Fundamentals of a Literature Review

Part I is an introduction to basic terminology, the field of research synthesis, and tutorials to get you started. It consists of two chapters that cover the basic terms and content you will need in order to understand how to use The Matrix Method.

Chapter 1, *Introduction*, defines what is meant by a review of the literature, describes the broader field of research synthesis, and discusses two internationally developed guidelines, one for designing better studies and the second for expert led reviews. A new feature, the PRISMA Flowchart, is introduced in the *Fifth Edition* as a complement to The Matrix Method that emphasizes better clarification of the literature reviewed.

Chapter 2, *Basic Concepts*, focuses on some of the fundamental information you will need to conduct your own review of the literature. Specifically, basic concepts are defined, the anatomy of a typical health sciences journal article is described, and a tutorial is presented on how to conduct a methodological review, which is one part of a review of the literature.

*Caroline’s Quest* is an ongoing section in each chapter. Its purpose is to demonstrate the process of understanding and applying the content of each chapter.

*What You Should Know or Be Able to Do by the End of This Chapter*, another new feature of the *Fifth Edition*, is included at the end of both chapters. Test yourself with these questions to determine whether you really did know what was covered.
Introduction

The Matrix Method is a versatile way to review the literature. The background and philosophy of a literature review and an introduction to the Matrix Method are described in the following sections in this chapter:

- Review of the Literature
- Well Beyond Index Cards
- To Own the Literature
- Research Synthesis: Historical Perspective
- Guidelines for Designing and Reporting Better Studies
- Guidelines for Expert-Led Reviews
- PRISMA, PROSPERO and a Journal
- IOM Standards for Systematic Reviews: Finding What Works in Health Care
- Scoping Reviews: Finding the Gaps in Existing Literature
- Future Guidelines and Revisions in the Health Sciences Literature
- Difference Between Systematic Reviews, Scoping Reviews, and Reviews of the Literature
- The Matrix Method: Definition and Overview
- Review Matrix: A Versatile Tool
- Overview of Chapters and Appendices
- References to Websites
- Caroline's Quest: Understanding the Process
- What You Should Know or Be Able to Do by the End of This Chapter
Chapter 1 Introduction

REVIEW OF THE LITERATURE

The purpose of this book is to describe the Matrix Method and the Matrix Indexing System. The Matrix Method is a strategy for reviewing the literature, especially the scientific literature. A review of the literature consists of reading, analyzing, and writing a synthesis of scholarly materials about a specific topic. When the review is of scientific literature, the focus is on the hypotheses, the scientific methods, the strengths and weaknesses of the study, the results, and the authors’ interpretations and conclusions. A review of the scientific literature is fundamental to understanding the accumulated knowledge about the topic being reviewed. The Matrix Indexing System helps the user create and maintain an electronic reprint file.

The term scientific literature refers to theoretical and research publications in scientific journals, reference books, textbooks, government reports, policy statements, and other materials about the theory, practice, and results of scientific inquiry. These materials and publications are produced by individuals or groups in universities, foundations, government research laboratories, and other non-profit or for-profit organizations. Throughout this text, the term source document will be used to refer to any of these sources, such as a journal article, a chapter in a book, or a research report. Currently, the most common type of publication used in a review of up-to-date scientific literature is a research paper in a scientific journal, such as the Journal of the American Medical Association (JAMA) or the American Journal of Epidemiology.

Reviews of the literature are the foundation for theses and dissertations, grant proposals, research papers, summary articles, books, policy and regulatory statements, evidence-based healthcare statements for health professionals, and consumer materials. Given the vast number of scientific publications produced over the past several decades, information retrieval and analysis in the form of a critical review of the literature have become more crucial than ever.

Over the past 20–30 years, the following terms have been used interchangeably: literature review, integrative review, systematic review, and meta-analysis. All share the same basic elements: (1) stating the purpose of the review; (2) screening and selecting scientific papers that meet specified criteria; (3) carefully reviewing the papers for excellence of scientific methods, statistical procedures, and validity and reliability of data collection; (4) summarizing findings across the studies; and (5) drawing conclusions based on the scientific evidence.

In this book, a literature review is defined as an analysis of scientific materials about a specific topic that requires the reviewer to carefully read each of the studies to evaluate the study purpose, determine the appropriateness and quality of
the scientific methods, examine the analysis of the questions and answers posed by the authors, summarize the findings across the studies, and write an objective synthesis of the findings.

In describing an integrative review, authors emphasize the review of past research in which the goal of the review is to base conclusions on many different studies. Although integrative review (or integrative literature review) is a term that tended to be found in the nursing literature, it now has broader appeal. An integrative review aims to synthesize the literature from the past with the current literature and to draw logical and useful conclusions.

The term systematic review appears more frequently in publications about evidence-based medicine. The term has been defined as an overview of scientific evidence in the medical literature that emphasizes treatment, causation, diagnosis, and prognosis. According to this definition, systematic reviews are prepared specifically for clinicians and provide the basis for the practice of evidence-based medicine. Other clinical fields have adopted the strategy of basing their clinical practices and decision-making processes on the evidence in the scientific literature.

Beginning in the early 2000s, the term systematic review was redefined in the growing field of research synthesis. Currently, systematic review or meta-analysis has a specific meaning tied to the use of guidelines for expert-led reviews issued by the Cochrane Collaboration or in the 2009 PRISMA Statement or the 2011 IOM Standards for Systematic Reviews.

A meta-analysis is a departure from the other three types of reviews because this kind of literature summary requires precise quantitative methods to summarize the results. The same standards of rigor in identifying the purpose of the review, careful selection of papers, and evaluation of methods are essential to this type of review.

In general, think about the first three types of reviews as being similar, with the names being used in specific fields or disciplines to basically refer to a very rigorous literature review. The meta-analysis is described more fully later in this text.

WELL BEYOND INDEX CARDS

Prior to the widespread availability of computers, many students conducted their first review of the literature in high school or in college when they learned how to do library research. Usually, they concentrated on where to gather information and how to use the library. With the advent of computers, students now learn about electronic information retrieval at the primary school level.

Using computers to retrieve information is not the only new development, however. The sheer amount of information to be examined and critiqued has increased...
exponentially over the past 50 years. The first decade of the 21st century alone wit-
nessed tremendous advancements in scientific knowledge, a dramatic increase in
the number of scientific journals, and a bewildering array of new forms of commu-
nication. Books and scientific journals are no longer the only venues for scholarly
literature. Information is available on the Internet, in national and international
meetings of professional societies, and in correspondence by email, on blogs, and
through social networking software such as Twitter, Facebook, and wikis. The issue
of how, where, when, and whether or not to obtain information from these sources
constitutes a present-day dilemma for anyone who reviews the scientific literature.
The art of conducting such a review is an entirely separate matter.

In the past, American students were advised to use index cards to record the
most salient points of the material being reviewed. Now students keep notes on
a computer or on other electronic devices. Despite such technological advances,
how to avoid getting lost in the details between generating a computer list of
research articles, accumulating electronic notes, and writing the final synthesis is
still something of a mystery to many people.

One way to master this process is to realize that a review of any body of lit-
erature actually consists of four fundamental tasks, after the subject of the review
has been decided:

1. Make decisions about which documents to review.
2. Read and understand what the authors describe in those documents.
3. Evaluate the ideas, research methods, and results of each publication.
4. Write a synthesis that includes both the content and a critical analysis of
these materials.

Given the complexity of each one of these tasks, it is easy to become over-
whelmed in the process. A strategy is needed to organize the books and papers
selected in the search and retrieval process, structure the information in order to
understand the progression of ideas by different authors across documents and
over time, and use that structure to develop a critique and write a synthesis of the
results of such a review. The Matrix Method provides such a strategy.

TO OWN THE LITERATURE

Something else can result from a thorough and comprehensive review of the
literature that may be even more valuable than a written synthesis—ownership
of the literature. To own the literature you must know it—know the major ideas,
what has been researched, the names of the authors and their professional affiliations, who collaborated with whom, what databases they did (or did not) use, the methodological strengths and weaknesses of the studies, what has been studied ad infinitum, and especially what is missing.

To own the literature is to be so familiar with what has been written by previous researchers that you know clearly how this area of research has progressed over time and across ideas. Without a thorough and comprehensive review of the literature, you are at the mercy of every critic and reviewer who is aware of what is known, how it evolved, and what has yet to be examined.

Unfortunately, such ownership cannot be acquired easily; you have to complete the entire process of a literature review, from the initial search to the final written synthesis, before you can take possession of the literature on a subject. Ownership is rarely mentioned when people describe the literature in a paper or presentation, but it exists; experienced reviewers achieve such ownership whether or not they realize it.

When you own the literature, you are in a better position to know what is missing in a stream of research. You can defend your ideas and anticipate what other scientists and researchers will say or do. Ownership is the mastery of how a specific body of knowledge evolved, what it currently comprises, and what has yet to be studied.

Acquiring ownership of the literature demands more than summarizing the studies or documents you reviewed. A summary merely describes. Your task is to read and analyze each document until you can picture what the authors did in a study or the logical process they went through in making a point. Then you must go back and critically analyze what was right and wrong each step of the way. To own the literature is to dissect each part of it and decide whether you agree with what the authors did or said. In other words, you must become engaged with the content, argue with the authors’ logic, and conclude for yourself whether that paper or study made sense from a scientific or scholarly standpoint. You must understand how the field has evolved, including the progression of ideas over time and across different authors. To own the literature you must learn about the conceptual models that served as the foundation for the research, and you must deduce what hypotheses were really being tested, who initiated the ideas, and who did the first research study. The Matrix Method will help you acquire ownership of the literature, but it is only a guide. The most important component is your active involvement with the literature.
RESEARCH SYNTHESIS: HISTORICAL PERSPECTIVE

Overview

Before delving into the details of the Matrix Method, it might be useful to think about the historical context of a literature review. A literature review is part of the larger endeavor of research synthesis, which is the analysis, interpretation, and use of scientific inquiry. Although the term research synthesis can be applied to all kinds of knowledge, this discussion is limited to examples of how the synthesis of health sciences research literature has evolved. The practices and tools used today for reviewing the health sciences literature can be traced back to 1879 with the publication of Index Medicus, a medical bibliography that included a subject and author index to articles published in medical journals. Today's most useful tools, however, are relatively recent innovations. A historical awareness of how the research literature has grown and when some of these tools were introduced will help put these developments into perspective.

Since the mid-1940s, the number of scientific publications has increased dramatically. What spurred this increase is complicated and best left to social and medical historians to explain, but certainly a major factor has been a concomitant rise in the amount of funding for research by the National Institutes of Health (NIH). These growth rates are shown in Figure 1-1. In this example, publications are those defined by the Science Citation Index as original substantive articles, editorial materials, letters, reports of meetings, correction notes, and reviews for the period from 1945 to 1996. The NIH dollars are those allocated for research grants.

Some critics suggest that there is no evidence of an increase in the rate of scientific publications over time, citing the following two reasons for this rationale: (1) the quantity of scientific publications has increased, but the quality has not, and (2) the rate of publications per health scientist has remained the same, but the number of health scientists has increased. Neither argument addresses the fact that scholars today must cope with an increase in the absolute number of journals and publications that must be considered when reviewing the literature.

In examining the growth rates in Figure 1-1, the increase in NIH grant dollars may not be as steep as indicated because the figures are actual dollars spent for each 5-year period, unadjusted for inflation. The real rate of growth may be flatter or dip more in some years than others, after inflation has been taken into account. For the sake of argument, however, consider the two rates of growth at their face value, and assume an upward trajectory for both.
What is important is the juxtaposition of the growth in the number of publications, the amount of research funding, and developments in resources for creating a synthesis of the research literature. Examples of these developments over the past 50 years can be assigned to three categories: (1) the establishment of bibliographic databases, (2) the availability of electronic tools for manipulating information, and (3) the emergence of synthesis applications.

**Bibliographic Databases**

Bibliographic databases include information in print and electronic forms. The first major development in this category for the health sciences was the creation of the National Library of Medicine (NLM) under the aegis of the Public Health Service of the Department of Health, Education, and Welfare. The NLM evolved
from the Library of the Army Surgeon General’s Office, which was established in 1836. With major funding from Congress in 1942, the NLM gathered a national collection of scientific books, papers, and reports located in Washington, DC. Accessing this information electronically was difficult for scientists in other parts of the country; this was only partially solved in 1961 with the creation of the Science Citation Index and later its sister application, the Social Science Citation Index, by Eugene Garfield, PhD. These indexes, owned and published by the Institute for Scientific Information, were acquired by Thomson Scientific in 1992.

In 1971, MEDLINE, an electronic database of the scientific literature in medical and other health-related journals and publications, was launched by the NLM and became one of the premier tools for health sciences researchers. Initially, access to MEDLINE was brokered by reference librarians, which made frequent or spontaneous use awkward in the daily life of most scientists. Such use could also be expensive, and a charge per reference had a chilling effect on financially strapped graduate students and unfunded assistant professors—the very users who most needed such access.

The rules for searching MEDLINE were also complicated. Reference librarians had to undergo specialized training to master the intricacies of the search, and not all research libraries had specialized personnel. Nonetheless, the availability of an electronic database that could be searched to locate specific studies was a major advantage for health scientists engaged in research synthesis.

Gradually, an infrastructure for an electronic bibliographic database became more refined, with standardized keywords and more easily understood rules for creating a search strategy. Although scientists intent on using the electronic version of MEDLINE were still bound to one of the research libraries, and bound even more tightly to the services of a knowledgeable librarian, this ability to access the research literature was a major advantage. The number of research publications had already begun an upswing by this point in time. This is reflected in the rate of growth shown in Figure 1-1 for the period after MEDLINE became available, although cause and effect have not been clearly established between the development and the rate.

The period since MEDLINE’s inception has seen the creation of myriad other bibliographic databases, such as PsycINFO (Psychological Information database produced by the American Psychological Association), International Pharmaceutical Abstracts, and CINAHL (Cumulative Index to Nursing and Allied Health Literature). Two additional bibliographic databases were launched around the turn of the 21st century: PubMed in 1997 and PubMed Central in 2008.

PubMed, based in the NLM, provides worldwide access to MEDLINE on the Internet. Anyone—scientist or layperson—now has access to the MEDLINE database of over 18 million references just by signing onto its website. Not only
is PubMed free, but the use of MEDLINE is no longer tied geographically to a library or restricted to the availability of a qualified librarian. All that is needed is a computer and access to the Internet.

PubMed Central, a part of the NIH, is a free digital archive of biomedical and life sciences literature. The goal of PubMed Central is to provide full-text papers, not just abstracts, of scientific research funded by the NIH. These two databases, PubMed and PubMed Central, are interrelated, and together they provide rapid access to research publications.

Electronic Tools

Only a few examples of developments in the second category, electronic tools, are described here, beginning with the microcomputer. Without a doubt, the introduction in the mid-1970s of a reasonably priced personal computer represents a seminal event in any historical description of the late 20th century. For reviewers of the literature, the availability of a personal computer vastly improved the quality of scholarly life. Word processing software, together with information in bibliographic databases, made the tasks of searching and abstracting the scientific literature far more efficient.

There continued to be other problems, however, one of which was the lack of a standardized format for citations and references to articles in scientific journals or books. If a health scientist had to switch from one formatting system, such as the APA system, to another (e.g., the AMA system), in the preparation of a paper or report, then he or she was forced to go back through the entire document and make the changes one by one. Although there is still no single, universal format, another kind of solution was developed. In the late 1980s, two reference management software packages were produced that automatically made changes from one formatting system to another, thus providing some relief for time-strapped researchers. Academicians created both software products—EndNote in 1988, and ProCite in 1989.

RefWorks, introduced in 2002, is a web-based product that is generally available to faculty and students through an institutional subscription at university and college libraries. Not only do these software packages satisfy their original intent of allowing the user to switch from one reference formatting system to another, but they now have additional features such as the creation of a reference library on the user’s own computer or web-based document, a search and sort capability, the seamless download of a reference and its abstract from electronic bibliographic databases to desktop computers, and the flexibility of user-defined information for each reference.

The impact of reference management software packages does not equal that of the personal computer in a list of important developments in the history of.
research synthesis or information management. Nevertheless, these software products are good, solid tools for everyday use and are like a set of well-honed kitchen utensils compared with the discovery of fire—the latter is necessary, but after that is available, the former makes the job easier.

Like the personal computer, another advance comparable to the discovery of fire was the establishment of the World Wide Web in 1989. With the Web, individual researchers have free and unlimited worldwide access to fellow researchers and also to multiple banks of information such as the electronic bibliographic databases and other scientific forums that have rapidly proliferated. The use of these electronic tools in combination with bibliographic databases, together with an increase in the absolute number of scientific publications and NIH grant dollars, contributed to developments in the third category of development: synthesis applications.

**Synthesis Applications**

It is easy to imagine that if the same rate of growth in scientific publications had been seen in the financial market, investors would have been ecstatic. There was more research, better science, and an exponential growth in new information, but the scientific community pondered how to make use of it. How could this growing reservoir of scientific knowledge be managed and used for the betterment of humankind or, at least, for individual patients? Three developments in the late 1990s illustrate a response to these issues: practice guidelines, evidence-based medicine, and the Cochrane reviews of clinical trials. These developments are shown at the far right of the timeline in Figure 1-1. Prior to their appearance, however, a new methodological technique, meta-analysis, was proposed in the mid-1970s, just before personal computers and the Web became available.

**Meta-Analysis**

Gene Glass, a professor of education, was one of the first to outline a way of statistically summarizing the results of multiple studies on the same topic. His initial paper was published in 1976. Health scientists quickly saw the advantage of this technique and began to apply it to biomedical research studies. The use of this and other techniques contributed to the development of the following prime examples of synthesis applications in the 1990s:

- Clinical practice guidelines generated largely by the Americans
- Evidence-based medicine created by the Canadians
- Reviews by the worldwide Cochrane Collaboration led by the British
All of these resulted from national and international collaborations, made possible by local, national, and international funding. These developments depend on the resources of bibliographic databases, electronic tools, and an intense commitment to making use of available research findings to improve the health care of individuals and the public.

**Clinical Practice Guidelines**

Practice guidelines were developed with the intention of providing practitioners, such as physicians, nurses, and allied health professionals, with sound strategies based on the scientific literature for delivering the best possible health care. A formal definition of a clinical practice guideline was provided by the Institute of Medicine (IOM) in 1992.13

In 1993, the first practice guideline was commissioned and funded by the Agency for Health Care Policy and Research (AHCPR), a federal granting agency created by Congress in 1989. Over the following 5 years, AHCPR commissioned practice guidelines on 19 topics that were published between 1992 and 1998. Examples of topics include acute pain management, depression in primary care, HIV infection, otitis media with effusion in children, and poststroke rehabilitation.

In conjunction with the American Association of Health Plans and the American Medical Association, AHCPR developed the National Guideline Clearinghouse website, http://www.guideline.gov, dedicated to enhancing access to the guidelines in 1998. The current successor of AHCPR is the AHRQ (Agency for Healthcare Research and Quality), which has redefined its role as the facilitator to other organizations, such as specialty societies, managed care organizations or local groups of clinicians, in their development of future practice guidelines.

**Evidence-Based Medicine**

The basic concepts of evidence-based medicine were conceived by a group of academicians at McMaster University in Hamilton, Ontario, led by Professor G. H. Guyatt. The medical school at McMaster has long been known for its innovativeness in medical education, and these clinician–scholars expanded their audience from a classroom of medical students in southern Canada to healthcare providers throughout the world.

Guyatt and his colleagues recognized the need for members of the medical community to improve their ability to evaluate and use the scientific literature.11
An ongoing series of Users Guides to the Medical Literature, published in *JAMA*, has provided a set of tutorials for clinicians on such diverse topics as how to use articles about diagnosis, prognosis, grading healthcare recommendations, and applicability of clinical trial results. A list of such articles from 1993 to 2000 is provided in the references section at the end of this chapter and also by year of publication in Appendix A. The concepts of evidence-based medicine have been adopted by clinicians in other disciplines, including nursing, dentistry, and pharmacy. A term with broader application has begun to emerge—evidence-based practice. The relationship between evidence-based practice and clinical practice guidelines has not been fully examined, although logically they are closely linked. Clearly, what they have in common is a foundation of scientific literature that has been carefully reviewed and systematically abstracted. At its simplest, evidence-based practice is what a practitioner such as a physician or nurse—clinician does one-on-one with a patient, whereas practice guidelines provide guidance for best clinical practice.

**The Cochrane Collaboration**

In 1992, a nonprofit organization, the Cochrane Centre, was created in Oxford, England, in response to concerns expressed 20 years earlier by Archie Cochrane, a British epidemiologist. An outgrowth of the Centre was the establishment in 1993 of the Cochrane Collaboration, an international, voluntary, collaborative effort to provide systematic and critical reviews of RCTs of health care. Participants in the collaboration are organized through collaborative review groups that include researchers, healthcare professionals, and consumers throughout the world, including experts in the United States and Canada.

The ongoing mission of the Cochrane Collaboration is to prepare, maintain, and promote the accessibility of systematic reviews of the effects of healthcare interventions. Current information about the Cochrane Collaboration in the United States can be found at http://us.cochrane.org.

Results of reviews of empirical studies by the Cochrane Collaboration are maintained in the Cochrane Library, in which communication is rapid and easily accessible via the Internet. Lay audiences can readily obtain the reviews themselves. Thus, the Cochrane Library has an important role to play in the democratization of healthcare information. The availability of the Cochrane Library dates back to the mid-1990s. The further development and impact of this resource for health professionals, policy makers, and consumers bear close scrutiny in the future.
This brief history of the emergence of the field of research synthesis in the health sciences has focused exclusively on developments in English language systems, and largely in North America, with some mention of the role of the British. Linguistic and geographic boundaries of science are disappearing daily, however, and the full scope of developments and use of research synthesis cannot be confined to a single language or these few countries. Globalization exists in the scientific arena, including the private sector.

Initially, the Cochrane Collaboration limited their focus to a synthesis of studies that used randomized clinical/controlled trials (RCTs). But a field of scientific inquiry needed to have matured to have a sufficient number of RCT papers available to make possible such a review. Although many fields had not reached that point, other scholars, scientists, practitioners, and the public still needed expert reviews of the current literature. By 2004, the Cochrane Collaboration broadened its methodological criteria to include reviews of scientific papers using non-RCTs or observational methods.

In the future, the history of research synthesis will need a broader cultural and linguistic perspective to provide a complete understanding of the impact of this discipline on the health of people. The role of the Internet, the importance of multidisciplinary collaboration, and access to scientific knowledge by people who are not health professionals will also be important factors in understanding how research synthesis can have an impact on the health and lives of people throughout the world.

GUIDELINES FOR DESIGNING AND REPORTING BETTER STUDIES

In the late 1990s, health sciences experts began to question the quality of studies reporting randomized controlled trials (RCTs). This concern led eventually to the publication of guidelines about how to design and report studies with RCTs as well as other designs, five of which are described in this section. As with the broader field of research synthesis, the specifics of early guideline development tended to be international in character. The number of guidelines has proliferated since then, and a current listing can be found at the National Guideline Clearinghouse (http://www.guideline.gov).

Most of the guidelines discussed in this section include a description of the guideline development, a checklist for designing and reporting better studies, and a flow chart for tracking the subjects of the study from recruitment to completion.
of the analysis. These five guidelines focus on studies with either RCTs (randomized clinical/controlled trials) (CONSORT or SPIRIT) or non-RCTs, known in the epidemiological literature as observational studies (cohort, case-control, and cross-sectional studies) (STROBE). Two other kinds of guidelines are for studies of meta-analysis of observational studies (MOOSE), and the validity and reliability of diagnostic measures (STARD).

Although epidemiological designs are most often used in medical or clinical journals, other research designs from the behavioral sciences are also part of the medical literature. Behavioral sciences designs, which are parallel but different from the epidemiological designs, include experimental designs that require randomization of subjects to two or more groups (similar to RCTs), and three other designs without randomization: quasi-experimental, pre-experimental, and observational designs.

Note the difference in the definition of “observational.” In epidemiology, observational designs are any of the nonrandomized designs; alternatively, in behavioral sciences designs, “observational” means one specific design that describes the systematic observation and reporting about one group of subjects at one point in time, with no intervention or pretests or posttests. Although the behavioral sciences designs are emphasized in this book, the epidemiological designs are discussed here in terms of the guidelines for the medical or clinical literature. It is important for students in the health sciences to know both systems, epidemiological and behavioral sciences designs.

The following section provides an overview of five selected guidelines for improving the reporting of studies with different methodological designs in the peer-reviewed literature. Of course, improving the reporting of a study depends not only on a specific research question, but also on an appropriate methodological design; thus, these guidelines are also useful in planning such a study.

**CONSORT (Consolidated Standards of Reporting Trials)**

The CONSORT Statement has two parts: (1) a checklist that describes the basics of what an RCT is and how it is to be reported in a paper submitted to a journal, and (2) a flowchart for tracking the number of patients from eligibility to completion of the trial. The CONSORT Statement has undergone three major revisions. It was published initially in 1996, revised in 2001, and most recently issued in 2010.

The 2010 CONSORT consists of a 25-item checklist and a flowchart documenting the number of subjects assessed for eligibility, randomized to two or
more groups with/without intervention, lost to follow-up, and included in the final analysis. The authors urge that the checklist be used together with the companion paper, CONSORT 2010 Explanation and Elaboration, which provides greater detail about the 25 items.\textsuperscript{50} The 2010 CONSORT Statement was published simultaneously in several international journals, including Annals of Internal Medicine, British Medical Journal, Lancet, PLoS Medicine, and Journal of Clinical Epidemiology. Over 400 peer-reviewed journals have endorsed the CONSORT Statement and included it in the “Instructions to Authors” section. Updates and future revisions can be obtained at their website (http://www.consort-statement.org).

**SPIRIT (Standard Protocol Items: Recommendations for Interventional Trials)**

The SPIRIT 2013 Statement for RCTs evolved from several previous international conferences and papers by another group of experts, as described in their paper\textsuperscript{51} published simultaneously in the Annals of Internal Medicine and the British Medical Journal. The SPIRIT 2013 Checklist consisted of 33 items for study design, conduct, reporting, and appraisal of randomized clinical or controlled trials. A comparison between the items in the 2013 SPIRIT with 2010 CONSORT checklists shows considerable overlap. Like the CONSORT Statement, authors of the SPIRIT paper have also published a companion article on Explanation and Elaboration about the details of each item.\textsuperscript{52} A website for future revisions of the SPIRIT 2013 statement is: http://www.spirit-statement.org.

**STROBE (Strengthening the Reporting of Observational Studies in Epidemiology)**

The gold standard for clinical research is the RCT; however, most studies in clinical journals are observational, based on cohort, case-control, or cross-sectional designs. Both CONSORT and SPIRIT address RCTs, and STROBE focuses on the other epidemiological designs. The 2007 STROBE Statement\textsuperscript{53} describes its development, a 22-item checklist, and a separate publication of explanation and elaboration about the items.\textsuperscript{54} Both papers, published simultaneously in the Annals of Internal Medicine, Epidemiology, and PLoS Medicine, are freely accessible and can be downloaded as a PDF on the PLoS Medicine website (http://journals.plos.org/plosmedicine/article?id=10.1371/journal.pmed.0040297).
The STROBE Explanation and Elaboration paper by Vandenbroucke et al. includes both a flowchart for tracking numbers of subjects in a study using these designs and an excellent summary of definitions and differences of the three observational designs (cohort studies, case-control studies, cross-sectional studies). The section on the three observational designs alone should be required reading for all health sciences students. (See Box 1. Main study designs covered by STROBE in the Vandenbroucke et al. paper.) The STROBE website (http://www.strobe-statement.org) lists the journals that include the STROBE statement in their instructions for authors. At the website, click the tab Endorsement to see the list of journals.

**MOOSE (Meta-Analysis Of Observational Studies in Epidemiology)**

Standards for reporting MOOSE were developed by an international, multidisciplinary group of experts in a series of workshops sponsored by the Centers for Disease Control in the United States. The MOOSE 2000 paper describes their checklist for authors, editors, and reviewers of these kinds of studies. The checklist consists of 35 items, categorized under six headings: background, search strategy, methods, results, discussion, and conclusions. Under the search strategy, the checklist also includes the reporting of citations located and included in or excluded from the final meta-analysis. Although the checklist was designed for studies that used existing databases for these designs, as noted under Comments, even meta-analyses of RCTs were considered observational studies. Thus, the MOOSE checklist would be applicable to all epidemiological designs. MOOSE is included in the EQUATOR Network (http://www.equator-network.org/reporting-guidelines/meta-analysis-of-observational-studies-in-epidemiology-a-proposal-for-reporting-meta-analysis-of-observational-studies-in-epidemiology-moose-group).

**STARD (STAndards for Reporting Diagnostic Accuracy)**

Another group of experts became concerned about the quality of reporting the completeness and the transparency of diagnostic accuracy, specifically the ability of readers to determine the potential for bias in a study and generalization of results from the study to a population. The resulting STARD Statement was to be used in conjunction with other guidelines, such as CONSORT, if applicable. Initially published simultaneously in over 20 journals in 2003, the STARD
Summary

Five guidelines for designing better studies were described in this section: CONSORT, SPIRIT, STROBE, MOOSE, and STARD. With the exception of the first two (CONSORT and SPIRIT), each of these guidelines serves a different purpose with a specific type of study. This set of five is only the first of many guidelines that have been issued over the years. It is important to remember the following two things about this set compared with the other guidelines introduced later in this chapter: (1) This set is for designing a study with the specific characteristics as stated, for example, if you are reviewing an RCT (or a study with an experimental design), then you will use either the CONSORT or SPIRIT guideline, not one of the others. But if the study is limited to one of the nonrandomized designs, then you will use the STROBE guideline. (2) More importantly, because your goal is to evaluate studies in a literature review, you might wait until you have assembled all of the relevant source documents, then use the appropriate guideline, for example, CONSORT, STROBE, to apply to each of the studies with the specific designs. Now, back to the brief history of research synthesis.

GUIDELINES FOR EXPERT-LED REVIEWS

Gaining a Perspective: A Typology of Reviews

Beginning in 2009, there were further major developments in the field of research synthesis in the health sciences, with strong leadership by scientists and clinicians in the UK. This resulted in different types of guidelines for scientific and clinical papers in the peer-reviewed literature. One of the best ways to gain a
perspective on what was happening at the beginning of this period of expansion is to read Grant and Booth’s paper about their typology of 14 kinds of reviews. The authors, based respectively in nursing and health and related research in two British universities, describe each type of review, their perceived strengths and weaknesses, and an example from the literature.

Currently, the number of types of reviews exceeds the 14 described by Grant and Booth, but some of the terms have become standardized, such as systematic review, which refers to the application of one or more of the standards for expert-led reviews, such as PRISMA or the IOM Standards, as described in this section. “Standardized Review” is an appropriate keyword to use in PubMed or other databases for finding these types of secondary source documents.

**Similarities and Differences Between Two Types of Guidelines**

The guidelines in the section above, Guidelines for Designing and Reporting Better Studies, differ from those described in this section, Guidelines for Expert-Led Reviews, by intended audience, purpose of the review, and ways in which the final paper will be used. Similarities and differences between these two types of guidelines are summarized in Table 1-1.

For example, the CONSORT Statement is to be used by author(s) in designing, implementing, and reporting a scientific study in a paper submitted for peer-review and by editors/journal reviewers in reviewing that submission for publication, whereas the PRISMA Statement is for an expert-led, multidisciplinary team in designing, administering, and reporting a review of multiple publications about a specific scientific topic. The major differences are in the audience to whom the guideline is addressed (authors/journal reviewers vs. team of expert reviewers), the scope of the review (a single study to be submitted to a peer-reviewed journal vs. evaluation of multiple studies already published in multiple journals), and the ways in which the guideline will be used (assess a single study vs. evaluate a review of multiple studies in a review). What they have in common is a similar format: a statement consisting of a checklist, a flowchart of either subjects (e.g., CONSORT) or documents (e.g., PRISMA), and often a companion paper on the explanation and elaboration of the checklist items.

With this understanding of the similarities and differences between these two categories of guidelines, we turn now to a description of some of the guidelines for expert-led systematic reviews.
<table>
<thead>
<tr>
<th>Type of Guideline</th>
<th>Audience</th>
<th>Purpose of Guideline</th>
<th>Ways in Which Guideline Will Also Be Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guidelines for designing and reporting better studies (CONSORT, SPIRIT, STROBE, MOOSE, STARD)</td>
<td>Authors of scientific papers Journal editors &amp; reviewers of medical/clinical journals</td>
<td>Checklist and flowchart of subjects from eligibility to analysis in the design and report of a peer-reviewed scientific paper Criteria for review for publication of a primary source paper</td>
<td>Description of design &amp; report of scientific paper submitted to journal for publication Review of scientific paper submitted for journal publication</td>
</tr>
<tr>
<td>Guidelines for expert-led reviews of publications (PRISMA, IOM Standards, STROBING Review)</td>
<td>Teams of experts in planning, administering, writing, and reporting a scientific paper Journal editors &amp; reviewers of medical/clinical journals</td>
<td>Checklist and flowchart of papers (documents) considered in planning, administering, and reporting of systematic review or meta-analysis Checklist for evaluating report of systematic review or meta-analysis</td>
<td>Checklist and flowchart used in review of systematic review or meta-analysis upon submission for journal publication Checklist and flowchart for evaluating expert-led systematic review or meta-analysis submitted for journal publication</td>
</tr>
</tbody>
</table>
PRISMA, PROSPERO, AND A JOURNAL

PRISMA: A Guideline for Conducting a Systematic Review or Meta-analysis

While recognizing the importance of the Cochrane Collaboration in research synthesis, the scientific field still needed guidelines for groups of experts independent of the Cochrane (although individual members may have such an affiliation), whose purpose was to synthesize peer-reviewed papers in their areas of expertise. This need was addressed in 2009 when the PRISMA Statement was published in the British Medical Journal (BMJ) by authors from Canada, Italy, and the UK. PRISMA had evolved from an earlier set of guidelines, QUOROM.3

The 2009 PRISMA Statement consists of three parts: (1) a checklist for organizing, planning, and reporting either a systematic review or meta-analysis, (2) a companion paper about the explanation and elaboration of each item in the checklist,61 and (3) a flow chart for tracking the numbers of records or documents identified, screened for inclusion, eligible, and included in qualitative and quantitative syntheses.

The first published guideline, the 2009 PRISMA Statement, was for studies based on aggregate data. A second guideline, the 2015 PRISMA-IPD, applied to studies that used individual patient data (IPD). In both of these guidelines, the focus was on RCT studies, although this was not a requirement, as well as those with qualitative and quantitative data.62 The authors cautioned that the 2009 PRISMA checklist was not to be used to assess the quality of a systematic review. Over the years, additional PRISMA guidelines have been published as extensions. The checklists for PRISMA, PRISMA-IPD, and other extensions are available online (http://www.prisma-statement.org). This website also provides the PRISMA Flowchart for Tracking Source Documents Throughout the Review Process and is shown in Exhibit 1-1.

PRISMA Flowchart and the Matrix Method

The use of the PRISMA Flowchart3 is rapidly becoming a standard in any review of the literature because of its innovative and efficient design. For that reason, the PRISMA Flowchart3 is now an important addition to be used with the Matrix Method. But the PRISMA Flowchart3 is the only component of the PRISMA Statement that should be used in your review. The other two components, the 27-item PRISMA Checklist7 and the explanation and elaboration of each item...

in the checklist, are intended for expert-led teams in conducting systematic reviews or meta-analyses.

In using the PRISMA Flowchart in your review of the literature, you must provide a citation every time you use it or refer to it. Here are the terms by the authors of the PRISMA Statement for using the flowchart in your own work:

This is an open-access article distributed under the terms of the Creative Commons Attribution Non-commercial License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.
See this statement in the BMJ publication by Moher, Liberati, Tetzlaff, and Altman under Footnotes at the end of the paper. At the website, www.prisma-statement.org, there is a copy of the PRISMA Flowchart described as the PRISMA 2009 Flow Diagram in the upper-right-hand corner of the screen that can be downloaded and modified by adding your own tracking numbers of documents throughout your review of the literature. More about the PRISMA Flowchart in Chapter 4, and again in Chapter 6 of this book. A copy of the PRISMA Flowchart can be seen in Exhibit 1-1.

**PROSPERO: A Registry for Prospective and Completed Systematic Reviews**

In order to create a more efficient system for experts in the time-consuming tasks of organizing, preparing, analyzing, and writing systematic reviews or meta-analyses to be submitted to peer-reviewed journals, the PROSPERO Registry was launched in 2012 by the Center for Reviews and Dissemination, University of York, UK. The Registry invites teams of experts to register systematic reviews or meta-analysis studies being planned, and publishes those that have been completed.

A checklist for creating a PROSPERO proposal was described in PRISMA-P (PRISMA-Protocols) issued in 2015. The Registry is free and can be accessed by the public as well as the scientific community on an international basis, with open access and articles freely available online. Both prospective and completed systematic reviews are available in this Registry. The website for PROSPERO is http://www.crd.york.ac.uk/prospero.

**SYSTEMATIC REVIEWS: A Peer-Reviewed Journal**

In 2012, the first issue of an online, peer-reviewed journal, SYSTEMATIC REVIEWS, was launched. Their website is: http://www.systematicreviewsjournal.com. Their commitment to an international mission can be seen in the affiliations of the three editors-in-chief: the Ottawa Hospital Research Institute, University of Ottawa, Canada; the RAND Corporation and UCLA School of Medicine, USA; and the Centre for Reviews and Dissemination, University of York, UK.

With the creation of this journal, an infrastructure for independent teams of reviewers was complete: (1) a set of guidelines, PRISMA, providing expert
teams in the field with a checklist of how a systematic review or meta-analysis can be administered and what to include, (2) a registry, PROSPERO,\textsuperscript{63} to avoid overlapping efforts by experts in the field interested in conducting systematic reviews intended for publication as well as a list of completed reviews, and (3) an electronic, peer-reviewed, open access journal, SYSTEMATIC REVIEWS,\textsuperscript{65} as one of several international journals available in the field for publishing the reviews. All three elements of this infrastructure have since been used throughout the world by researchers and specialists in clinical fields, including those in the United States, since 2012.

IOM STANDARDS FOR SYSTEMATIC REVIEWS: FINDING WHAT WORKS IN HEALTH CARE

In the United States, the IOM, a division of the National Academies of Sciences, Engineering, and Medicine, issued their own standards in 2011 for initiating and reporting a systematic review, comparable to the PRISMA Statement. These IOM Standards for Systematic Reviews can be found at their website (http://iom.nationalacademies.org/Reports/2011/Finding-What-Works-in-Health-Care-Standards-for-Systematic-Reviews.aspx; in the box labeled Report at a Glance, click on Standards for Systematic Reviews). The IOM Standards were developed for studies that addressed evidence-based practice issues and to guide decisions about health care in the United States under the Affordable Care Act after its implementation in 2013.

The 21 IOM standards, like the 27 items in the PRISMA Checklist,\textsuperscript{3} are comprehensive and clearly focused on systematic reviews by multidisciplinary teams of experts, with funding and staff to prepare each review for publication in a peer-reviewed journal. At the IOM website, standards are described for (1) initiating a systematic review, (2) finding and assessing individual studies, (3) synthesizing the body of evidence, and (4) reporting systematic reviews. Reading through the standards can be of use to those who are learning how to prepare a plan for a literature review, but too many of the items in the checklist are well beyond the level of understanding of the beginning reviewer; thus the goal of conducting a systematic review or meta-analysis is more appropriate to teams of highly experienced reviewers preparing systematic reviews.
SCOPING REVIEWS: FINDING THE GAPS IN EXISTING LITERATURE

A scoping review is a rigorously defined protocol used to identify the gaps in research on a specific subject. In general, the topic being reviewed has not fully matured to justify a systematic review or meta-analysis, but is of importance to healthcare policy and other health sciences research in its earlier stages. For example, a study of the first report in the United States of AIDS, in 1981, described only five subjects. This was an observational design, based on careful review and description of the case histories; there was no comparison group, only careful observation. Over the following decade, approximately 400 reports were reported with increasingly sophisticated methods and research questions about the disease. Thus in the early 1980s, the AIDS literature did not have a sufficient number of papers to warrant a systematic review, but the literature could qualify for a scoping review.

The 2005 paper by Arksey and O’Malley was one of the first to describe a methodological framework for conducting scoping studies. There was a problem with the Arksey and O’Malley paper, however, caused by a significant delay between the year the manuscript was accepted (2003) and its publication (2005). None of the papers in the references section is newer than 2002. Nonetheless, the Arksey and O’Malley paper is often the classic starting point in describing the history of scoping reviews.

A more specialized focus was a review of scoping studies in the nursing literature in 2009, which still found problems with the existing methodology. In 2010, Levac et al. described improvements to the Arksey and O’Malley methodology and upgraded the quality of this type of review. The practicalities of implementing both the Arksey and O’Malley framework and the Levac modifications were described by a large interprofessional group of experts in a 2013 paper, including their suggestions for working together as a team.

Perhaps it was inevitable that a paper was published recently (2014) of a scoping review of scoping reviews in which the authors further documented the need for improving the methodology. Finally, the Joanna Briggs Institute (JBI) at the University of Adelaide, South Australia, AU, published an online guide, “Reviewers’ Manual 2015: Methodology for JBI Scoping Reviews,” that offers a detailed set of instructions for this type of expert-led review, available at their website (http://joannabriggs.org/assets/docs/sumari/Reviewers-Manual_Methodology-for-JBI-Scoping-Reviews_2015_v2.pdf). These five papers plus the manual provide an excellent overview of the methodology and application of scoping reviews up to 2015 for those interested in using this approach.
FUTURE GUIDELINES AND REVISIONS IN THE HEALTH SCIENCES LITERATURE

As shown in this summary, many guidelines are updated every few years, often in response to rapid changes in the clinical or scientific fields. This section includes three sources for staying up to date about new guidelines and systematic reviews or meta-analyses that have been updated and revised. These sources are like three tools in your scientific repertoire as you review the literature: not necessarily used every day, but good to know about.

Hint

For the first two of the three sources in this section, collaborate with a partner and use a computer. Have the partner read aloud the instructions in italics, and you apply them on the computer. (For example, go to the National Guideline Clearinghouse website (www.guideline.gov), and do just what the instructions say.) Then reverse roles. Explore the website together to see what else you can learn.

This will be time well spent when you get into creating your own review of the literature. (If you do not team up with someone, then it is like reading the instructions for how to ride a bicycle the first time you do it, with no bicycle and no other person to help you. Sure, you can do it by yourself, but it is not nearly as much fun!)


The National Guideline Clearinghouse (NGC) was launched in 1999 by the Agency for Health Research (AHRQ), a U.S. government agency, as described at this website: http://www.guideline.gov. A categorization of guidelines by disease/condition, treatment/intervention, and health services administration is available. (At the website, go to the box to the left, click Guidelines, then under Browse, click By Topic. Clicking the arrow next to the topic provides further classification of the guidelines.) Clinical practice guidelines are restricted to only those submitted or revised within the past 5 years.

Further information about specific guidelines by clinical specialty is provided under another tab. (At the website in the box to the left, pull down the
Chapter 1 Introduction

tab Guideline Matrix, which describes Clinical Specialty by Methods Used to Analyze the Evidence. Each cell in this matrix has the number of guidelines in the database, and clicking that number will provide each citation and the NGC number.) This is an invaluable tool. For example, if you want to review all guidelines for Nursing that had a Systematic Review with Evidence Tables, then do this: Click Guideline Matrix, go down to “Nursing,” scroll the matrix over to the last column on the right with the title “Methods Used to Analyze the Evidence.” Click the number in the cell to go to a complete list of the citations for all guidelines currently available. Scroll down that list to select which guideline you are interested in.

To see each of the guidelines in greater detail, expand the tab Guideline Syntheses. Alternatively, go to the tab FAQ for further information about the development of the guidelines. The NGC is updated weekly at a website that is free, available to the public, and accessible from a general browser. AHRQ has produced a YouTube tutorial about the Search and Browse features of the NGC, which you can access by typing this into your browser: National Guideline Clearinghouse: Search & Browse (Official Tutorial).

The number of guidelines at http://www.guideline.gov can be daunting, with over 2,000 listed in 2015. (At the Home Page, under the Guidelines tab, under Browse, click Guideline Index to see a current count of individual guideline summaries in the database.) There are ways to narrow your search for specific guidelines. Use the Search box at the top of each page, or click the FAQ tab to see commonly asked questions and answers.

The website also lists guidelines added within the past 2 weeks: from the Home page, go to Guidelines tab, under Browse, click Guidelines in Progress. A current list of guidelines that have been either updated or withdrawn in the NGC Archive is available. (Under the Guidelines tab, under the Browse section, click Guideline Archive for guidelines that have been either Updated or Withdrawn. Both updated/withdrawn lists include a citation for each guideline.)

**EQUATOR Network: Enhancing the Quality and Transparency of Health Research**

Another way of tracking guidelines is to examine reviews by study type, for example, randomized trials, systematic reviews, qualitative research, available at the EQUATOR Network website: http://www.equator-network.org. The mission of this international umbrella organization is to provide a reliable source for improving the reporting of health research studies with the goal of supporting...

The EQUATOR Network grew out of an international project begun in 2006 at Oxford, UK, and now has three centres based in the UK, France, and Canada. In addition to current events and announcements of international meetings, the EQUATOR Network succinctly summarizes types of reporting guidelines, such as CONSORT and PRISMA.

The website is free and includes both guidelines completed since 1996, and guidelines under development. (Under “Library for health research reporting” on the Home page, click “Reporting guidelines under development” for a list of guidelines currently under development.) Currently (late 2015), the list includes 284 completed guidelines and is growing. The website also lists courses and events, news, a blog, and other information about guidelines and their development.

**LIVING SYSTEMATIC REVIEWS: A Perpetual Source**

Despite the intense effort needed to organize and complete a systematic review or meta-analysis, once published, its usefulness is limited to an estimated 2.5–5.5 years, mainly because of rapid developments in the field. This time limitation is related to the broader issue of a gap between research and healthcare practice. To address both of these problems, a new term, LIVING SYSTEMATIC REVIEW, has been created to describe an online update or revision of a systematic review or meta-analysis that takes into account new research or subsequent developments in the field. This concept and its practice are quickly evolving, and publications about LIVING SYSTEMATIC REVIEWS can probably best be found through Google Scholar or Google at this point in time.

**DIFFERENCES BETWEEN SYSTEMATIC REVIEWS, SCOPING REVIEWS, AND REVIEWS OF THE LITERATURE**

**Systematic Reviews**

A systematic review requires a clear and concise question; uses systematic and explicit methods to identify, select, and critically evaluate relevant research; and collects and analyzes data from authors of such documents as part of the review process. Both a systematic review and a review of the literature use primary source data such as peer-reviewed papers about a study, although PRISMA
guidelines also permit documents from other sources, such as the grey literature or editorials. One of the major differences is that the PRISMA Statement assumes that the reviewers are experts in their fields, such as clinical sciences, research design, methodology, and biostatistics, and have funding for staff and other resources for a systematic review; whereas a review of the literature assumes an individual, usually a graduate/professional student, who is conducting and completing an original study with minimal funding for resources. The product of a systematic review is either a narrative synthesis of the research or a meta-analysis if sufficient numbers of studies permit, or both (usually in a mixed mode review). A narrative synthesis consists of a nonstatistical summary of the literature, in contrast to a meta-analysis review of the literature.

Scoping Reviews
A Scoping Review may be appropriate for review studies that do not have enough peer-reviewed papers to permit a PRISMA review. But systematic reviews, scoping reviews, and a review of the literature using the Matrix Method share in the rigor in which the studies are evaluated by reading, selecting, analyzing and reporting the results. All three of these types of reviews require attention to standardization of research synthesis methods. And, in all three types of reviews, there is a commitment to the reproducibility and replication of the methods in selecting and excluding source documents. This is accomplished with the use of a flowchart for tracking the numbers of source documents through the different stages of the review process.

Reviews of the Literature: The Matrix Method
As described in this book, a review of the literature consists of a structured process for defining the research question, selecting, reading, organizing, analyzing, and writing a narrative synthesis of previous research on a topic of interest to the beginning graduate or professional student in the health sciences. The Matrix Method is intended to teach you how to read a paper, organize the review using the Matrix Method, analyze it, and create a narrative synthesis. The alternative, a meta-analysis, is not taught in this book (other than to describe it) and is beyond the scope of what is expected of a beginning student.

Unlike the expert-led reviews, this review of the literature is envisioned as a solo activity, with guidance by faculty or mentors. The emphasis is on primary source documents, preferably in the peer-reviewed literature, with possibly a section on secondary source reviews (such as systematic reviews) or tertiary reviews.
(such as reviews of reviews). A review of the literature is the fundamental first step in how to read and analyze papers by other scientists and determine what is missing in this body of work. Thus, a review of the literature, as described in this book, is the initial step for the student’s proposal for an independent scientific study, usually in the form of a Master’s project or doctoral dissertation. With this perspective about research synthesis, we now turn to an introduction and overview of the Matrix Method for reviewing the literature.

THE MATRIX METHOD: DEFINITION AND OVERVIEW

The surfeit of information in the health sciences literature presents both a problem and an opportunity. What is needed is a structured way of organizing and conducting a literature review. The Matrix Method offers one such system. With this section of Chapter 1, we now get down to the details of “how to do it.” What follows is a summary of those details.

The Matrix Method is both a structure and a process for reviewing the literature. The structure is provided by the Master Folder that contains all of the notes and documentations you accumulated as you reviewed the literature. The Master Folder includes four major subfolders, as shown in Exhibit 1-2, consisting of the following:

1. Paper Trail Folder—documenting your search of the literature: This is a record of the search process you used to identify relevant materials. Examples include which librarians or other experts you talked to about the search, notes about the materials examined, keywords used to search the electronic bibliographic databases, and, especially, a list of instructions for electronic searches and the instructions you gave. Think of this as a

<table>
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<tr>
<th>EXHIBIT 1-2  Structure of the Matrix Method: Subfolders in the Master Folder</th>
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<tr>
<td><strong>Type of Subfolder</strong></td>
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</tr>
<tr>
<td>Paper Trail Folder</td>
</tr>
<tr>
<td>Documents Folder</td>
</tr>
<tr>
<td>Review Matrix Folder</td>
</tr>
<tr>
<td>Synthesis Folder</td>
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</table>
chronological diary or personal blog about the process you went through as you conducted this review of the literature.

It is here in the Paper Trail Folder that you will begin to build the PRISMA Flowchart of Documents that you will eventually report in your final paper. More about this in Chapter 4.

2. Documents Folder—organizing documents for review: This section includes a downloaded copy, PDF file, or link to the journal articles, book chapters, and other materials gathered for your review of the literature. These are the documents used to create a review matrix, which goes in the third folder.

3. Review Matrix Folder—abstracting each document: The review matrix is a spreadsheet or table with columns and rows that you use to abstract selected information about each journal article, book chapter, or other materials included in your review of the literature.

4. Synthesis Folder—writing the review of the literature: This is the outcome of your use of the Matrix Method, a written synthesis of your critical review of the literature based on the materials you abstracted in the review matrix. The Synthesis will include your narrative review of the literature and a copy of the most recent number of documents you identified at each stage in the PRISMA Flowchart of Information Through Defined Phases of this Literature Review.

In addition to structure in the form of a Master Folder, the Matrix Method also provides a process for how to create and use the materials in each of the four folders. The Matrix Method was specifically designed for reviews of the health sciences literature, but it can be used for reviews of the literature in any field by anyone at any level of expertise, from novice to seasoned reviewer. The key to the versatility of the Matrix Method lies in the use of the review matrix, which is described briefly here.

**REVIEW MATRIX: A VERSATILE TOOL**

With a review matrix, you create a structured abstract of all the source documents from your literature review. A review matrix is like a spreadsheet or a table—a rectangular arrangement of columns and rows. All that is needed to set up a blank review matrix is a blank spreadsheet or the table option in a word processor.

The columns across the top of a review matrix are the topics or headings you use to abstract each document or study. The rows down the page are the
documents or studies. The point at which each column and row meets is a cell, which is where you write notes about a document. An example of the format for a review matrix is shown in Exhibit 1-3, in which there are four columns and two rows. Each column has a topic—such as author/title/journal, year, purpose, or type of study design—and each row consists of a journal article. Thus, the review matrix is a place to record notes about each article, paper, study, or report on the basis of a standard set of column topics.

Column topics can range from very general to specific. For example, a review matrix for Shakespeare’s plays might include these column topics: setting, characters, chief protagonist, chief antagonist, and psychological theme. Alternatively, if the focus was on the scientific literature, the matrix would feature other kinds of column topics: hypothesis, independent variables, dependent variable, methodological design, and sampling design.

No matter what the level of expertise or area of focus is, you are entirely in control of the review matrix. You decide which column topics to use and which documents or studies to review. The process you use to make those decisions—which topics, which documents—is described in this text. In the course of making those decisions, abstracting the articles, and writing the synthesis, you begin to take ownership of the literature.

OVERVIEW OF CHAPTERS AND APPENDICES

The creation and use of the review matrix and Master Folder are described in the remaining chapters. Although the Matrix Method can be applied to the literature on just about any topic, there is an emphasis throughout this text on the
health sciences. The nine chapters in this text are organized into the following three parts:

- Part I. Fundamentals of a Literature Review—Chapters 1 and 2
- Part II. The Matrix Method—Chapters 3 through 6
- Part III. Applications Using the Matrix Method—Chapters 7 through 9

Chapters 2 through 9 are described briefly here, followed by an overview of the Appendices. At the end of each chapter is a section titled “Caroline’s Quest,” which includes practical examples of how the concepts can be applied.

**Chapter 2: Basic Concepts**

This chapter consists of definitions of concepts that are fundamental in any review of the literature, especially those used in the Matrix Method. Also included in this chapter is a description of the different parts of a typical scientific paper published in most health-related journals. If you know where to find specific topics, then you will be in a better position to abstract the study. Chapter 2 also describes the basic elements of a methodological review of the literature. These elements can be used as the sole basis of a review or, more realistically, as a list of possibilities for inclusion, together with the content of the paper under review. A list of potential column topics for reviewing the research methodology in the scientific literature is given in the section “A Methodological Review of the Literature: The Methods Map.”

**Chapter 3: Paper Trail Folder: How to Plan and Manage a Search of the Literature**

This chapter describes what steps to take in doing a review of the literature: how to develop a keywords list, how to locate source materials; how to use the snowballing technique; what to consider in a computer search of established databases such as MEDLINE, PsycINFO, and Science Citation Index; and use of the Internet.

**Chapter 4: Documents Folder: How to Select and Organize Documents for Review**

This chapter includes a description of how to choose documents and organize journal articles and other source materials. The advantages of maintaining a chronologically ordered set of PDF files or other types of electronic copies in the Documents Folder are also discussed.
Chapter 5: Review Matrix Folder: How to Abstract the Research Literature

The review matrix is the heart of the Matrix Method. This chapter describes how to set up a review matrix, including issues such as choosing topics to abstract, variations in topics, addition of topics later in the process, and a step-by-step guide for constructing the review matrix.

Chapter 6: Synthesis Folder: How to Use a Review Matrix to Write a Synthesis

This chapter is a description of how to use the review matrix to critically analyze and write a narrative review of the literature, including a discussion of the differences between a summary and a synthesis. The importance of tracking the number of source documents and including them in the PRISMA Flowchart is emphasized in this chapter. Your adaptation of the PRISMA Flowchart will be included in your final copy of your narrative synthesis in the Synthesis Folder.

Chapter 7: A Library of Master Folders

This chapter describes the advantages of maintaining a collection of Master Folders for use over time, or by a team of people, or across interrelated topics. Specifics include how to create and expand a library of Master Folders.

Chapter 8: The Matrix Indexing System

This chapter describes a system for integrating information from electronic databases and reference libraries created with reference management software and copies of papers in the Documents Folder in the Master Folder. The advantages of this system are discussed, together with information on how to set up and use such a system.

Chapter 9: Matrix Applications by Health Sciences Professionals

This chapter describes four kinds of applications for the experienced health sciences professional. These include the use of the Matrix Method in (1) conducting a research project, from writing a grant proposal to publishing the results; (2) standardizing the review process for a meta-analysis; (3) creating and using clinical practice guidelines; and (4) applying the concepts of evidence-based medicine.
Appendix A: Useful Resources for Literature Reviews
This is a handy list of books, journals, and Internet websites that can be useful when searching for scientific literature that is not available in the standard sources. The appendix is a potpourri of useful information.

Appendix B: Structure of Computer Folders for the Matrix Method
This appendix describes how to create and organize computer folders on your desktop for the Matrix Method. Examples are given to help you understand this structure before you use the Matrix Method to review the literature.

Appendix C: Data Visualization: A Digital Exploration
This appendix describes recent advances in data visualization and how these resources could be used in describing scientific research. In this appendix, you go into a digital environment and explore the possibilities for the use of data visualization for a review of the literature now and in the future. Check the front cover of this book to obtain your password that gives you access to Appendix C.

REFERENCES TO WEBSITES
Website addresses are given throughout the remaining chapters, and especially in Appendix A. Each address on the Internet, called a universal resource locator (URL), was examined and determined to be accurate and functional at the time this text was published; however, the Internet is a dynamic environment, and URLs can change on an hourly basis. For this reason, neither the author nor the publisher is responsible for the accuracy of the URLs provided in this text.

Caroline’s Quest: Understanding the Process
Just as a picture can be worth a thousand words in explaining a concept, a practical example can be equally valuable in demonstrating the process of using a strategy such as the Matrix Method. With that in mind, each of the nine chapters in this book will conclude with a description of the experiences of a typical graduate student, Caroline Collins, as she learns about matrix applications.
Caroline Collins is learning how to use the Matrix Method and the Matrix Indexing System to review the literature on smoking behavior for her master’s thesis in public health. Caroline’s thesis topic is the characteristics of teenage girls who smoke.

Caroline tends to be a bit impatient and will occasionally try to take shortcuts to avoid some of the more time-consuming details of the Matrix Method. Fortunately, she meets weekly with her advisor, Professor Dickerson, who gives her advice about using the matrix applications. Caroline’s experiences and Professor Dickerson’s explanations illustrate not only the process but also why certain steps in the Matrix Method are needed and how the Matrix Indexing System can help her organize her materials.

In medieval times, a quest was a chivalrous enterprise involving an adventurous journey that often required courage or determination. In modern times, a quest is defined as a search or pursuit. Although Caroline does not have to deal with dragons in the library, her review of the literature does require persistence and determination in her pursuit of knowledge—a pursuit that is occasionally adventurous. Thus, in both the modern and the ancient senses of the word, Caroline has embarked upon a quest.

A word of advice: If you are having trouble understanding some of the basic problems in implementing the Matrix Method or why certain steps were included, Caroline’s adventures will be a valuable resource. All of her questions and objections are based on feedback from my own graduate students over many years, and you may find your own questions here.

**What You Should Know or Be Able to Do by the End of This Chapter**

A final section about what you have learned will be included at the end of each of Chapters 1 through 6 that describe the Matrix Method. At the end of Chapter 1, you should know or be able to do the following:

1. Define the basic terms about a review of the literature:
   - review of the literature
   - scientific literature
   - source document
   - bibliographic database
   - research synthesis
   - scoping review
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2. What does “to own the literature” mean, and how can it be acquired?
3. Describe a brief historical summary of the field of research synthesis.
4. What is a meta-analysis, and how does it differ from a narrative review of the literature?
5. Describe the differences between PRISMA, PROSPERO, and SYSTEMATIC REVIEWS.
6. Describe the PRISMA Statement and the IOM Standards for Systematic Review. How do they compare?
7. What is the difference between the PRISMA Checklist and the PRISMA FLOWCHART for DOCUMENTS?
8. Describe the three sources that you can use to stay up to date about changing guidelines in the future.
9. What is the Matrix Method?
10. What are the four folders in the Master Folder?

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