The Principles of Biomedical Scientific Writing: Citation

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Abstract

Citation, the act of properly referring to others’ ideas, thoughts, or concepts, is a common and critical practice in scientific writing. Citations are used to give credit to own work, to support an argument, to acknowledge others’ work, to distinguish other authors’ ideas from one’s work, and to direct readers to sources of information. A good citation adds to the scientific prestige of the paper and makes it more valuable to the reader. The citation has three basic elements: quoting from others, an in-text reference to the source, and bibliographic details of the source. Beyond technical skills, the citation needs an in-depth knowledge of the field and should follow basic rules, including the selection of relevant and valid sources, stating information/facts from others’ work, and referring to others’ work accurately and ethically. Several systems and styles are used to cite scientific sources; however, the most commonly used systems in medical sciences are ‘author-date’ systems (e.g., Harvard system) and numerical systems (e.g., Vancouver system). Here, we discuss how to make an accurate, complete, and ethical citation, and provide simple and practical guides to organize references in a scientific medical paper.

Keywords: Citation, Reference, Medical Scientific Journals, Scientific Writing

1. Context

According to Merriam Webster dictionary, the word citation is defined as “an act of quoting,” where quote means “to speak or write from another usually with credit acknowledgment.” In scientific communication, the citation is commonly considered a technical practice to refer to the source in the text to represent that the information is derived from an external source (1, 2). The citation is more than just referencing; it provides more value than acknowledging the source of literature being reviewed and making a reference list (2). Citation helps the authors put their work in connection with previous ones, to tell the story artfully, to acknowledge others’ work, and to contextualize study findings (2-4). A well-referenced paper supports the novelty and value of the work and improves its visibility (5).

Regardless of its importance, the citation may be the least noticed aspect of a scientific manuscript (6). Citation errors, including misquotation and errors in the bibliography, are common in the medical literature. The prevalence of misquotations in different journals ranges from 10% to 20% (7), and about 50% to 70% of references of published papers contain at least one error (8, 9). Inaccurate quotations are displeasing for the cited author, misleading for the reader, and initiate circulation of false facts (7, 10). The consequences of bibliography errors include difficulty in reference retrieval, limitation for the reader to read more widely, failure to credit the cited author(s), and inaccuracies in citation indexes.

Following our previous guides on how to write Introduction (11), Material and Methods (12), Results (13), Discussion (14), Title (15), and Abstract and keyword (16) of a hypothesis-testing paper, here, we provide a practical guide on importance and function of the citation of a scientific medical paper. We discuss how to select sources for the citation, quote information from others’ work, refer to the sources, and make an accurate reference list for a scientific biomedical paper.

2. Functions of Citation

The citation is used to give credit to an author’s work, acknowledge other’s work, distinguish an author’s ideas...
from others, direct readers to original sources of information, and avoid plagiarism (2-4, 17). Citation help readers to understand the work, to justify the conclusions, to judge the novelty and scope of the manuscripts (18), and critically evaluate what contribution the study makes (4, 19). Using proper citation is the only way to use the work of others and not commit plagiarism (20). To avoid plagiarism, authors need to accurately refer to the most relevant publications and cite facts and conclusions (1, 20). Functions of the citation in different sections of an original paper are shown in Box 1; note that the result section does not have any citation.

### Box 1. Functions of the Citation and Appropriate Number of References in Different Parts of an Original Paper (3, 12, 14, 21)

| Section/Details | Functions |
|-----------------|-----------|
| Introduction    | Refines the research question (5 -10 references) |
|                 | Provides sufficient background about the study question |
|                 | Shows current knowledge relevant to the study question |
|                 | Shows how the study question has been previously studied |
|                 | Presents concepts and variables associated with the research question |
| Material and methods | Elaborating the research method (5 -15 references) |
|                 | Describes new or previously published methods, protocols, or standards |
|                 | Describes complex or less-known statistical analyses |
|                 | Defines diagnostic criteria used in the study |
|                 | Rationalizes sample size estimation |
|                 | Justifies specific research design or methods |
| Results         | No reference |
| Discussion      | Supports interpretations of outcomes and conclusions (10 -20 references) |
|                 | Compares the study findings with the others |
|                 | Reflects current view of the question/problem (conflicting, consensus or controversial opinions) |
|                 | Supports possible explanations and implications |
|                 | Contextualizes the study findings |

### 3. Components of the Citation

The citation has three components: (1) quotation, i.e., providing either a summary, a paraphrase or a direct quotation from others’ works, (2) in-text references, i.e., brief addressing to the source, and (3) bibliographic details, i.e., name of the authors, source of publication, date of publication.

#### 3.1. Quotation

Quotations from other sources can be provided by direct quoting, paraphrasing, or providing a summary (3). In direct quoting, others statements (more than six consecutive words) are exactly copied, put in the quotation marks, and immediately followed by an in-text citation to the original source; every word and punctuation mark should be exactly the same as the original version (17, 20, 22). Direct quoting is used when original words express an idea distinctively or more concisely than your summary, as well as to present well-known statements or to provide historical context for a particular theory or construct (8, 23). Direct quoting is not used for reporting findings of a published work, variable names, and operational definitions. Box 2 provides some practical tips for the appropriate use of direct quotations.

### Box 2. Practical Tips for Appropriate Use of Direct Quotations in Scientific Writing (8, 23)

#### Use of Direct Quotations

- Use ‘single’ quotation marks in the UK writing style and “double” quotation marks in the US writing style
- For nested quotes (i.e., a quote within another quote), use the opposite style of quotation marks i.e. ‘…”…”’ for UK writing style and “…’…”’ for US writing style
- In case of omitting a part of the quotation, use ‘…’ (ellipsis) instead of the omitted part
- In case of inserting your words or different words, into a quotation, put them in a []
- To pointing out an error in a quotation, don’t correct it and add [sic] after the error
- In case of using italic font to make an emphasize, indicate it by word ‘my italics’ within in-text citation
- For block quoting (a long quote ≥ 25-30 words), it should be set off from the main text as a separate indented paragraph and not be enclosed in quotation marks

In paraphrasing, authors express others’ writing in their own words (23), followed by a reference to the original source. In cases of paraphrasing another’s work or idea, authors should check their statement to be accurate and fair (17, 20). Use of synonyms and rephrasing are typical ways to change the original statements (9); however, if the paraphrase is too close to the source text in wording, syntax, and structure, it may be considered ‘patch-writing’, which is “the act of making small changes and substitutions to the copied source material” (24). Note that paraphrasing and summarizing are complex and critical academic skills and depend on one’s knowledge of the content (25).
In providing a summary, a brief statement of the main points of a work (paper, book or chapter) is presented (23) using a neutral, affiliating, or distancing approach; in affiliating and distancing approaches, not only existing knowledge is summarized but also authors present their stance/viewpoint (2). The authors need to present their approaches accurately and persuasively by using appropriate verbs (2). For a neutral summary, use of verbs ‘comment’, ‘explain’, ‘indicate’, ‘note’, ‘describe’, ‘observe’, remark’, ‘state’, and ‘find’ is recommended (2). These referring verbs can be used either in the present or the past tense; using the present tense indicates that the source is recent and still valid, whereas the past indicates that the source is older and may be out of date (3). To find further appropriate verbs and vocabularies to cite the literature being reviewed, readers can refer to other works (2, 26).

3.2. In-Text References

In-text references (brief address to the source in text) are presented by three major systems: ‘citation-sequence’, ‘citation-name’, and ‘name-year’. In the ‘citation-sequence’ system, numbers are used to refer to the reference list (27, 28), which is numbered sequentially according to the appearance in the text. In the ‘citation-name’ system, the numbering system is used to refer to the reference list, which is numbered in alphabetical order by authors’ names; it means numbers are used in the text regardless of the order in which they appear (28). The ‘name-year’ system consists of the surname of the author and the year of publication, and the reference list is alphabetically ordered first by author and then by year (28). If ‘name-year’ system is used, in case of referring to two references with the same first author, chronological hierarchy order is followed (e.g., Annesley, 2010; Annesley, 2011), and in case of the same first author and same publication year, the references need to be differentiated by alphabetical letters after the year of publication (e.g., Annesley, 2010a; Annesley, 2010b) (19). If the name of author/editor cannot be identified, use the title of the work and the year of publication instead; if the date is not identified, use the phrase ‘no date’ after author’s name and where both author and date are unknown, use the title followed by ‘no date’ (23).

Citation management software programs (e.g., EndNote, Reference Manager, RefWorks, ProCite, and RefBase) easily connect in-text references to the reference list. These programs can format in-text references and bibliographic details in a different style (discussed in section 4) and can change them from one style to another.

The general rule to refer to a reference in the text is to place the reference immediately after the idea or fact introduced. In other words, an in-text referring might appear in the middle of a sentence and not always at the end (6, 19).

Unless a sentence ends with a fact (in which case the citation follows), the authors should not pool all the references at the end of a sentence (29). In case of citing multiple facts in a sentence, it should be clarified which reference is corresponding to which fact (19). Wherever more than one reference is used to support a fact, the authors should refer to the references in chronological order (the oldest reference is listed as the first in-text reference) (19). For direct quoting or citing a specific idea or piece of information, the page number of the quote should be included in the in-text reference (23, 30). For an in-text citation that refers to secondary sources (second-hand references), name the original source and then use the term ‘cited by’ followed by the reference for the work in which it is quoted (e.g., Schweer, cited by Harrison, 1992, p. 774) (31).

3.3. Bibliographic Details (Reference List)

Every in-text reference should have a corresponding entry in the reference list (28); the exceptions are ‘personal communications’ (28), and ‘unpublished data’ (6) that are referenced within the text, but do not appear in the reference list. According to the British Standards Institution, a reference is “a set of data describing a document, sufficiently precise and detailed to identify it and enable it to be located” (32). The essential elements and order of the most common forms of references, including journal articles, books, reports, and websites, are given in supplementary Box 1.

The bibliographic details provided in the reference list should be accurate and complete to ensure that readers will be able to locate the material as easily as possible (32). The accuracy of the reference list increases the credibility of the author, the journal, and the research itself (33). To increase the accuracy of the bibliographic details, ICMJE (International Committee of Medical Journal Editors) recommends that “References should be verified using either an electronic bibliographic source, such as PubMed, or print copies from original sources” (34). Errors in the reference list usually arise by copying bibliographic details from previous papers; thus, authors should not copy from reference lists or databases, and the only reliable source is the original paper published in the journal (8). In case of using second-hand information, bibliographic detail of a source, where the information is found, should be included in the reference list.

4. Referencing Systems and Styles

Broadly, three types of referencing systems are employed in the academic world (3). These are, (i) consecutive-numbering system (well-known as Vancouver), (ii) author-name-publication year system (well-known as Harvard)
The first format for bibliographic references in medical science was adopted officially by the Vancouver Group and the National Library of Medicine (NLM), in 1979 (37). The Vancouver Group was a small group of editors of medical journals who met informally in 1978 in Vancouver, British Columbia, to establish guidelines for the format of manuscripts submitted to their journals (37); the group expanded into the ICMJE and developed the Uniform Requirements for Manuscripts Submitted to Biomedical Journals,’ which is updated regularly (38). The reference style is famed as the Vancouver style because of its origin, and it has become a broadly accepted bibliographic format (8). According to the Vancouver style (the author-number system), references are numbered consecutively in the order in which they are first mentioned in the text; references in text, tables, and legends should be identified by Arabic numerals in parentheses (38). The Vancouver style is used by PubMed and MEDLINE.

The Harvard system, so-called as the ‘parenthetical author-date method’, is another popular referencing system (31). The origin of the system is obscure; however, the first evidence of the system goes back to 1881, when Edward Laurens Mark, professor of anatomy and director of Harvard’s zoological laboratory, published a landmark cytological paper and used parenthetical author-year citation (39). As Chernin narrated (39), from an editorial note in the British Medical Journal in 1945, the expression ‘Harvard system’ was not introduced by the Harvard University, but an English visitor to the library of Harvard University was impressed by the system of bibliographical reference and named it as the ‘Harvard system’ upon their return to England. The Royal Society defined the Harvard referencing system in 1965 as “a system in which names and dates are given in the body of the text and the references alphabetically at the end of the paper” (31).

Although most biomedical journals have adopted the Vancouver style, some still prefer the Harvard system, because they like to know just what author(s) is/are being cited as they read the text (40). However, the Harvard system is criticized due to potential difficulties that it may create for the readers. For example, if they are interested in an item in the reference list, they need to look it up within the main text. This system may also disrupt the text when a large number of references need to be cited within a paragraph (40).

Although medical journals specify Vancouver or Harvard systems, some journals have made minor modifications (41). For example, they have modified the referencing systems, both in-text references, and bibliographies, they have changed punctuation marks, used bold, and italics enhancements, alphabetical or sequential ordering of references, or have made combinations of variations that create a unique reference style that is as large in number as the number of journals currently published (41, 42). Authors should carefully follow the format used by the target journal that is usually given in the Information/Instructions for Authors.

5. Other Considerations

5.1. Dealing with Scientific Sources

The most important challenge of the citation process in a scientific work is ‘which sources must be selected for citation’ and ‘How do the authors deal with the literature being reviewed to cite others accurately and ethically?’ Existence of a large number of publications on the topic makes selection difficult; however, authors should artfully select them to cover all citation purposes and add to the manuscript scientific prestige (43). Among available sources, the most relevant, valid, methodologically sound, and those with a landmark contribution to the topic should be selected (9, 17). If there are a significant number of prior studies on the topic, the most comprehensive and the most recent works should be selected because they presumably discuss and reference the older studies (44).

The most valid and available sources for citing are published peer-reviewed original journal articles; primary sources (research articles written by those who conducted the research) are preferred (21). Secondary sources (review papers) can be used when primary sources are unavailable, or a summary for elaborating research problem is more effective; however, they should not be taken as definitive word or fact on the topic (9). Citation of review articles rather than the original papers should be limited (45, 46) since it fails to provide credit or acknowledge the effort of the authors of original research papers. In addition, it may lead to misinterpretation or oversimplification of original research findings (45). The use of high-quality systematic review is acceptable; otherwise, it should be acknowledged in the text as a review paper to prevent misleading the casual reader about the originality of the work (9).
Less valid sources (i.e., theses, conference proceedings, unpublished data, abstracts, and personal communications) are not recommended (19) unless they contain essential information not available from public sources (47). These less valid references can only be used for supporting the results of preliminary studies or citing parallel results in another study population (17). In case of referring to ‘unpublished sources’ or ‘personal communications,’ the written permission of the author is required to ensure the accuracy of the data and prior approval from the authors (6, 17).

Sources that may not be found in public domain, e.g., submitted but unaccepted journal articles, meeting abstracts, and posters should not be used (6, 17). Standard textbooks are not cited except for describing a theoretical or methodologic principle or a statistical procedure. As stated by ICMJE, authors are responsible for checking that the references cited not be retracted articles (34).

5.2. Statement Needs to be Supported by a Reference

As a general rule, findings/statements of other’s work need to be supported by references (9). Statements like ‘the literature suggest that...’ or ‘there is general agreement that...’ should be followed by addressing one or more references (9); it is, however, not appropriate and usually essential to support a statement with more than 3 or 4 references (9). In contrast, common knowledge in a field, defined as facts, dates, events, or information that are expected to be known by someone studying or working in a particular field (e.g., long-established facts or theories), or facts that can be found publicly (e.g., date of the second world war) and are likely to be known by many people (e.g., capital cities of the countries) do not generally have to be referenced (23).

5.3. Accuracy and Ethics of the Citation

Accurate citation is a crucial issue, enabling readers to follow the flow of ideas and statements in a scientific field and ensure the integrity of the science being communicated (19, 48). Citing the sources without retrieving and reading their full-texts and understanding their entirety (19), giving multiple similar references to support a single statement, or using a single source to support multiple statements are among examples of inaccurate citations (48). Since an abstract is a brief summary of the work, its content may not accurately present details reported in the text, and therefore, it is a poor practice to cite references after skimming results of the abstract rather considering the whole text (9).

To avoid inaccurate quoting, the authors should review the entire original article to check the facts. They should be careful in case of paraphrasing or summarizing in order to make sure that the intent or meaning of the original author is not altered (49). To reduce the risk of misinterpretation of information, the use of secondary sources should be avoided (49). According to NLM, “The medical literature is full of references that have been cited from other references, serving only to perpetuate erroneous information”, thus, they emphasize that the authors should never reference documents that they have not read (27).

Spurious citation, biased citation, and over self-citation are also common problems of citation (Box 3). Self-citation, defined as citing one’s own work in a scientific paper, is a common practice and is an essential part of scientific communication, which represents the continuous and cumulative nature of the research process (50). When a researcher works on a specific topic for years, 25% self-citation is not uncommon (46). However, either irrelevant self-citation or over self-citation are considered unethical practices, which affect the precision of the paper (50, 51). The spurious citation occurs where sources are not needed but are included anyway, e.g., over-citation or redundant citation (i.e., where the extra sources do not add any value beyond the first source), or citing an obscure, historical reference to give an impression of erudition (4).

6. Common Errors and Problems of Citation

Citation errors reflect badly on the authors and the publishing journal and may reflect underlying flaws in other areas of the published research (33). Citation content errors (e.g., inaccurate quoting from others) and both major and minor errors in referencing (both in-text references and bibliographic details) can occur during the citation process (4, 7, 33). Inaccurate quotations or misquotations are perpetual citation errors that lead to circulate a false ‘accepted fact’, which are very hard to correct (10). A list of common citation errors is provided in Box 3.

Major errors in references, which are responsible for up to 21% of citation errors in the medical field (53), prevent the source being retrievable (4). With minor errors (i.e., punctuation and spelling mistakes in bibliography, i.e., name of authors, title, journal, volume, year, and page numbers), references can still be found (4, 9). Potential pitfalls of citation-management software programs may also cause some citation errors (54). Several duplicate copies of a reference in the software may be inserted due to importing the same reference on a number of different occasions (maybe with different patterns); this may lead to the appearance of duplication in the reference list (6, 48). In the case of anonymous papers (prepared by a committee or a group of authors), some mistakes may occur (54). Another common mistake relates to the journal-title; the journal-title may be imported in the abbreviated form, while both full title and conventional abbreviation need to be entered.
into the journal section of the reference manager (54). To sum up, the author is responsible for final checking the accuracy of the bibliographic details (19) and should correct reference manager databases before the reference is exported to the final bibliography.

7. Conclusion

Making good and accurate citations adds to the manuscript’s scientific prestige and signifies that authors have an in-depth knowledge of the literature and writing skills. An original research paper usually has 25 - 40 references and the authors should be note that citing too few or too many references may reflect poor intellectual attitude and work validity. The most important, most elegant and the most recent sources should be selected for citation.

Footnotes

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References

1. Masic I. The importance of proper citation of references in biomedical articles. Acta Inform Med. 2013;21(1):348-55. doi: 10.5455/aim.2013.21.1348-55. [PubMed: 24167388]. [PubMed Central: PMCPmc3804522].

2. Lingard L. Writing an effective literature review : Part II: Citation technique. Perspect Med Educ. 2018;7(2):133-5. doi: 10.1007/s40037-018-0407-2. [PubMed: 29500746]. [PubMed Central: PMCPmc5889578].

3. Bailey S. References and Quotations. In: Bailey S, editor. Academic writing: A handbook for international students. Routledge; 2014. p. 52-60.

4. Mack C. How to Write a Good Scientific Paper: Citations. Journal of Micro/Nanolithography, MEMS, and MOEMS. 2012;11(3):30101.

5. Penders B. Ten simple rules for responsible referencing. PLoS computational biology. 2018;14(4):e1006036. doi: 10.1371/journal.pcbi.1006036. [PubMed: 29649210].

6. Fooke M. Why references; giving credit and growing the field. Chest. 2007;132(1):344–6. doi: 10.1378/chest.07-0320. [PubMed: 17625096].

7. de Lacey G, Record C, Wade J. How accurate are quotations and references in medical journals? Br Med J (Clin Res Ed). 1985;291(6499):884–6. doi: 10.1136/bmj.291.6499.884. [PubMed: 3931753]. [PubMed Central: PMCPmc4167576].

8. Rogers SM. Quoting Published Material: Reference Formats. In: Rogers SM, editor. Mastering scientific and medical writing. Springer; 2007. p. 65-71.

9. Mc DD. The appropriate use of references in a scientific research paper. Emerg Med (Fremantle). 2002;14(2):166–70. doi: 10.1046/j.1442-2026.2002.00321.x. [PubMed: 12471014].

10. Vickers MD. Citation errors—there is still much to be done. Can J Anaesth. 1995;42(1):1063. doi: 10.1007/bf03010885. [PubMed: 8590509].

11. Bahadoran Z, Jeddi S, Mirmiran P, Ghasemi A. The Principles of Biomedical Scientific Writing: Introduction. International journal of endocrinology and metabolism. 2018;16(4):e84795. doi: 10.5812/ijjem.84795. [PubMed: 30464776].

12. Ghasemi A, Bahadoran Z, Zadeh-Vakili A, Montazeri SA, Hosseinpanah F. The Principles of Biomedical Scientific Writing: Materials and Methods. Int J Endocrinol Metab. 2019;7(1). e88155. doi: 10.5812/ijem.88155.

13. Bahadoran Z, Mirmiran P, Zadeh-Vakili A, Hosseinpanah F, Ghasemi A. The Principles of Biomedical Scientific Writing: Results. Int J Endocrinol Metab. 2019;7(2). e92113. doi: 10.5812/ijem.92113.
