

Directed Reading Article

Writing an Effective Literature Review

Amanda Bolderston, M.R.T.(T), BSc, MSc, FCAMRT^{a,*}

^a Princess Margaret Hospital, University Health Network, Toronto, Ontario

LEARNING OBJECTIVES

On completion of this directed reading article, readers should be able to:

1. Define the types of commonly used literature review
2. Discuss literature search strategies
3. Describe methods to critically appraise the resulting literature
4. Define ways of synthesizing the evidence into a useful and relevant review
5. Identify ways of writing a readable (and publishable) literature review

*This article is a directed reading and provides the equivalent of 2 hours of continuing education that may be applied to your professional development credit system.

ABSTRACT

A literature review can be an informative, critical, and useful synthesis of a particular topic. It can identify what is known (and unknown) in the subject area, identify areas of controversy or debate, and help formulate questions that need further research. There are several commonly used formats for literature reviews, including systematic reviews conducted as primary research projects; reviews written as an introduction and foundation for a research study, such as a thesis or dissertation; and reviews as secondary data analysis research projects. Regardless of the type, a good review is characterized by the author's efforts to evaluate and critically analyze the relevant work in

Introduction

The literature review has been called the "Cinderella" of research, because it is often seen as the poor relation to primary research, or the dull but necessary prelude to a research report or proposal [1]. However, a good review can extract new ideas from others' work by synthesizing and summarizing previous sources. New theories can be built from the evidence discussed, and new directions for future research can be suggested. A literature review can also facilitate the use of best

the field. Published reviews can be invaluable, because they collect and disseminate evidence from diverse sources and disciplines to inform professional practice on a particular topic. This directed reading will introduce the learner to the process of conducting and writing their own literature review.

RÉSUMÉ

Une analyse documentaire peut être une synthèse informative, indispensable et utile sur un sujet particulier. Elle peut identifier ce qui est connu (et inconnu) dans le domaine, identifier les domaines de controverse ou de débat et aide à élaborer des questions qui ont besoin de recherche supplémentaire. Il y a plusieurs formats utilisés généralement pour des analyses documentaires, y compris des examens systématiques menés comme des projets de recherche primaires; des analyses écrites comme introduction et fondement pour une étude de recherche, telle qu'une thèse ou une dissertation; et des études comme projets de recherche d'analyse de données secondaires. Indépendamment du type, une bonne analyse est caractérisée par les efforts de l'auteur à évaluer et à analyser de façon éclairée le travail pertinent dans le domaine. Les études publiées peuvent être de très grande valeur pour recueillir et diffuser les preuves de sources et de disciplines diverses afin d'informer la pratique professionnelle. Cette lecture dirigée initiera l'étudiant au processus de mener et d'écrire sa propre analyse documentaire.

available evidence in daily practice, by supplying answers to clinical questions [2]. Literature reviews are also an ideal first step into the world of publishing. All the investigator needs is an initial research question, access to a literature database (such as MEDLINE or CINAHL), and some basic evaluation and writing skills.

Definition of Literature Reviews

Literature reviews are found in many places and are written for many reasons, including "proposals for funding and for academic degrees, in research articles, in guidelines for professional and evidence-based practice, and in reports to satisfy personal curiosity" [3].

* Corresponding author. Radiation Therapy Department, Princess Margaret Hospital, Room 5-969, 610 University Avenue, Toronto, Canada M5G 2M9, Tel: +416-946-4501; Fax: +416-946-2019.

E-mail address: amanda.bolderston@rmp.uhn.on.ca.

According to Steward [1], a good review should be:

- Comprehensive: evidence should be gathered from all relevant sources.
- Fully referenced: allowing others to follow the path of the author to the paper's conclusion.
- Selective: using appropriate search strategies to find the key evidence.
- Relevant: focusing on pertinent data.
- A synthesis of key themes and ideas.
- Balanced: between different ideas and opinions.
- Critical: in its appraisal of the literature.
- Analytical: developing new ideas and understandings from the evidence.

A literature review can provide a concise examination and discussion of evidence in a particular area. When looking for a quick overview of a topic, published review articles can cover a wide range of subject matter at various levels of completeness and comprehensiveness based on analyses of literature that may include research findings [4]. Above all, the author should provide readers with a clear picture of the subject and its associated range of perspectives and opposing views and avoid presenting "dry and impenetrable lists of poorly debated facts, randomly selected and referenced" [4].

Annotated bibliographies and literature reviews have some similarities. As with the literature review, an annotated bibliography is an account of the research that has been carried out in a given area. However, an annotated bibliography is usually just a list of relevant sources with an accompanying brief summary. Sometimes the annotated bibliography will contain an assessment of the sources' value or relevance, but there is no attempt to synthesize the various sources into a coherent conclusion reflecting the author's opinion, as is usual in a literature review.

Types of Literature Reviews

There are several commonly used formats for literature reviews that will be discussed in brief. However, this article will concentrate on the literature review as a secondary data analysis leading to a publishable piece of work.

Systematic Reviews

The systematic review is related to the meta-analysis, which is an attempt to quantitatively condense the results from several papers into a single statistic [5]. Creating a systematic review allows for increased power and precision in estimating effects and risks. In addition, the systematic review is an invaluable practice tool. Large quantities of information can be evaluated and synthesized into a shorter document. This allows clinicians to keep abreast of new developments without having to track down and read several long reports. Organizations or policy makers can use systematic reviews to help formulate guidelines to promote the use of best evidence in practice [6].

The Cochrane Collaboration is perhaps one of the best-known proponents of systematic reviews designed to answer clinical questions about the effectiveness of treatments. For example, the Cochrane review on interventions for relieving the pain and discomfort of screening mammography examined seven randomized controlled trials involving 1,671 women [7]. Among other things, the report concluded that giving women written or verbal information about the procedure before the mammogram could reduce their pain or discomfort.

Secondary Data Analysis Projects

This type of review is a research project in its own right and therefore should be conducted with appropriate rigour. The secondary data review can be undertaken whether there is little known about a subject or where there is a wealth of information available. Either way, the researcher should begin with a clear statement of purpose or a research question [1]. The approach to organizing and analyzing the data acquired in the secondary data search is more qualitative in nature and the material is often organized by theme.

Introduction to a Primary Research Topic

The literature review is used to set the scene for a primary research topic and therefore can be fairly concise. This preliminary evaluation should also serve to convince the reader that the researcher has considered the previous published work on the topic and that the new research they have conducted is important and adds to this body of knowledge. The argument moves from a broad and general appraisal to a more specific examination of the pertinent issues [8]. This sort of review is essential to introduce the study and provides a foundation for the author to formulate a discussion of the results.

The Steps of the Literature Review

Although these steps are presented here in a fairly linear way, the completion of the review often follows a somewhat circuitous path. The search (or search results) may need to be revisited several times during topic selection. In addition, the search is often revisited as the review develops and new areas of relevance are identified [9].

Starting Out

The most important preliminary decision for potential authors is determining why they are performing a literature review, because this will influence the approach taken. Is the end result to be a publishable research paper, part of a departmental report, an attempt to establish standards and guidelines for practice, the prelude to a thesis/dissertation, or a personal undertaking to solve a pressing practice question? Is there a choice in the topic or is the area of interest already circumscribed?

Assuming the authors would like to disseminate their work in a journal and they are fairly free to choose a subject that interests them, one of the first steps should be a preliminary,

fairly superficial search in the relevant area. This will ascertain whether there is already enough published literature to provide a solid base for the review.

The second step is to define the focus of the review. Often the difficulty is not the topic selection, but narrowing the focus of the review down to a manageable size. For example, the topic of fatigue in people with cancer would yield a vast quantity of information, whereas examining the use of exercise as an intervention to relieve fatigue symptoms in radiation therapy patients would reduce the field considerably. The question, search strategy, and criteria for excluding studies from the review are decided before conducting the literature search and should all be explicitly defined in the “Methods” section of the final article [10].

Keywords are the words used to find relevant and useful material during the search. The keywords chosen for the search are important, as they are “the cornerstone of an effective search” [9]. Before starting, it is important to consider all possible words that might relate to the topic. This includes synonyms and alternate terms (for example, the word *renal* is an alternate term for kidney). Spelling is also worth considering; a search for “hematology” may exclude Canadian or British articles (where the term used may be “haematology”). Some databases allow truncation (using part of a word), Boolean searching (for expanding, joining, or excluding keywords), and other functions to refine and focus a search. Searches can be restricted by other factors such as the language of the publication, full text only, review papers only, year of publication, and so on. It is worth exploring the online support options of the database you are using, because many databases contain information on the useful search features available, or even offer online tutorials.

Most databases use a so-called controlled vocabulary to establish common search terms (or keywords). This ensures a consistent way of retrieving information that may use different terminology for the same concept. The National Library of Medicine’s preferred list of terms is called Medical Subject Headings (or MeSH terms) [11]. This continually updated list of more than 19,000 terms is used by numerous health organizations, databases (including MEDLINE), and medical libraries to index information. Familiarity with MeSH terms and their use will facilitate keyword selection and the resulting database searches.

Searching the Literature

Spending time planning the search strategy is important, because a well-conducted search will identify the relevant articles and texts and ultimately yield higher quality work. It is beyond the scope of this article to offer more than a brief overview of the process. However, there is a plethora of information readily available on conducting effective literature searches (Figure 1). One invaluable source of information is your local medical librarian or information specialist who may offer tutorials on searching medical databases or personalized assistance with literature searches. The author should keep track of the search strategy to ensure the procedure is

Articles

Brette, A., & Gambling, T. (2003) Needle in a haystack? Effective literature searching for research. *Radiography* 9, 229–236.

Marshall, G. (2005) Critiquing a research article. *Radiography* 11, 55–59.

Books

Hart, C. (2001) *Doing a literature search: a comprehensive guide for the social sciences*. London: Sage.

Fink, A. (2004) *Conducting research literature reviews: from the internet to paper*. 2nd ed. London: Sage.

Online

Doing quality literature searches. Yale University School of Medicine. <http://www.med.yale.edu/library/education/hic/searching.html>

The University of Sydney. Information literacy - Doing a Literature Search.

<http://www.health.usyd.edu.au/current/research/litsearch.php>

National Library of Medicine Medical Subject Headings (MeSH) Index <http://www.nlm.nih.gov/mesh/MBrowser.html>

Figure 1. Selected Searching and Appraising Resources.

rigorous, explicit, and comprehensive [9]. The strategy can be communicated in the “Methods” section of the published article; this allows readers to follow the author’s course of action.

The authors must decide on the discipline that best covers their area of interest. The most obvious for medical radiation technologists and therapists would be the medical radiation sciences, and would include journals such as the *Journal of Medical Imaging and Radiation Sciences*, *Radiography* or *Radiologic Technology*. However, relevant information may be found in other disciplines such as nursing, medicine, other allied health professions, psychology, sociology, and education.

Most literature searches today are electronic, because many health centre or hospital libraries have evolved from repositories of journals and texts into information centres staffed by expert librarians or information specialists. However, books can provide useful information in certain topic areas. It is worth bearing in mind that some texts can become rapidly outdated, and journal articles may contain more recent information. The Internet is also a source of information that can be accessed. Care must be taken when appraising Web sites for accuracy of information, because much of the material is unregulated. Wikipedia [12], for example, is a popular source of information and contains more than 2 million articles. However, the content can be edited by anyone; thus, reliability is an issue. There are many reputable health Web sites that can be accessed; some via gateways that screen each listed site for quality (Table 1).

The “grey” literature is defined as any material that is not commercially published, and therefore not searchable using electronic databases. Grey literature can also include conference proceedings, dissertations, theses, government information, and committee reports. The importance of accessing this type of information will vary according to the type of literature review being written. It has been suggested that these types of sources are only required for Master’s level work and beyond [13]. However, grey literature may be an important source of information for the emergent disciplines of the

Table 1
Electronic Sources of Information

Database	URL	Characteristics
PubMed	www.pubmedcentral.nih.gov	The National Library of Medicine's free search service. Available through the World Wide Web. Rapid updates of published material. Some free full text material.
MEDLINE	www.nlm.nih.gov	Contains abstracts and references from 1966 to the present. Combines more than 3,900 medical and nursing journals into a single database. Includes Canadian Journal of Medical Radiation Technology, Radiography and Radiologic Technology.
CINAHL	www.cinahl.com	The Cumulative Index to Nursing and Allied Health contains abstracts and references from 1966 to the present. As well as more than 1,700 journals, CINAHL provides access to health care books, dissertations, selected conference proceedings, standards of professional practice, and educational software.
Evidence-based Databases		
Cochrane Database of Systematic Reviews	www.cochrane.org	Includes full text of the regularly updated systematic reviews of the effects of healthcare prepared by The Cochrane Collaboration. Free summaries are available; the full version is subscription only.
BMJ Clinical Evidence	www.clinicalevidence.bmj.com	The <i>British Medical Journal's</i> online decision-support resource describing the best available evidence from systematic reviews, randomised controlled trials, and observational studies.
Health Information Gateways		
Health on the Net	www.hon.ch	Non-profit, non-governmental organization, accredited to the Economic and Social Council of the United Nations for patients and health care professionals.
National Library for Health	www.library.nhs.uk	Funded by the UK's National Health Service for patients and health care professionals.

medical radiation sciences. For example, pertinent material may only be available as posters or presentations delivered at conferences (published only in the conference syllabus) or as articles published in journals that are not indexed in the major databases [14].

As articles come to light, accurate references and notes must be kept. There are several methods of capturing references. One of the easiest is to cut and paste the information into a Word document to be appended to the finished article as a reference list. References can also be written onto index cards with a summary of the article's key points. As an alternative, there are several reference management software packages commercially available such as EndNote, Reference Manager, and ProCite. The reference style to be used will vary from journal to journal, although the American Medical Association style used by PubMed and MEDLINE is fairly common.

In addition to literature captured by the initial database search, the reference lists of the articles found can be scanned for more articles that may have been missed. It should be fairly obvious who the experts are in the area of interest; it may also be worthwhile doing another search using their names for further information. Depending on the subscriptions held by the organization, some of the articles discovered through the databases may be available for free download. If this is not the case, the article may be available for interlibrary loan or in hard copy locally. Sometimes colleagues with university affiliations may be able to access hard-to-source information through university libraries.

There is some debate about relevant and recent research dates being included in literature reviews [15]. It is generally

acknowledged that recent literature is the most current, although it is important to include any seminal work in the field using the original primary sources regardless of the dates of the original research.

Appraising the Literature

The ability to critically appraise literature and weigh the evidence is central to the tenets of evidence-based patient care, which is one of the primary driving forces behind health care today [16]. A literature review, when done well, can help practitioners sift through the vast amounts of published information and assist in their clinical decision-making.

When reviewing the literature, it is best to concentrate on primary evidence rather than secondary evidence when possible. Primary evidence is original research such as clinical trials, studies, or statistical reports. Secondary evidence includes articles in which the author reports on original research or data (such as a literature review). Including mainly primary evidence ensures that the reader can interpret the original evidence for herself or himself and eliminates potential bias or inaccuracies from second-hand reports of other people's work [17].

Literature is generally categorized according to the perceived strength of the evidence it contains; thus, the review should discuss the strengths and weaknesses of the articles reviewed. There are many standard methods available for systematizing this process, mainly based on quantitative research evidence. For example, the Centre for Evidence Based Medicine's comprehensive "Levels of Evidence" tool [18] stratifies studies into 10 levels from the highest credibility (a homogenous systematic review) to the lowest (a piece

expressing expert opinion without explicit critical appraisal). These tools can be useful for grading evidence, but promulgate the notion that the randomized controlled trial is the gold standard against which all other forms of research should be compared [1].

In reality, the evidence being sifted for a literature review will usually cover a wide variety of published material from descriptive articles with little discussion or analysis to review articles that summarize and evaluate research. It may also include reports of completed research and even single-author opinion pieces. To complicate things further, the results of the search can contain information from both peer-reviewed and non-peer-reviewed sources. The peer review process in respected journals is an indicator that the material is held to a high standard. However, non-peer-reviewed articles can often add important information and should not be discounted. As a rule of thumb, the literature resulting from the search must be appraised in a fairly broad way and the appraisal needs to be sensitive to the format of the publication. This will allow the author to weight the information from each source for inclusion and contribution to the conclusions of the final literature review.

Other questions to consider when reading the gathered material include the following [19–21].

1. Does this relate to the question posed by the literature review?
2. Is the problem or issue and its significance (scope, severity, relevance) clearly defined?
3. Could the problem have been better addressed from another perspective?
4. What is the research orientation (eg, quantitative, qualitative, mixed methods)?
5. Has the author fairly evaluated the literature, including literature taking a position she or he does not agree with?
6. Does the author appeal to emotion or use rhetoric? Does there seem to be an objective basis to the reasoning?
7. Does the material add to the understanding of the field? Is it useful for practice?
8. In a qualitative study, how transparent are the author's methods and approaches? Is there an attempt to show the trustworthiness of the results? This may include:
 - a. Triangulation: using more than one method of data capture
 - b. An audit trail: documentation of decisions made during data collection/analysis
 - c. Peer review: independent review of the themes by team members or peers not involved in the research
 - d. Member checking: interpretations of the data are shared with participants
 - e. Data saturation: data are gathered continuously until all themes are exhausted
 - f. Negative case analysis: looking for contrasting experiences/examples to disprove emerging theories

9. In a quantitative research study, how good are the components of the study design? This may include:
 - a. Sampling size and techniques
 - b. Are the results generalizable to a wider population?
 - c. Stated strengths and weaknesses of the study
 - d. Threats to the study's reliability and validity
 - e. Was the power of the study calculated?
 - f. Are there any obvious biases?
 - g. Are the conclusions validly based on the data and the analysis?

Many reviews contain a summary table designed to present an overview of the articles discussed in the review and their key findings. This can add clarity and make the process of following the author's development of the review easier for the reader. The headings of the table will depend on the purpose of the review. For example, in a review of the literature pertaining to radiotherapy for bone metastases and fractionation schedules, McKee [22] presented the studies used according to date, study size, fractionation schedule, and study conclusions. McKee also summarized the studies according to level of evidence (ie, giving the highest weight to evidence from randomized controlled trials).

In synthesizing the evidence, the author will attempt to bring together the material that has been presented. The reader should trust that the issues have been represented accurately and fairly and be left with a mental map of the territory that allows them to explore previously unanticipated areas, formulate their own ideas and opinions, and decide where they might want to travel to in the future.

Writing the Final Article

There are several good texts, online sources, or summary articles that can provide further guidance for novice writers (Figure 2). General advice on writing for publication usually includes setting time (and space) aside for writing, among other words of wisdom. When putting the final article together, many writers find that their thoughts are not organized in a linear fashion. Ideas can be developed in different areas simultaneously and then reorganized in a later draft. It has been noted that medical radiation technologists and therapists do not have a well-established tradition of research to reflect on when writing for publication. This may make the first step into submission for publication quite daunting [23]. It is therefore helpful to recruit the support of a colleague who has experience in writing to critique the article as it is being developed and to offer support.

The article will begin with the "Introduction" section; this will provide the framework for the reader by providing a brief summary of the area of interest, the relevance to the reader and the paper's intent. The "Methods" section will describe the search strategy, including the databases used and other sources of information explored. It will also include the keywords used (including MeSH terms if appropriate), as well as the inclusion and exclusion criteria and an explanation of why these were selected.

<p>Articles Keen, A. (2007) Writing for publication: pressures, barriers and support strategies. <i>Nurse Educ Today</i> 27, 382–388.</p> <p>Kliwer, M.A. (2007) Writing it up: a step-by-step guide to publication for beginning investigators. <i>Can J Med Radiat Tech</i> 38, 27–32.</p> <p>Books Hall, G.M. (1994) How to write a paper. London: BMJ Publishing Group.</p> <p>Online The Journal of Medical Imaging and Radiation Sciences (JMIRS) author submissions guidelines http://www.camrt.ca/english/publications/instructions_authors.asp Dixon N. Writing for publication: A guide for new authors. <i>International Journal for Quality in Health Care</i> 2001. 13(5); 417 - 421 http://intqhc.oxfordjournals.org/cgi/reprint/13/5/417.pdf</p>
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Figure 2. Selected Writing for Publication Resources.

For the “Discussion” section, or body of the article, it is easier to break the main section up into thematic areas and treat each area as a mini-review. This section can also be organized chronologically depending on the focus of the review. Each section should be as comprehensive as possible. The review should be balanced and acknowledge controversies, unanswered questions, issues of bias, and differing opinions. If there is evidence, it should be emphasized and rated for its quality. The important information from the article’s sources should be recapitulated, but also synthesized by rephrasing the significance of the work and relating it back to the question posed by the literature review [24]. Tables and figures can highlight key points in the text, and a summary table of the references being discussed is often helpful.

The conclusion should answer the “so what” question—namely, will this article change practice or add to the discussion on the subject? What should the reader take away from the review? Is there a theoretical framework that can be constructed from the literature that would contribute to practice? Are there gaps in knowledge that can be answered by further research? The author will refer back to the literature and bring pertinent points to the fore. Key issues from the review will be synthesized and reflected on.

It is often useful to look at examples of literature reviews that have been published in the area of interest or the target journal. However, there are a few general points to bear in mind when crafting the final article. It is important that the author keeps his or her own voice throughout the process; therefore, quotations from other authors should be used sparingly. Generally, several drafts will be needed before the article is finished. The peer-review process after submission to a journal will undoubtedly produce several areas for revision, but hopefully these can be minimized with wise counsel. Usually the author will have a specific journal in mind for submission. Almost all journals have online style guides for authors. It is well worth consulting this *before* writing up the review, because the article may be returned if it does not follow the journal’s format. Often the guidelines are very detailed and may assist the writing process by providing a framework for the emerging article.

However the writing is carried out, the end result should be “a good read... literature reviews should get the reader going!” [1].

Conclusion

“Originality rarely means starting from scratch, but looking to expand that which is already known [25].”

A good review can be an invaluable tool to the practitioner, providing a succinct summary and analysis of the pertinent information in a given area. As “discursive prose” [18], a review can be enlightening, challenging, and readable. There are many rewards associated with producing a useful piece of work. A literature review can provide the fledgling researcher or author with the first step into the rewarding world of publishing.

It is hoped that this article will encourage readers to investigate topics within their own professional area of interest and consider submitting their own literature review for publication.

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