awareness or knowledge among public even if a monetary benefit is a part of it. A diagnostic product advertisement quoting from a review article that describes the utility of available diagnostic tools is acceptable under this principle.
- (e) Used with the intention of describing or summarizing in a news report.

Citing the source with reference is mandatory even if a content is used under fair use policy. Fair dealing of copyright content in India is similar to fair use policy in the USA. As per Sec. 52(1) of the Copyright Act 1957 [11], fair dealing of copyrighted contents with respect to research and education, excluding computer programs, is however limited to essentially three conditions. These include:

- (a) If a content from a copyrighted source is used only for private use, research, criticism, or review
- (b) If the content is used with the intention of making a criticism or a review of the work
- (c) If the content is used for news reporting in a newspaper or as a video film

It is not acceptable to fix a limit on word count for a permissible limit of fair use or fair deal since the quality of the used content is as important as the quantity that is being used under fair use policy. A single passage that describes the mechanism or principle involved in the findings of a research work has the equal importance of two to three passages that describe the background problem statement in a research work. It is not permissible to use a content from a source under fair use, if that part adds more significant value to the work than any other part. Further, the intention with which a copyrighted content is being used carries significance in deciding fair use. An intent of primarily commercial gain or competing interests in the market does not come under fair use; rather an intent of criticizing a work or to educate the public about an existing work involves fair use.

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## 17.5 Consequences of Plagiarism and Copyright Violation

Plagiarism is an unethical practice in scientific community and the subsequent consequences would be worse if it also involves a copyright violation. Copyright protection is a right offered legally by the law to the copyright holder. Plagiarism can result in penalties ranging from withdrawal of research publication by the journal or publisher, academic disrepute, and ban by journals depending upon the extent and nature of plagiarism. In some cases, faculty may also face disciplinary action as decided by the institute that employs them. In a research publication with several authors, all are equally liable if plagiarism has been detected. A senior author cannot claim unawareness of an instance of plagiarism on the grounds that the manuscript was written by the student. Further, lack of awareness of plagiarism is not considered as a valid excuse when plagiarism has been detected.

Copyright violation, on the other hand, can invite a civil suit in the court of law and result in payment of compensation for damages. It must also be noted that copyright violation can also be dealt as a criminal offense according to section 63 of Copyright Act, inviting penalties such as imprisonment for 6 months to 3 years with a fine of 50,000–200,000 rupees. The penalties are more in repeat offenders [12].



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## **17.6 Committee on Publication Ethics (COPE) Guidelines on Plagiarism**

Scientific journals consider plagiarism as a serious issue. As a general guideline for journals, the Committee on Publication Ethics (COPE) has issued guidelines for editors to handle circumstances where plagiarism has been brought to their notice, in a manuscript that has been already published and in a manuscript that has been submitted for publication in the journal. If plagiarism is present only in a few phrases, then the journal may contact the author and consider publishing a correction for a published article or ask authors to rephrase plagiarized contents for a manuscript that has been submitted for publication. However, if the plagiarized content involves large portions, the journal may contact the author for explanation and consider retraction of article or rejection of the article, along with informing the superior of the author and the institution that employs the author. Detailed flow-charts of the processes involved for detected plagiarism and other misconducts have been given in the website of COPE [13].

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## **17.7 Avoiding Plagiarism**

Plagiarism can be avoided by adopting the following measures at various levels in an institution.

### **17.7.1 Education and Awareness**

In several instances, plagiarism occurs unintentionally due to lack of awareness and guidance. However, an excuse of ignorance is not accepted when plagiarism is detected. It is essential to include topics related issues of plagiarism in training programs for research methodology and scientific writing. The degree of plagiarism depends upon the method of scientific writing and the level of knowledge and competence in the writer. A poor knowledge requires frequent reference into the source document and leads to the use of similar words and sentences in the manuscript.

### **17.7.2 Read, Understand, and Write Without Source Nearby**

For young researchers early in the research career, it is a good suggestion to stay away from the source document during the actual preparation of manuscript, thus avoiding the temptation of frequent referrals and consequent subconscious plagiarism. If a researcher is not able to continue with the manuscript without frequent referrals, it indicates lacunae in understanding which should be first addressed. However, contents such as statistical data, numerical data, etc. can be referred to avoid mistakes.

### **17.7.3 Write Notes from a Primary Source, and Prepare Manuscript from Notes**

Preparation of manuscripts such as review of literature for a thesis or a review article involves reference to several other research publications and reviews. Although concepts are easy to learn, it is advisable to prepare notes for finer details and also to develop a flow of ideas that would be used in the writing of the article. A common mistake done especially by students is to read a source article and transfer the required information directly into the manuscript by paraphrasing few to several paragraphs. In such instances, it is a natural tendency to use the same language style and choice of words as the source article in the manuscript. The end result of such method would be just a poorly paraphrased version of an existing literature which may amount to plagiarism.

### **17.7.4 Follow the Guidelines for Scientific Writing**

Researchers should always ensure that contents taken from other sources are provided with appropriate citations. If a phrase is used verbatim from another source, it must be given in quotations. A well-paraphrased content of a source would reduce a large source content to even a mere couple of sentences. Poor paraphrasing is a just mere alteration of a paragraph, sentence by sentence, thus retaining the original size of the source content. It is the author's responsibility to identify the copyright holder and the nature of copyright terms and conditions in order to seek permission to use copyrighted content. Further, an author must still provide the citation to the copyrighted content for which permission has been obtained. Obtaining permission to use copyrighted content does not relieve one from identifying the original source of the citation.

### **17.7.5 Self-Check for Plagiarism**

In current times with the development of technology, it is easy to scrutinize a manuscript for plagiarism as well as to do a self-check for plagiarism before submission to a journal. There are several free and paid softwares available that can check a manuscript for plagiarism and provide the results within minutes. These softwares provide results in the form of similarity index which is the proportion of a number of words in a manuscript which are seemed to be occurring in published literature to the total number of words in the manuscript. It is not a good idea to consider a cutoff limit for similarity index in deciding whether a manuscript is plagiarized or not. Even a 10% similarity index in a document containing 10,000 words would amount to plagiarism of 1000 words, which is equal to one to two pages of the article. The entire manuscript must be checked for similarity to published literature, and plagiarized content must be adequately paraphrased and cited with reference. Figure 17.1 shows a self-check for avoiding plagiarism.

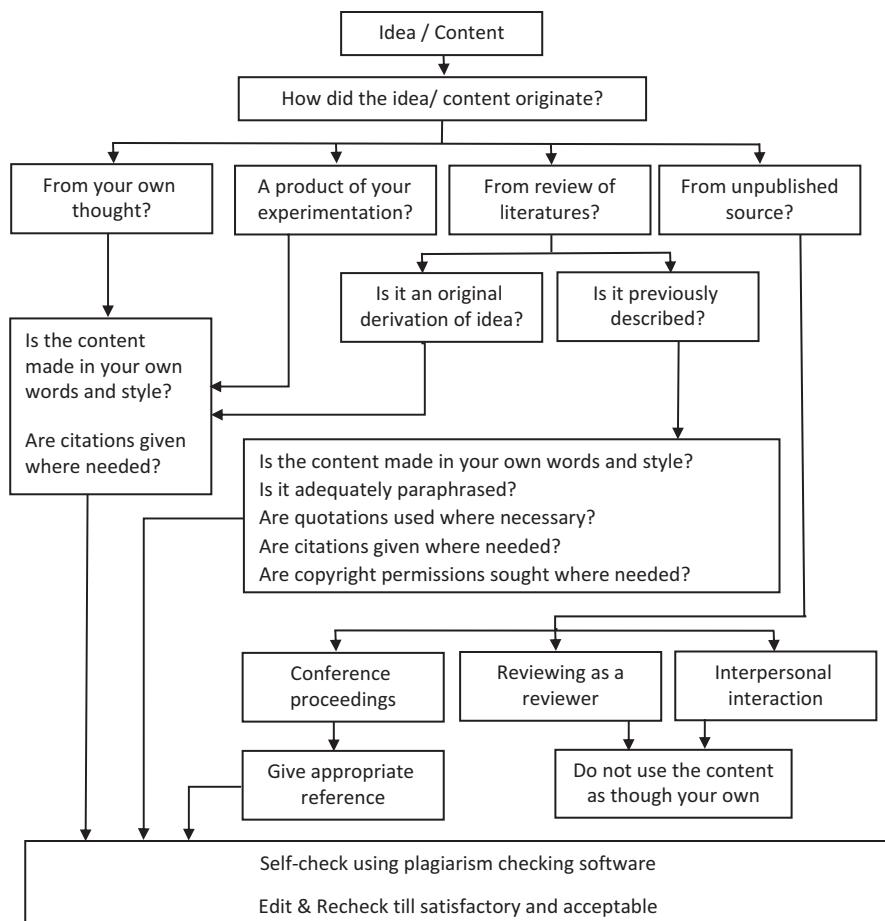


Fig. 17.1 Self-check for avoiding plagiarism

### 17.7.6 Avoid Publication of One Research Work into Multiple Parts

In order to increase the publication count, researchers may be tempted to break one large research project into smaller parts with splitting of objectives, publishing each as a research paper. Very often, the methodology and background information tends to remain similar. This can result in larger similarities between such publications and issues of self-plagiarism. In genuine circumstances, if parts of a manuscript have been published elsewhere, the authors may inform the editors during the time of submission regarding earlier submissions made with justification.

Merely citing a reference to a poorly paraphrased or a plagiarized content in a manuscript does not provide immunity from the principle of plagiarism. Every published work that is being used in a manuscript must be given due citation and

reference statement, irrespective of its quantity, quality, or scope of fair use policy. However, this does not imply that a mere copying of content is permissible as long as the citation is provided. Irrespective of citation and acknowledgment, a researcher is not allowed to copy the content from published material unless it involves contents of definitions, criteria, classifications, and guidelines. In such cases, it must be made clear to the readers that the content is taken verbatim from another source and it should be enclosed in quotes in addition to the citation and providing the reference.

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## 17.8 Tools to Check Plagiarism

Scrutinizing a manuscript for plagiarism has become easier with the developments in the field of information technology. Free as well as paid softwares are available for checking plagiarisms. Some of the free softwares to check plagiarism include Duplichecker, Viper, PlagTracker, PaperRater, Dustball, etc. [14–18]. Paid softwares offer more flexibility and wider search capability among databases while detecting plagiarism. Turnitin is a paid web-based tool which can be used to screen manuscripts for plagiarism against a large collection of databases that includes more than 60 billion web pages, 600 million student papers, and 154 million journal articles, periodicals, and books [19]. WriteCheck and iThenticate are other paid online-based softwares developed by the same developers of Turnitin [19–21], to enable students check themselves for plagiarism with the former and to enable faculty to assess the student’s manuscripts for plagiarism by the latter. Grammarly is primarily a tool that helps the student to write manuscripts with correct grammar in English. It also has an additional feature of checking the content for plagiarism [22].

The reports issued by the paid and free softwares are similarities. It must be understood that all similarities are not necessarily plagiarism and plagiarism does not necessarily be similar in textual content alone. There can be no automated method of screening manuscripts and labeling a plagiarist. Each manuscript needs to be reviewed individually using the online tools, while carefully assessing the identified similarities.

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## 17.9 Other Publication Misconducts

In addition to plagiarism, other types of publication misconducts include data fabrication and data falsification. According to the definition of US Public Health Service, data fabrication is “making up data or results and recording or reporting them,” whereas falsification is “manipulating research materials, equipment or process, or changing or omitting data or results so that the research is not accurately represented in the research record” [23]. Both these practices are aimed at deceiving the scientific community and are serious misconducts in publication of research. However, an honest error is not to be considered as research fraud or publication misconduct since there was no intention to deceive the readers.

Data fabrication or falsification are suspected when the findings could not be reproduced under similar settings by other researchers and there is inadequate or lack of documentation. It is difficult to assess the actual prevalence of data fraud, and as a result, the available data represent only the tip of an iceberg [23]. The consequences of data fabrication and falsification are significant in the medical field as many treatment plans are designed based on evidence generated by research. A viable treatment plan may lose its significance or an ineffective treatment plan may receive unwanted attention and investment of resources, thus making it a serious offense or misconduct. As per COPE guidelines, the course of action for a suspicion of data fabrication or falsification in a manuscript under review or in a published article follows the same procedure as for plagiarism [13].

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## 17.10 Conclusion

Plagiarism in the scientific field, often called as scientific theft, is an act that is unethical professionally and can violate legal terms related to copyrights. It is certainly avoidable with the right attitude toward science, awareness, and effort. It is the duty of educators to create an awareness regarding the issues of plagiarism among the pupils and inculcate the attitude of honest scientific conduct. An ideal scientific manuscript is one which provides new information or idea to its readers and duly acknowledges the contribution of others. Intentional fraud in the form of data fabrication and falsification has serious consequences in the scientific community. The ideal way to overcome these issues of publication misconduct is through the creation of awareness and training programs with rigid evaluation protocols.

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## Case Scenario

1. You find a very good illustrative diagram in a textbook that is suitable for a research manuscript that you are writing. Comment on the appropriateness of each scenario below.
  - (a) You scan the page and insert the image in your manuscript without seeking copyright permission.
  - (b) You redraw the diagram exactly as it has been published and insert in your manuscript without seeking copyright permission.
  - (c) You reproduce the diagram either by scanning or redrawing but seek and obtain copyright permission.

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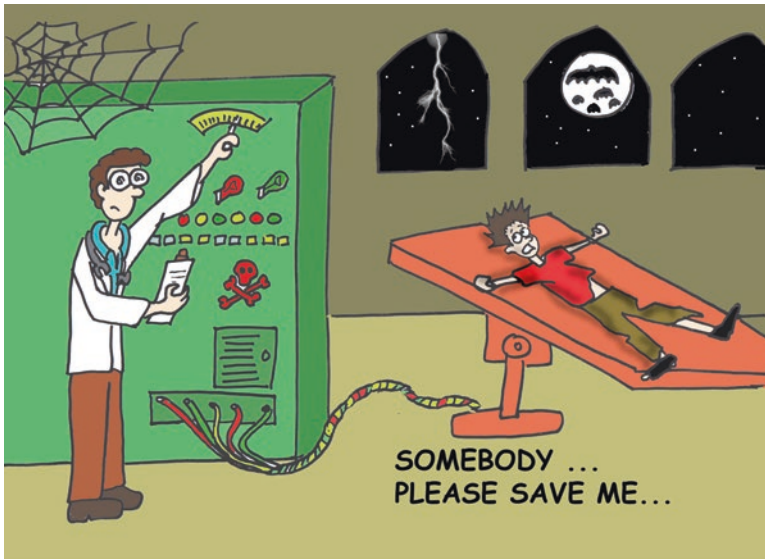
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# Ethical Dilemmas and Etiquettes of Scientific Publication

# 18

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Dinoop Korol Poonambath, and Ajay Halder

*The medical journals of this country are flooded, as we all know, with immature and sometimes apparently useless publications, and one is sometimes torn between one's desire to keep it down and to let a pupil have the great value to his personality of publishing something. – Elliot Carr Cutler*



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## Key Points

- Documentation of research findings is very important as they pave the way for future research and make the findings more comprehensive.
- The criteria of authorship include (1) substantial contribution to conception, design or collection, or analysis and interpretation of data, (2) drafting or revising critically a data, and (3) final approval of data for publication.
- Duplicate submission is the submission of the article to two or more journals simultaneously, resulting in unnecessary peer review, editing, and copyright issues.
- The “Ingelfinger rule” defines “sole contribution” which means an article submitted for publication is accepted by a journal only when it is not published/presented elsewhere to preserve novelty and prevent plagiarism.
- A similar form of duplication is the “salami” publication, where the author splits the research content into multiple publications to increase the number of publications.
- Plagiarism has been traditionally defined as stealing and publishing someone’s idea, thought, language, or expression as one’s own original work.
- International guidelines like COPE have provided checklists and flowcharts to guide editorial process and policies.
- The editorial and peer-review processes need to be void of potential conflicts of interest that may positively or negatively affect the decision-making.
- Newer measurements have been phased-in to measure the scholarly performance such as citation count, publication count in high-impact factor journals, Hirsch index (h-index), RG score, and AMiner.

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## 18.1 Introduction

Medical sciences have been continuously advancing with newer diagnostic and treatment modalities introduced every year. These newer modalities have been introduced based on rigorous research studies facilitating analysis of their advantage, their limitations, and their feasibility. These content also pave the way for future research. Professional/scholarly proficiency in medical professionals is frequently assessed by analysis of their research contribution/publications. These assessment methods/metrics have been extensively used for measurement of academic excellence, designation promotion, and increments in pay or other incentives. These measures of scholarly performance have led many researchers to manipulate or publish fallacious research content leading to subsequent wastage of resources as well as resulting in a negative impact on the patient management. Ethical issues in publishing research content can arise due to sheer ignorance or as a result of intentional egocentric motives to reap untoward benefits. Hence it is pertinent that the authors should be aware of publication ethics to avoid such malpractice. The journal editors/ peer reviewers have an onerous task to be cognizant of such issues and should be able to recognize and deal with them [1–4].



## 18.2 Importance of Documentation

Documentation of research findings is very important as they pave the way for future research and make the findings more comprehensive. Therefore, the focus needs to be applied to the type of research being conducted and should be judged based on their outcome. This is possible only through documentation and writing; preparing a manuscript can be a wonderful yet exhaustive experience.

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## 18.3 Ethical Issues and Dilemmas

Journal editors and peer reviewers need to be conversant with the various international guidelines guiding publications ethics. Examples include the International Committee of Medical Journal Editors (ICMJE), Committee on Publication Ethics (COPE), World Association of Medical Editors (WAME), World Medical Association (WMA), Council of International Organizations for Medical Sciences (CIOMS), etc. The ethical issues in research publication can be broadly classified into two types: authorship and editorial. The common authorship ethical issues faced are failed authorship criteria; duplicate submission; duplicate publication; gift or ghost authorship; data being plagiarized, fabricated, or falsified; etc. The common editorial ethical issues are improperly managed peer-review process, alleged scientific misconduct, expeditiousness, conflict of interest and confidentiality, etc.

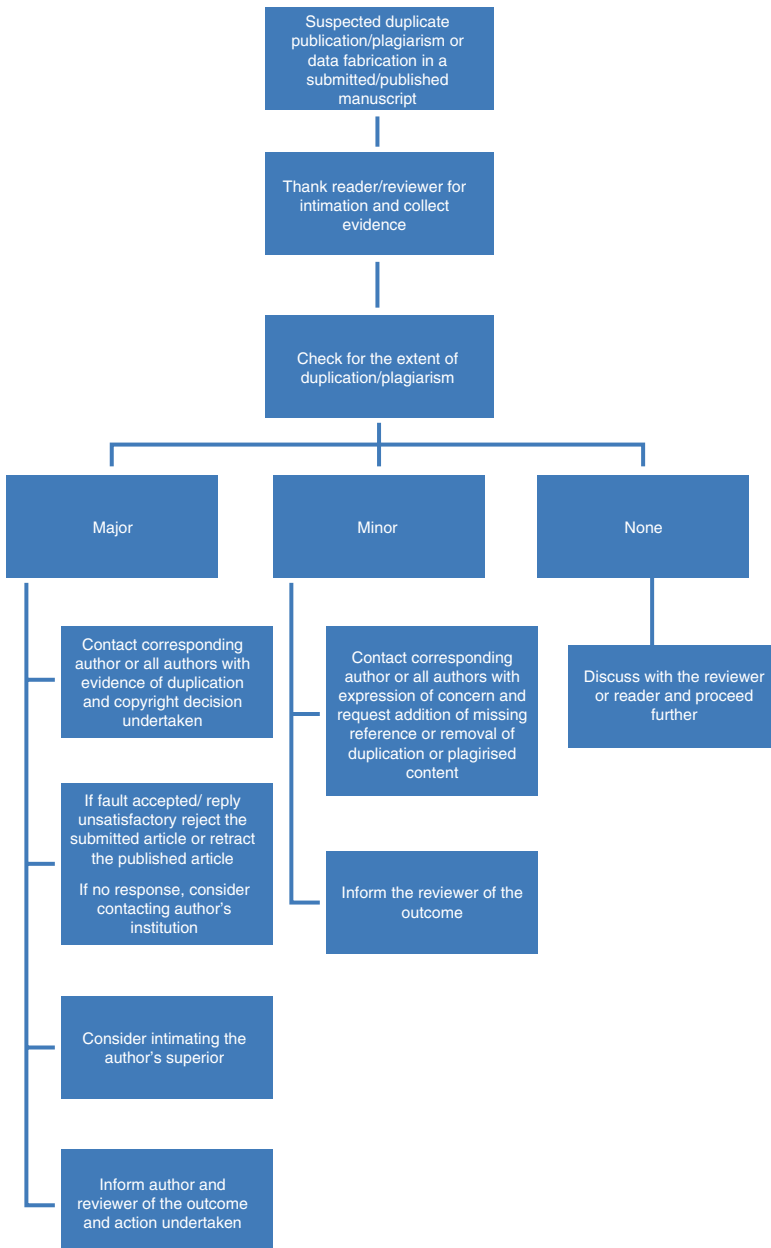
### 18.3.1 Authorship Ethical Issues

Editors and peer reviewers of most journals frequently encounter these ethical issues. The commonest issue faced is the “authorship” itself, which is relatively difficult to identify [5–9]. The ICMJE, which is also called the “Vancouver group” (since the first meeting was in “Vancouver”), has proposed criteria to consider a researcher as an author of the publication. The criteria include three parameters and all three needs to be fulfilled to claim an authorship. The criteria are as follows: (1) a substantial contribution to the concept, design of the study, or analysis of data, (2) critically revising or drafting a data, and (3) final approval for publication. Gift or ghost authorship are ethical issues where an author doesn’t meet the ICMJE criteria. In gift authorship, authors are included who don’t meet these criteria, and in ghost authorship, authors are excluded who would otherwise fit into the ICMJE criteria. Individuals with significant contributions to the publication but not fitting the ICMJE criteria need to be addressed in the acknowledgments. Examples include funding agencies, writers, illustrators, etc. Duplication of scientific content is another common author ethical issue faced by the journal editors or peer reviewers. This refers to submission of same research content to more than one journal at a time, thereby resulting in unnecessary peer-review process and copyright problems. Although nonmedical journals use prepublication posts of research content in public forums (e.g., arXiv) for maximal dissemination and critique, it has not been

practiced by medical journals, which usually follow the “Ingelfinger rule” of sole contribution [1]. Duplicate/redundant publication, also known as self-plagiarism, is the publication of multiple manuscripts with overlapping content. Another emerging ethical issue is the “salami publication,” which has become a common practice adopted by authors in which they split the research content into multiple fragmented parts so as to maximize their number of publications. Plagiarism, although less common in the recent years due to introduction of plagiarism detection software (e.g., eTBLAST, iThenticate, Turnitin, etc.), had been a frequently encountered ethical issue in the past. Plagiarism is stealing and publishing someone’s idea, thought, expression, image, or language and claiming that as an original work. These issues can be prevented when the sources are acknowledged/cited or reproduced with permission. Fabrication of data is yet another issue where authors manipulate research data to strengthen conclusions by adding or removing outliers. These issues can lead to falsified meta-analysis data that are considered the highest level of evidence for development of guidelines. Various checklists and flowcharts for journal editors have been provided by international guidelines like COPE, which have been beneficial when any of these ethical issues are encountered [2–4]. Figure 18.1 shows the steps in dealing with a plagiarised manuscript.

### 18.3.2 Editorial Ethical Issues

There is a definite lack of awareness about editorial process contributing to scientific misconduct in publication ethics. There should be no conflicts of interest in the editorial/peer-review processes as that may affect the decision-making. Self-assessment of expertise to review the content should be undertaken. Authors of scientific research deserve prompt review/expert opinion on their research content so that the novelty of the research content submitted for publication is preserved. When scientific misconduct is identified in a submitted article, it is important to maintain confidentiality and the matter should be communicated to the authors for rendering their explanations on the same. If the author/corresponding author does not respond to the repeated requests made by the editorial team/reviewers to reply to the queries or clarifications raised, then the matter should be communicated to the institute head where the authors are employed or to the necessary authority. If the study showing scientific misconduct has already been published, immediate attention should be drawn toward it without delay, and on a priority corrective measures like expression of concern, publication of errata or retraction of article should be undertaken. If financial aid is obtained by the journals, the financial contributions obtained shouldn’t interfere or bias the editorial decision-making process. According to the WAME, journals should adopt clear policies with the sponsors about their influencing the editorial decision process [5–7,10, 11].



**Fig. 18.1** The steps in dealing with a plagiarised manuscript

## 18.4 Promising Newer Metrics

Scientific misconduct is associated with researchers who are in pursuit of untoward scholarly excellence without having authentic contribution/data. The use of certain metrics such as the number of publications to assess a researcher's scholarly performance is not accurate due to abovementioned issues. In recent years, newer measurements have been introduced to measure the performance standards of professionals, which include citation count, publication count (high-impact factor journals), and related indices like Hirsch index (h-index). "Citation count" parameter, when used alone, may not be sufficient for assessment since many authors resort to inappropriate self-citation. Skewed citation counts also arise as some editors prefer accepting articles citing one's journal. Conglomerate measurements have been introduced to overcome these disadvantages, which include metrics like ResearchGate (RG) score and ArnetMiner (AMiner). "ResearchGate" uses RG score, which is based on parameters like involvement of the researcher in discussion fora, database of their research contribution, and reputation. Unfortunately, due to its skewed result and irreproducibility, this score has been recently criticized [12]. "ArnetMiner" is an online free software, designed to identify association between research content and researchers. It uses many indices like Hirsch index, journal's impact factor, activity, etc. in addition to citation and high-impact factor publication counts, to assess a researcher's scholarly excellence [13, 14].

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## 18.5 Conclusion

Currently, scholarly performance assessment for researchers relies on primitive ways of eliciting the number of publications. Authors resort to many of the abovementioned methods of scientific misconduct to attain the benefits of scholarly excellence. Three steps should be undertaken to produce high-quality flawless research evidence, which includes:

1. Editors and peer reviewers have to be vigilant while dealing with publications.
2. Institutions should initiate assessment of researchers' scholarly performance using the abovementioned promising composite metrics rather than following sheer numbers.
3. Researchers should be encouraged to bring about quality in publications rather than quantity.

Following these steps would go a long way in improving the quality of the research publications, thereby improving medical practice.

## Case Scenario (Handling Plagiarism)

The editor in chief of a reputed journal gets an email communication regarding plagiarized content in one of the original articles published in the recent issues of the journal. The reader mentions that most of the content has been copied from an article published in another reputed journal of the same specialty. As an editor,

1. How will you proceed further and handle this issue?
2. What is the impact of such issues to the journal and to the society?
3. What preventive action would you incorporate to avoid such issues in future?
4. Are there any recommendations/guidelines which are to be followed while encountering such issues?

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