CHAPTER 3

Systematic Reviews: Consolidating Research Evidence for EBP

THEODORA D. KWANSA

CHAPTER OBJECTIVES

The main objectives of this chapter are to:

• Explore the significance, rationale, and benefits of systematic reviews.
• Examine the process of reviewing, condensing, and summarizing research evidence.
• Describe the processes of data extraction and abstraction.
• Identify the processes of quantitative research synthesis, meta-analysis, and the PRISMA statement.
• Explore the approaches to synthesizing qualitative research evidence and the related terminologies.
• State the need for systematic reviews, meta-analysis, and qualitative research synthesis.

Introduction

This chapter focuses on systematic reviews of multiple studies with similar design(s) and method(s) and combining and condensing the findings for evidence-based support of professional practice. Meta-analysis, which allows for pooling and interpreting emerging concepts to create new theories, is also explored.

The Rationale and Advantages of Systematic Reviews for EBP

Generally, systematic reviews are informative overviews of carefully selected primary research studies that have rigorously applied specific research design(s), methodology, and methods to investigate a clinical problem/phenomenon. This problem/phenomenon and the related review question(s) might relate to the effects of clinical intervention, healthcare policy, or the effectiveness of specific aspects of professional practice. Identifying, compiling, critiquing, summarizing, and condensing the best available evidence and synthesizing these compose the stages of systematic review. As the name suggests, systematic reviews are rigorous in terms of following exact processes, transparent in terms of being applicable to different contexts in actual situations, and repeatable. They provide cumulative evidence from the findings of pertinent studies that policy makers and clinical practitioners can draw on. Thus, systematic reviews can be used to employ evidence-based best practice, designed to achieve positive outcomes and patient satisfaction. Other benefits include helping to inform and direct policy, and clinical decision making, and the development of standards to ensure correct implementation of recommended guidelines.

Hemingway and Brereton (2009) identified specific professionals and stakeholders who may require sound and trustworthy information at varied times, on a considerable range of interventions and aspects of healthcare delivery. Healthcare practitioners—clinicians, nurses, therapists, and healthcare managers—as well as policy makers, patients, and consumer representatives may, at some time or another, seek specific evidence-based information on clinical interventions or aspects of the healthcare policy, such as the effects, practicality, significance, and the relevance of certain aspects of professional practice or a specific treatment. These authors note that systematic reviews help to ease the additional demand on practitioners who may be inundated with several reports and emerging new findings from numerous research studies. Practitioners constantly face the challenge and professional expectation to keep up to date with ongoing advances in scientific techniques and new procedural interventions. Emerging new ideas often involve implementing changes in policy, clinical decisions, and guidelines (Brown et al., 2006; Crombie & Davies, 2009; Petticrew, 2003; Petticrew & Roberts, 2006).
Without a doubt, information from a large amount of research is easier to grasp when condensed in a systematic review (Hemingway & Brereton, 2009). Earlier proponents, including Oxman (1993), maintained that the pooling of several studies yields better assurance, in terms of more comprehensive evidence, about the effectiveness of specific interventions. Systematic reviews allow for determining and confirming consistency in studies that are conducted across different clinical contexts and targeting comparable patient populations. A single independent study, by contrast, may fall short of being generalizable to other population groups.

Systematic reviews have the additional benefit of thoroughness as long as the reviewer(s) use well-designed and approved frameworks. Conducted correctly, systematic reviews can provide a clearer picture of the overall effects, both positive and adverse, of particular clinical interventions. In addition to confirming what is already known, systematic reviews also help to identify the deficits or gaps in professional knowledge and practice and thus provide a guide for future research (Brown et al., 2006; Petticrew, 2003; Petticrew & Roberts, 2006). Crombie and Davies (2009) note that a key feature of systematic reviews is the unbiased critical appraisal of all the available relevant studies. A concise summation of the rationales, main benefits, and implications of systematic reviews is outlined in Box 3-1.

**BOX 3-1 Summary of the Emphasis on Systematic Reviews for EBP**

- Provide cumulative evidence from relevant available studies to inform clinical practitioners and policy and decision makers
- Provide sound evidence basis for guiding organizational policy decisions on standards of health care and practice
- Reveal the impact of specific policy regulations on particular aspects of professional practice
- Yield better assurance, more comprehensive and consistent evidence about the effects, practicability, significance, and suitability of specific treatment interventions
- Provide a clearer picture with better insight and understanding about the overall outcomes, both positive and adverse, of clinical interventions
- Help to identify the deficits or gaps in professional knowledge and practice thus providing a guide to future research and appropriate contexts for particular investigations


Despite the above observations, as Petticrew (2003) remarked, systematic reviews are often criticized for not incorporating precise guidance on what indicates evidence of effective or ineffective interventions. However, reviews of healthcare interventions may not yield enough evidence to answer precise questions on the effectiveness or ineffectiveness of specific interventions. Perhaps practitioners might find it less daunting to conduct systematic reviews if they could find review guidelines that state parameters and instructions for applying them to ensure standardization. Arguably, non-systematic review is a quick way to put forth introductory papers on specific opinions on policy and practice. Nonetheless, that process falls short of providing an all-inclusive combination of best available evidence. The general view is that a non-systematic review carried out carelessly and incorrectly can yield serious misrepresentation of detail and cause confusion. Petticrew (2003) examined the reasons for the lack of specific guidance for systematic reviews of social and healthcare interventions. He highlighted Millward, Kelly, and Nutbeam’s 2001 work, which showed a limitation in the number of trials in social and health care and reviews involving outcome assessments.

**Non-Systematic Reviews Examined**

Non-systematic reviews do not necessarily aim to identify all the relevant published studies that applied a specific research design or methodology to investigate a specific clinical problem. Rather than critically appraising and synthesizing the research findings, non-systematic reviews characteristically present a broad discussion of the findings from some studies and substantiate with relevant references. Additionally, non-systematic reviews do not require adherence to an exact and precise review protocol. Consequently, without compliance or application of specific pre-set criteria to the study selection, a non-systematic review might be carried out in a rather haphazard manner. Thus, a non-systematic review may largely represent the reviewer’s subjective interpretations based on fixed ideas and lead to distorted conclusions (Sandelowski, 2008). An outline of the principles and essential components of systematic reviews is presented in Box 3-2.

**Evaluating the Quality of Each Selected Research Study**

The process should involve critical examination of each study to assess the methodology for thoroughness and correct application, data analysis techniques, level of detail in the presentation of the research results, degree of accuracy of the measurements, and outcomes/results. Moreover, the process should involve critically examining the methodology for possible replication and generalization of the findings. Some experts recommend blinding the quality assessors to hide the identity of the researchers/authors of the study.
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The Need for an Extensive Systematic Review

Readers may find it useful to access the Database of Abstracts of Reviews of Effects (DARE) at www.crd.york.ac.uk/crdweb/. The Cochrane Database of Systematic Reviews (CDSR) at http://www.cochranelibrary.com/cochrane-database-of-systematic-reviews/index.html also provides healthcare researchers and practitioners full and regularly updated texts of systematically reviewed healthcare intervention effects. Policy and protocols also undergo similar high standard review processes conducted by the Cochrane Review Groups in the Cochrane Collaboration system. The U.S. National Library of Medicine (NLM), which is part of the National Institutes of Health (NIH), also produces extensive data on all aspects of medicine and health care, which is accessible at http://www.nlm.nih.gov/.

Other useful sources of systematically reviewed studies include the National Institute for Health and Care Excellence (NICE), the Scottish Intercollegiate Guidelines Network (SIGN), and the Evidence for Policy and Practice Information (EPPI) Centre, which provides reviews of policy and protocols relating to social welfare and social care, health education, health promotion, and public health. The World Health Organization (WHO) is another good source, as it has the reputation of ensuring that its guidelines and recommendations are based on meticulously reviewed research studies, meta-analysis, and meta-synthesis on interventional effects and other forms of substantiated evidence. The Centre for Reviews and Dissemination (2009) provides a detailed guide for systematic review. For copyright reasons, readers are encouraged to explore the CRD document themselves.

Selecting the Team of Reviewers

A carefully selected review team should represent all the disciplines in the particular area of clinical practice. This ensures joint participation in the review and ultimately, shared ownership, support, and cooperation in implementation of EBP. Experts advise that implementation of change should be facilitated by a team of professionals who have the relevant backgrounds of specialism (Lo Biondo-Wood & Haber, 2013). The review team should advise not only practitioners with a range of knowledge and expertise in the clinical specialism, but also in systematic review methods, information retrieval, research, health economics, and statistics.

The Role of a Consultative Committee

The consultative committee represents an advisory group comprising professionals from the healthcare organization, expert researchers, and stakeholders from the public sector(s) (who may be patient representatives and service users). This team of advisers has the responsibility to examine and comment on the review protocol and the final report, and to provide support, clarification, and guidance. In essence, the advisory group ensures that the review is pertinent for meeting the needs of all relevant stakeholders. Therefore, this

BOX 3-2 Key Considerations and Actions in Systematic Reviews

Constructing pertinent review questions:
These should be focused, well-defined and unambiguous.

Developing a review protocol: The purpose of this is to outline the process of constructing the review question, the search and retrieval of evidence materials, the eligibility criteria, the study selection, information extraction, quality assessment, synthesis, interpretation, conclusion, and preparation of the review report.

Extensive search of the literature and other relevant sources: The process for locating the pertinent studies should be comprehensive.

Defining and using criteria for selection of eligible studies (inclusion/exclusion criteria): Criteria should be clearly reasoned and applicable to the identified problem/phenomenon and the review questions. The PICO model (Patient/Population/Intervention, Comparison, Outcome) may be used and the selection should target full research reports. Experts recommend involvement of at least two reviewers to ascertain consistency in the application of the studies’ inclusion/exclusion criteria.

Extracting pertinent details from the reports of the selected studies: The process of data extraction should be consistent. Both electronic and script pro-formas are available.

reports, the institutions, and the particular journals of publication. Subjective preferences in the research report in terms of potential biases should also be given careful consideration.

Initial Preparation

Because systematic reviews involve considerable rigor, preparation is important and should be carefully thought out. It is important to establish what reviews, both previous and current, have been conducted on the particular clinical problem and what review questions were asked.

Another motive for systematic reviews may be obligatory response to a commission. The commissioning body may demand verification of the best available evidence through systematic reviews of such issues as organizational policy, emerging new procedures/treatment interventions, or the prevalence and pattern of spread of an infection. For more detailed information, readers are encouraged to explore both the Cochrane Handbook (Higgins & Green, 2011) and the Centre for Reviews and Dissemination (CRD) publication, Guidance for Undertaking Reviews in Healthcare (Centre for Reviews and Dissemination, 2009).
group should have the authority to examine the feasibility of implementing the recommended guidelines (Gagan & Hewit-Taylor, 2004). It is important that such groups are established prior to commencing the systematic review.

**Developing the Review Protocol**

Lo Biondo-Wood and Haber (2013) recognize the advantage of putting evidence-based policies, procedures, and guidelines in writing. Public and organizational/administrative dynamics that may potentially hinder the use of research findings should be carefully examined. Appropriate measures should be taken to address these before embarking on the implementation of EBP. Brown, Wickline, Ecoff, and Glaser, (2009) and other authors cite barriers such as inadequate staffing capacity, varied levels of competence, unequal and inadequate management support, neglected research training, and experience. Other limitations include deficient research activities, disinterest and lack of motivation to conduct studies, and poor application of credible findings to clinical practice in certain areas. The tendency to consistently apply unsubstantiated and intuitive practices could lower the standard and quality of care delivery.

The protocol should outline clear, practicable, reasoned, and achievable actions to ensure correct and efficient implementation. An important advantage of developing a protocol is to avoid omissions and inconsistencies that may result in inaccurate conclusions being drawn. In addition, a protocol provides a practical guide to the review process and the intended use for the findings (Crombie & Davies, 2009; Hemingway & Brereton, 2009; Kitchenham, 2004). In reality, while most of the decisions about the systematic review and meta-analysis are incorporated in the protocol, additional decisions may become necessary as the review progresses. The following is a sample protocol derived from existing protocols.

**Key Components of the Protocol**

The protocol should provide a schedule and venue for the review meetings, specify the processes to be employed in the review, and serve as a guide to deciding on the review question. This helps to refine the question and make clear which intervention is being explored and why.

The protocol should also include an outline of the study selection process. To avoid bias, criteria for inclusion and exclusion should be clearly defined. The protocol should also outline the processes of data extraction and assessment of the quality of the research studies in terms of design and methodology. The technique for data synthesis should be concisely stated together with the strategy for disseminating the findings from the review. Any modifications to these processes should be clearly documented in relation to the review question.

The use of an approved and formal systematic review framework facilitates these processes. While some are produced with accompanying narrative guides or instructions, others are considered relatively self-explanatory and easy to apply. A copy of the review framework should be enclosed separately or incorporated in the protocol (Crombie & Davies, 2009; Hemingway & Brereton, 2009; Kitchenham, 2004). Other key stages are examined here.

**Relevance of the PICOS Format and Criteria**

The process for selecting relevant studies for systematic reviews traditionally considers population, intervention, comparators, and outcome (PICO). Study design has been added to the process to create PICOS.

**Application of the PICO(S) Criteria: An Exemplar**

The main purpose for the review should be stated, specifying the exact clinical issue that is to be explored. For example:

To explore the impact of specific campaigns, including sexual health promotion and patient education, sexual health screening, safer sex, and condom usage designed to target young adults between 18–24 years of age in X area(s). The review would cover all clinical settings within the . . . locales and/or geographical areas.

**P: Population/Patients or Study Participants** Details about the characteristics of the participants should be indicated in the statement or review question. Relevance to the target population should be recognizable such as gender, age range, type of medical condition or specific health problem, degree of severity, and specific status of the problem or condition.

**I: Intervention, for example, Specific Medication or Therapeutic Procedure** The particular treatment intervention(s) should reflect those specified in the review question. Multiple treatment interventions should be clearly itemized according to relevance to the review. For example:

Sexual health promotion/education
Sexual health screening for chlamydia and other STIs
Promotion of condom use

**C: Comparators** The nature of the comparators should be explained in terms of the study/control groups or the types of treatment interventions and modes of delivery. For example:

Comparisons of an intervention group of sexually active young adults who regularly attend sexual health clinics to those who seldom ever or never attend clinics.

Or,

Implementation of specific behavior change interventions with guidance and instructions provided in the group context as well as on individual basis.
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O: Outcome This relates to the effectiveness of the treatment intervention(s). The outcomes should be recorded as a direct result of the intervention(s) but if not, the compounds or co-interventions that may have been in place should be clearly specified. Additionally, the exact nature of each observed and measured outcome should be clearly recorded. For example:

Clear evidence of improvement in the sexual behaviors of the research intervention group.

Clear evidence that increased proportion of the intervention group of young adults demonstrated behaviors indicative of being better informed about and practicing safer sex with fewer sexual risk-taking behaviors.

Negative outcomes should also be clearly reported and more exact descriptors and terminology specifying the nature of each type of outcome should be stated. The challenge is whether the outcomes were observable, measurable, and recordable to achieve objectivity in each of the selected studies.

S: Study Design A design that allows for objectivity and consistency is likely to have been carefully developed. For example: "randomized controlled trials" with appropriate attention to detail. This could prove to be a challenge in some areas of sexual healthcare where empirical quantitative or other seminal studies may be relatively limited.

The above suggestions draw on various guidelines for systematic reviews including Petticrew (2003) and Petticrew and Roberts (2006).

The Literature Search and Retrieval of Published Evidence Materials

Comprehensive systematic search and retrieval of published evidence materials forms an essential requirement in systematic reviews. Documentation provides an audit trail and helps the reviewers, the target audience, and other readers to judge the exhaustiveness of the search. It also allows for determining the extent of inclusion of the range of research studies that were accessed (Kitchenham, 2004).

Determining the time frame over which the search should cover depends on the nature and complexity of the problem/phenomenon under review and on how rapidly that field of clinical practice has undergone progressive development and change. Therefore, the extent to which the particular problem and the related intervention have been investigated could be an influence (Scottish Intercollegiate Guidelines Network [SIGN], 2011). The search for reports on seminal work should lead to identification of empirical studies if the topic has been explored by experienced researchers. Other high-quality studies from both primary and secondary sources may also be identified. An all-inclusive exploration is advantageous to obtain all available pertinent studies on the topic (Crombie & Davies, 2009; Hemingway & Brereton, 2009; Polit & Beck, 2008).

While it is important to consider a varied range of studies, it is crucial to determine whether the studies are directly or indirectly related to the topic. Therefore, in a preliminary search, particular attention should be paid to potential limitations such as publication preferences and other deficiencies that may influence the range of studies published. Because these can influence the selection of studies for reviews, those problems are considered here.

Use of Approved Set of Eligibility Criteria for Objective Selection of the Studies

The stages of study selection outlined here are derived from various sources; in particular, Kitchenham (2004), Hemingway and Brereton (2009), and Higgins and Green (2011).

- Stage one: Abstract selection. Based on the abstracts, studies that are not relevant to the problem are excluded. Studies deemed relevant to the problem of interest are retained.
- Stage two: Population. Studies are examined for relevance of population/patient characteristics.
- Stage three: Intervention. The studies are examined for the nature of the intervention and its delivery. The exact content and mode of delivery should be stipulated. Other facts could include specifying who delivered the intervention and where that intervention took place. Once again, studies that fall short of the specifications are excluded at this stage.
- Stage four: Comparison. This stage examines the comparison and/or control processes and further exclusions carried out as necessary. Comparators should be specifically defined (Hemingway & Brereton, 2009; Kitchenham, 2004).
- Stage five: Expectation. The indicators of the intervention outcome are used to determine the size, nature, and extent and significance of the effects, both positive and adverse, of a specific intervention. The importance of clearly defining the relevant set of outcomes such as measures of mortality and morbidity, quality of life, and specifically related experiences of physical function should be emphasized. In the case of the participants’ experiences, the review may involve qualitative studies or a combination of quantitative and qualitative studies. From that assessment, further exclusion is carried out as necessary (Hemingway & Brereton, 2009; Kitchenham, 2004).
- Stage six: Study design. This stage assesses whether the design employed for the investigation in each study accords with the stipulated indicators for those designs. The designs are meticulously examined, followed by more sensitive analysis at the stage of synthesis or integration of findings (Hemingway & Brereton, 2009; Kitchenham, 2004). Robustness of the study design is often the determining factor for
including a study in the review. However, studies of the same design may not necessarily be of the same high standard and quality. A particular caution relates to the risk of omitting studies that have direct relevance within the context of the review if the set criteria were too narrow and/or too rigidly adhered to. However, unrealistically broad criteria that allow for varied interpretations and application could result in poor and/or complicated comparisons and syntheses (Hemingway & Brereton, 2009; Kitchenham, 2004).

At each of these stages, the specific reason for the exclusion should be documented in the appropriate column indicating the nature of the limitation or deficiency (Hemingway & Brereton, 2009; Kitchenham, 2004; SIGN, 2011).

**Extracting Pertinent Data**

Data extraction is the process of pulling out essential information about the main aspects and key attributes of individual research studies. Because studies of different designs present variations in methodology, the amount and content of data to be extracted is bound to vary. Key considerations for data extraction depend on the purpose of the review and the specific design of the selected research studies. An appropriately devised set of extraction criteria with a clear and methodical system of documentation helps to achieve the desired consistency and accuracy of extraction. Furthermore, the technique for analyzing the data and the data presentation depend on the key issues conveyed in the review question and objectives (Higgins & Green, 2011; Petticrew & Roberts, 2006; Polit & Beck, 2008). A copy of the data extraction form should be included in the review protocol. Because reviews are carried out on several studies, it is pragmatic to use a well-devised purposeful, tested, and approved data extraction form.

Various formats are available, such as the Cochrane Study Selection, Quality Assessment & Data Extraction Form. Two examples of application that may be of interest to readers are the Data Extraction Form for HIV/AIDS Provider Training, and the Quality assessment for Intervention Studies of HIV/AIDS Provider Training, and the Quality assessment for Intervention Studies of HIV/AIDS Provider Training. The sample shown in Box 3-3 can be further adapted: for example, the inclusion and exclusion criteria could be structured to allow for recording indicators relating to the population, the design, the intervention, and the outcomes with an additional column for specifying the elements that justify exclusion (Khan, Kunz, Kleijnen, & Antes, 2011).

Clearly, the use of an approved framework with a pre-specified set of criteria helps to achieve efficient and well-organized recording of the extracted data (Petticrew & Roberts, 2006; Polit & Beck, 2008). Moreover, standardization increases confidence in the data extraction process (Hemingway & Brereton, 2009). The selected framework or template must be up to standard and easy for the team to use. While certain versions may be useful for introductory purposes, practitioners and educators are urged to explore more comprehensive, formally designed formats and current electronic and updated versions that continue to emerge.

As the team gains more familiarity with the process of data extraction, modification and pilot testing of the identified data extraction forms becomes more practical and achievable. The sample shown in Box 3-3 can be further adapted: for example, the inclusion and exclusion criteria could be structured to allow for recording indicators relating to the population, the design, the intervention, and the outcomes with an additional column for specifying the elements that justify exclusion (Khan, Kunz, Kleijnen, & Antes, 2011).
Assessment of the Meticulousness of Each Study Design

Because the process of data extraction in systematic reviews and quality assessment of the research studies are linked, these processes tend to be undertaken concurrently.

Assessment of Risk Bias

The strength and truthfulness of the findings from research studies become doubtful when flaws occur in the design. Shortcomings in research design that adversely affect findings may occur in the form of selection, performance, measurement, and attrition biases (Khan et al., 2011). These can be explained as inadequate allocation procedure; dissimilarities in the characteristics of the participant groups; lack of clarity of the blinding process applied to the participants, the care deliverers, and those who assessed the outcomes; and imbalance in the sample sizes caused by unpredicted dropouts or other losses. Further shortfalls may be attributed to inadequate management and lack of clarity of the intention to treat, the related analysis, and how missing data were accounted for. Each predicted bias should be clearly recorded together with the relevant elements of quality assessment (Khan et al., 2011). The impact of specific risk biases may be rated as high, low, or unclear in relation to causing over- or undervaluation and misrepresentation of the true effects of the intervention. To gain a better understanding of this concept, readers are encouraged to explore Higgins & Altman (2008) in the Cochrane Handbook for Systematic Reviews of Interventions.

Assessment of the Suitability of the Statistical Techniques and the Degree of Accuracy

The statistical techniques and methods of analyzing data may depend on the adequacy of the sample size. The sample should be appropriately representative of the population in its components, subgroups, strata, and other relevant characteristics (Higgins & Green, 2011; NICE, 2006).

- Assessment of generalizability.
- In the appraisal of findings, two factors are crucial: (1) the study sample should be representative and should characterize the target population, and (2) the findings...
should be generalizable to other populations beyond the study population or participants. The study should have been conducted to closely represent standard current practice. Differing views are proposed about assessment of the generalizability of findings from quantitative and qualitative studies, taking account of the specific designs employed (Higgins & Green, 2011).

- Assessment of the quality of the research report.

The research report should be clear and comprehensible. There should be adequate detail on all important aspects addressed in a full quality appraisal to allow for possible replication of the research process. Reporting on a particular criterion should clearly indicate whether it was met or unmet or lacking in clarity.

While some reporting systems only focus on a scoring system, others require the assessors to provide brief statements on specific aspects of the study. In order to deal with the large number of selected studies in systematic reviews, the use of quality assessment checklists has become quite popular.

The more elaborate assessment forms may have all the criteria stated for each key element assessed. Additionally, instructions on exactly how the scoring should be done may accompany the assessment forms. Guidance may also be provided on how to summarize and interpret the overall grade, the aggregate rate, or the total score.

Readers are encouraged to explore different methods before making a choice (Higgins & Green, 2011; NICE, 2006). Suggested sources of additional reading are included in the reference list, and readers are encouraged to explore the National Collaborating Centre for Methods and Tools (NCCMT) Quality assessment tool for quantitative studies (2008). Khan et al. (2011) and Armijo-Olivo, Stiles, Hagen, Biondo, and Cummings’s (2012) Assessment of Study Quality for Systematic Reviews are also useful.

Tables 3-1 and 3-2 represent simple pro-formas that can be adapted and applied to assessment of quantitative and qualitative research quality in conjunction with data extraction. These should be regarded as rather broad formats that may require adjustments to meet the purpose for the particular review.

### Data Abstraction: Relevance in Systematic Review Data Synthesis and Meta-Analysis

Data abstraction is an important process in systematic review and reviewers/meta-analysts should provide a detailed explanation of the process in the full report. Standardized/
formal data abstraction forms can be adopted for use or an original version created, if properly pilot tested. The completed abstraction form should be incorporated in the final report. The information provided in the data abstraction should convincingly show that the selected and included studies are appropriate for synthesizing and combining the results (Grimshaw et al., 2003).

Experts suggest that the process of abstraction be carried out by at least two members of the review team who should work separately. Additionally, they should be blinded to the original authors of the studies and the institutions in which the studies took place. After comparing the abstractions, any discrepancies should be resolved and clearly documented (Grimshaw et al., 2003). Practitioners and systematic reviewers are urged to explore and critically examine selected data abstraction forms.

The scoring systems also vary. Raw figures, risk ratios, and the results from intention-to-treat analyses should all be reported. The latter relates to analysis of participants regardless of whether they received the intervention or not and regardless of what happened later.

An example of a data abstraction form deriving from various sources, including Grimshaw et al. (2003), is provided in Table 3-3. This example is intended simply to illustrate possible development of an abstraction format that draws on existing ones. Depending on the type of review and the specific purpose, review teams might prefer to develop a more suitable abstraction format de novo.

• In the column relating to the inclusion and exclusion criteria, the specific factors should be clearly defined with precise statements or scored against benchmarks. The reasons for exclusion should be
concisely stated and the degree of diversity or heterogeneity also stated.

- In the column relating to the study design and methods it may be useful to refer to an existing pro-forma for quality appraisal to determine relevant key elements to look for and allocate appropriate scoring for specific study characteristics including, for example, randomization, allocation concealment, blinding, follow-up, analysis of intention-to-treat, sampling technique, sample size, intervention group, control group, baseline characteristics, and observed outcomes against the projected outcomes.

- In relation to the methods, the type(s) of data, techniques of analysis and presentation of the results, the raw data, the effect size—ratios of odds/risks, and other key results should be examined and appropriately scored.

- The impact of heterogeneity among the studies and related subgroup data and sensitivity analysis should be recorded for assessing the impact of the research quality on the results.

- The identified key strengths and the identified key limitations of the study should be stated and the overall quality score recorded.

- In the column relating to specific clinical details, the type of clinical settings, locations, patient characteristics and participant characteristics, age range, gender, and specific problem of clinical/public health interest relating to the study may be indicated.

**Data Synthesis Explored**

By and large, studies focusing on healthcare interventions essentially quantify the degree and measure of efficacy. Thus, the positive or negative impact of the specific intervention on the outcomes tends to be documented in numerical or statistical formats as summarized and presented by the researcher(s) in their report. Quantitative research studies tend to involve application of comparable processes of data collection and similar techniques in analyzing the data. Moreover, synthesizing quantitative data involves application of approved specific processes and techniques with strict statistical structuring and exactness in documenting the results. Therefore, combining the findings across studies can be achieved meaningfully (Ring, Ritchie, Mandava, & Jepson, 2010). Primary studies included in reviews of quantitative data are likely to be homogeneous in their focus on the same topic and application of comparable research design. Importantly, their similarities also include application of comparable methodology in terms of the type of data, the analysis, and the results.

Various approaches have been proposed for identifying and selecting qualitative studies for synthesizing based on the application of a specific set of criteria for inclusion (Box 3-4). As Ring et al. (2010) remarked, some approaches applied to the synthesis of qualitative research studies share similarities to the synthesis of quantitative studies, including the search for identifying relevant primary studies, the use of criteria for inclusion and exclusion, and assessment of the quality of the research studies. Nevertheless, the approaches to qualitative research synthesis and the processes involved tend to be more complex, involving multiple interconnected elements, underpinning thoughts, deductions, and reasoning toward the anticipated goals. The findings tend to be presented in various ways and the interpretations also vary rather than reaching a common understanding. Synthesizing primary qualitative research data presents particular challenges (Ring et al., 2010).

**Determining an Appropriate Method for Synthesizing Specific Data**

Randomized controlled trials (RCT) remain the preferred methodology and are therefore the more commonly used research design for evaluating healthcare interventions. Meta-analysis is the most frequently applied quantitative technique for data synthesis. However, qualitative research synthesis involving narrative process may also be applied as

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**BOX 3-4 Main Assumptions and Rationales for Synthesizing Qualitative Research Evidence**

- Synthesizing qualitative research evidence potentially helps to broaden the scope and depth of existing professional knowledge.
- Qualitative research synthesis enables reviewers to create more contemporary concepts and develop new interpretations from the synthesis of available research evidence. This strengthens the basis for ongoing research.
- Apart from gaining deeper insight about the effects of clinical interventions and aspects of healthcare policy, the synthesis may also help to identify issues requiring more in-depth exploration.
- Furthermore, synthesizing research data helps to establish better understanding about specific problems and phenomena encountered in clinical practice.
- The role of qualitative research synthesis in helping determine the factors that enhance or inhibit the effectiveness of specific therapeutic or interventional services is now recognized.
- Synthesis of qualitative research evidence has the potential for generalizing findings in clinical practice and policy decision-making.

an acceptable alternative if quantification of the data is not considered practicable. Also, RCTs may not be applicable to many systematic review questions on healthcare issues. Moreover, many systematic reviews do not encompass statistical data and, therefore, meta-analysis may not be applicable for combining results from the studies.

**The Benefits and Key Elements of Meta-Analysis**

Meta-analysis allows for generalizing the findings from related studies to the target population indicated in those studies. Other benefits are that meta-analysis helps to resolve the problem of professionals missing significant findings from high-standard and quality empirical studies. Nevertheless, in determining whether combining the results from multiple research studies would be feasible, account should be taken of the clinical and statistical significance. Meta-analysis is not always possible or necessary (Khan et al., 2011; Sutton & Higgins, 2008).

**Summary of Main Arguments for Quantitative Meta-Analysis**

- Meta-analysis offers unbiased synthesis of data from carefully selected experimental or other high-quality quantitative studies. The technique allows for integration of multiple studies, including large empirical research and relatively smaller studies that may have been considered as inconclusive.
- The process offers more detailed statistical calculations with precision, which ensures that relatively minor details that may be significant for clinical decisions in treatments can also be identified and taken into account.
- The merging of results from studies with consistently small numbers of participants effectively increases the total sample size and, therefore, improves the statistical power and generalizability of the findings and results.
- The pooled results from larger numbers of patients/clients provide more valid and convincing information about particular clinical problems and the effects of treatment interventions that may not have been extensively investigated. In this case, pooling may also afford greater confidence in the related clinical decisions.
- Rather than simply reporting the odds ratio of occurrence of a condition among the study group comparative to the control group, meta-analysis allows for calculating the risk ratio or relative risk ratio as well. (Khan et al., 2011; Sutton & Higgins, 2008)

**Logical Stages of Meta-Analysis**

- Because meta-analysis forms a key component of systematic review, the initial stage begins with that.
- Clearly formulated question of clinical significance. This is important because unfocused and broad questions result in ambiguous criteria and inconsistency in the selection of studies.
- Development of a protocol outlining all stages including the technique of combining the results by meta-analysis. Determining which comparable factors, outcome measures, and summary effect measures to be applied should be stated in the protocol.
- Thorough search of the literature and identification of relevant studies.
- Construction and application of eligibility criteria.
- The selection of pertinent studies guided by predetermined set of eligibility criteria. It is important that the operational definitions provided in the research report are carefully noted and a scoring system applied.
- Methodical data extraction to determine comparability of corresponding elements in the selected studies. These include the type of intervention, outcomes, intention-to-treat, and the particular results that can be effectively combined in the meta-analysis.
- Thorough examination of the studies to ensure that pertinent and seminal studies are selected for inclusion while studies with dubious and non-significant results are rejected. The exact quality standards must be defined for deciding which studies to select for meta-analysis:
  - Type of research design/paradigm and thorough critical examination of the conduct of the study. The sampling technique should be examined for the statistical basis for calculating the sample size.
  - Risk bias assessment should be detailed and methodical. Potential systematic errors and the strategies for dealing with them including the system of randomization—allocation/selection bias.
  - The degree of thoroughness in the implementation of the research intervention should be ascertained and there should be planned procedures for dealing with performance bias.
  - Procedures for reporting inconsistencies in the outcome measures and the intervention effects—detection bias.
  - Publication bias can occur in the process of locating and selecting relevant studies for meta-analysis. These may depend on the direction of the results and whether these are statistically significant. Additionally, language and potential interpretation issues can cause publication bias.
  - The statistical techniques employed. Appraisal of the degree of precision applied in the data collection process, the data analysis, and degree of accuracy of the results.
  - Generalizability.
  - The completeness and quality of the research report. (Khan et al., 2011; Sutton & Higgins, 2008)
Amalgamating Research Study Results: Effect Estimates and Weighted Average

Meta-analysis allows for combining the effects from all the relevant studies to calculate the overall mean effect or the summary estimate. Combining effects from a number of studies requires that they are expressed in the same units. An estimation of the effect size represents the extent of the intervention effect. The effect estimates are based on data obtained from the individual studies, and each study produces a different estimate of the magnitude of the intervention effect. While individual effects refer to the observed effects in separate studies, summary effects refer to the pooling of the effects from each of the studies in a meta-analysis (Khan et al., 2011).

Each study is weighted according to the exactness of the statistical calculation of the sample size. Weighting also takes account of differences in measurement error between studies. Studies that represent more rigorous precision are given weightier effect estimates than those that do not meet the expected level of rigor and precision. The pooled effects observed across the studies are statistically calculated as a weighted average effect. The process allows for determining which studies’ results contributed more significantly to the pooled or sum total—the summary effect. The contribution is proportional to the amount of information in the study. The more empirical studies with larger sample sizes attain heavier weighted average when pooled or amalgamated than those with smaller sample sizes (Crombie & Davies, 2009). Further clarification of the weighting process is provided here, together with the combined effect.

The Fixed-Effect Model

This model is based on the assumption that there is one true effect size and that all the included studies estimate the same effect size. Therefore, the combined effect represents that common true effect size. The weight allocated to each study would represent the amount of information generated by that particular study so that the larger studies yielding more information would be more heavily weighted and the relatively smaller studies less weighted (Borenstein, Hedges, & Rothstein, 2007; Khan et al., 2011). This model upholds that consistency persists in all the studies with no variations in the size of treatment effects, thus implying that there is no statistical heterogeneity in the treatment effects among the studies. Any emerging variation occurring within a particular study can be attributed merely to chance. Therefore, the estimated ratios, for example, as calculated in each of the studies would show equivalent values (Borenstein et al., 2007; Polit & Beck, 2008).

Random-Effects Model of Meta-Analysis

This model holds that the estimation of treatment effects could vary between one study and another and that variations can also occur within the same study. Variations in results may be influenced by how vigorous the campaigns, the type and substance of information, and the amount and depth of the education and counseling support provided to the study groups. Other variations in the results may arise from the duration and persistence of the health promotion campaigns targeting different population groups within colleges and places of employment. The random effects model allows for determining the distribution of effects among the various studies. The effect size may be affected depending on how consistently and accurately the outcomes are measured in each study.

The random effects model accepts variations in the results between studies and within studies so that the weighting of studies combines both of these variances. The studies included in the meta-analysis represent random samples of the particular effects. This model aims to estimate the mean of the true effects across the studies; therefore, the combined effects would be calculated to determine the mean in that distribution. The argument is that while large studies present more precise estimates than smaller studies, variations also occur in the effect sizes among these categories of studies. Each effect size represents a separate sample from the population whose mean value is estimated. Therefore, in the allocation of weights, balancing is achieved whereby the larger studies might not overpower and unbalance the analysis and small studies might not be underestimated. In the random effects model, pooling is feasible when the range and size of variations are noticeably diverse and unexplainable with discrete and disparate effect sizes. Individual studies would be found to have yielded differing values or ratios of intervention effects (Borenstein et al., 2007; Crombie & Davies, 2009; Sutton & Higgins, 2008). Understanding the relevance of these models is necessary to enable reviewers to choose the most appropriate model for analyzing selected studies for the systematic review.

Sensitivity Analysis

Sensitivity analysis allows for comparing the findings from given systematic reviews and meta-analyses to determine if these realistically substantiate rigor and validity in the methods applied. The sensitivity tests may help to establish the impact of excluding certain studies categorized as outliers with distinctly divergent results. Thus, the initial process would involve analysis of the findings from all the selected studies that meet the criteria for inclusion (Khan et al., 2011). Following the initial meta-analysis, a repeat process is carried out involving sensitivity testing. In that repeat analysis, those studies that were originally rejected or excluded because of poor or questionable quality and/or lack of detailed reports would be included in order to compare the results. Thus, sensitivity tests afford a means of testing how sensitive the results are to changes in the conduct of the meta-analysis. A further test may involve the intervention effects across the subgroups identified in the selected studies. This may require conducting separate reviews and meta-analyses for subgroups of patients who are likely to respond differently to the treatment intervention because of different preexisting medical conditions or specific characteristics. Thus, sensitivity...
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The Relevance of Homogeneity and Heterogeneity

Homogeneity in meta-analysis is based on the assertion that the statistical quantification of the pooled results from the selected research studies should, for practical purposes, represent the combined effect from numerous comparable studies. Many meta-analysts hold the view that it is crucial to ensure that the observed effects from the individual studies are adequately comparable, equivalent, and consistent. This enables the analyst to convincingly assert that the combined estimate of results through meta-analysis realistically produces a true representation across the selected studies (Crombie & Davies, 2009; Deeks, Altman, & Bradburn, 2001).

Heterogeneity is commonly examined and tested for with regard to the range of variation and bias that occurs in the conduct of research studies and their results. Heterogeneity relates to the inevitable occurrence of multiple differences among studies. It is important to explore in what ways the studies differ, identify the specific types of differences, and establish how those differences might influence the effectiveness of a treatment intervention. Examples of diverse factors that may impact on the nature and extent of intervention effect include the type of disease, seriousness of the condition, and the available resources. Other factors include the environment of care delivery, quality of care provided, and the major consequence of the disease or medical condition, such as death or disability of varied durations. Importantly, interpretations from this technique depend to a large extent on the number of studies examined (Higgins, Thompson, Deeks, & Altman, 2003).

Depending on the nature and degree of diversity, the factors may be categorized as clinical, methodological, or statistical heterogeneity. These effectively describe the identified source of the diversity among the studies. Clinical heterogeneity (diversity) refers to patient-related factors. Thus, gender, age, the exact diagnosis and severity of the condition, and other prescribed medications the patients may be using at the time constitute clinical heterogeneity (Higgins et al., 2003; Khan et al., 2011).

Differences in the clinical trials may occur in the form of crossover or parallel group studies. Variations may occur in the thoroughness of allocation concealment or blinding against detection bias. Varied durations of treatment interventions and analysis of intention-to-treat may also reveal differences among studies. See Cochrane Handbook for Systematic Reviews of Interventions: Cochrane Training (http://training.cochrane.org/handbook).

Statistical heterogeneity refers to variations in the treatment effect. Because meta-analysis is applied to estimate the combined effect of numerous studies, it is necessary to carefully examine the treatment effect in the individual studies. To establish statistical heterogeneity, the estimates of the treatment effect in the individual studies are calculated to ascertain that they are adequately comparable to justify a combined estimate of effect (Higgins et al., 2003; Khan et al., 2011). Meta-analysis essentially seeks to combine studies that have yielded similar intervention effect. The intervention effect may yield positive/favorable or negative/unfavorable results. Statistical heterogeneity indicates diversities in the interventions across the studies. These reflect clinical as well as methodological heterogeneity (Polit & Beck, 2008).

Moreover, analysts look for excessive variation in the estimate of the treatment effect. The presence of excessive variation in the observed treatment effects would suggest statistical heterogeneity. In that case, the systematic reviewer may choose not to carry out meta-analysis, as the result could lead to drawing conclusions that are ambiguous and misrepresent the observed effects in the studies (Khan et al., 2011).

Alternative processes of random effects model, subgroup analysis, and meta-regression may be applied. These allow for establishing the reasons for the occurrence of variations in treatment effects in different studies. Brief overviews of these processes are provided.

Meta-Regression and Subgroup Analysis

Calculation of the combined effect size would be questionable and probably lead to inaccurate clinical decisions if wide-ranging heterogeneity across the studies is disregarded. Therefore, it is crucial that review teams and practitioners should ascertain if the treatment effect is likely to vary in different circumstances and in what ways. The disparity in the effects could make the appropriateness of this stage of the meta-analysis questionable and unjustified. Meta-regression allows for examining the types and nature of diversities and the extent to which particular factors influence the intervention outcomes and indeed, the effect size (Polit & Beck, 2008).

Subgroup analysis focuses the meta-analysis on the specific subgroups of participants involved in the studies. In order to avoid errors and drawing ambiguous conclusions, early determination of what groupings will be investigated and analyzed is important. Experts maintain that carrying out subgroup analysis at the later stage of the meta-analysis and after the results have been calculated could create bias in the reporting of the results.
Subgroup analysis may not give clear or full information about how specific variations in the mode of administration of the intervention treatment affected the outcomes (Khan et al., 2011; Noyes et al., 2011). Additionally, subgroup analysis may not reveal or confirm exactly how varied are those observed outcomes among the subgroups from the population studied. Any observed variations could be attributable to particular factors in the characteristics of one subgroup or another. Experts suggest that conclusions from subgroup analysis should be viewed with caution and interpreted tentatively because they derive from subdivisions of studies and contrasts rather than precise scientific statistical tests.

While meta-analysis allows for investigating the extent to which specific study characteristics might be associated with specific intervention effects, meta-regression goes a stage further. For example, meta-analysis could be used for investigating the impact of carefully planned and methodically delivered behavior-change program for one group of study participants and the observed results may show greater degree of effective positive outcome. However, a participant group (a control group) who were not exposed to that behavior-change program would show different outcome effects. This means that two subgroups under investigation may yield different treatment effects in meta-analysis due to certain factors in the study design.

Meta-regression provides a means to identify the specific factors that may have contributed to disparities (Borenstein, Hedges, Higgins, & Rothstein, 2009). However, meta-regression may not be entirely appropriate for assessing differences in treatment effects.

Various processes have been proposed such as determining the relationship between specific factors, study and/or patient characteristics, and the magnitude of effect observed in each study. Nevertheless, systematic reviewers, practitioners, and decision-makers are cautioned that these tests are not entirely flawless. They may have low statistical power and may fall short of revealing all the disparities present in the studies and the results. Meta-regression requires that each study be allocated an appropriate estimated weight.

Moreover, careful decision should be made regarding an appropriate effects model that is applicable to meta-regression. Many experts consider the random-effects model to be more appropriate for analyzing variations between studies for the purposes meta-regression (Borenstein et al., 2009).

Summary data incorporates the averages of effect size, severity of disease and length of follow-up. Meta-regression seeks to explore the influence of study characteristics on the size of the effects observed in systematic reviews and/or meta-analysis. However, meta-regression is unable to directly link specific patient factors to the size of treatment effect. Nonetheless, the size of treatment effect may be lost if continuous data with constant/constant number of values were converted to dichotomous data with only two possible values of presence/existence or absence/non-existence. Therefore, regression based on individual patient data may have to be employed to address that limitation (Borenstein et al., 2009).

### Reflective Considerations

The following reflective activity can be undertaken on individual basis, in pairs, or in small groups. The summary outline is intended to provide ideas that may serve as directions and/or broad objectives for systematic review teams or colleagues in the multidisciplinary team.

Taking account of the setting, participants, interventions, outcomes, research designs, and methods employed in the studies, carefully reflect on the following:

- Consider the problem of hospital-acquired infection and formulate a problem title, questions, and objectives to be explored for systematic review with a view to implementing a feasible intervention in the context of EBP.
- Consider the preliminary stages of literature search and perusal activities.
- Consider the development of a protocol and develop an outline of the key components that should be incorporated for an achievable in-house EBP implementation.
- Consider which members of the multidisciplinary team could effectively participate in the systematic review team.
- Consider which clinical leads could be involved in an advisory committee.
- Discuss the stages of the actual literature review and possible components of a simple format for data extraction and consider a clear format for data abstraction.
- Consider the selection of the pertinent studies; outline the main criteria for inclusion and exclusion.
- Consider the key components of quality appraisal of the selected research studies for classification of the levels of evidence.
- Consider what factors may influence meta-analysis or meta-synthesis of the findings from the included studies.
- Consider the question, “Is the review team confident that combining and meta-analyzing the study results/findings would be pragmatic, meaningful, and consequential for guiding clinical decisions?”
- Consider what possible intervention(s) that might be feasible to implement in this scenario.
- Consider what additional steps might be necessary to produce substantial information for drawing conclusions and making recommendations to inform relevant clinical decisions and action plans by the policy/decision-makers.
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**Reporting and Appraising the Meta-Analysis**

The following section considers the importance of detailed reporting of completed meta-analysis. The framework Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) is examined here. Practitioners are encouraged to explore and to carefully examine the full PRISMA statement together with the underpinning principles, recommendations, and correct application.

The following key elements derive from the PRISMA checklist and may usefully guide correct development, reporting, and evaluating to finalize completion of in-house systematic review projects and meta-analysis. Detailed, accurate, and transparent reporting is essential if effective judgment is to be made for possible application to evidence-based clinical decision making and care provision.

Box 3-5 presents concise outlines of the main components of the PRISMA frame and draws on the model developed by Moher, Liberati, Tetzlaff, and Altman (2009). Practitioners are encouraged to examine these critically and compare with the original authors’ model.

**The Role of Narrative Synthesis**

Narrative synthesis involves synthesis/integration of evidence relating to effectiveness and other questions in a narrative. The process involves compiling the findings from studies included in a systematic review and summarizing them in textual form (Rodgers et al., 2009). The current recommendation is that all numeric tables presented in systematic reviews should be accompanied by narrative text. Apart from providing an explanation and summary of the main characteristics of the results and findings of the included studies, it also provides an analysis of the variations within and between studies (Noyes, Popay, Pearson, Hannes, & Booth, 2008). An overall judgment of the strength of the evidence should also be stated. Narrative synthesis is necessarily carried out when the studies are found to be overly diverse in terms of clinical and methodological variations to allow for combining the data in meta-analysis. However, some amount of narrative description is necessary to integrate and interpret the evidence. Nevertheless, it is contended that narrative synthesis is not strictly objective but can be potentially subjective compared to the rigor and precision of meta-analysis. To avoid or minimize potential bias, the process should be performed in a strictly methodical manner, detailed and transparent enough to be repeatable, although this could prove to be difficult to achieve (Noyes et al., 2011; Rodgers et al., 2009).

**Framework for Narrative Synthesis**

Different frameworks have been proposed as a guide for carrying out narrative synthesis and specific formal guidance should be explored. In particular, readers would find it useful to read Popay et al.’s (2006) Guidance to the Conduct of Narrative Synthesis in Systematic Reviews and Rodgers et al.’s (2009) Testing Methodological Guidance on the Conduct of Narrative Synthesis in Systematic Reviews.

The framework for narrative synthesis comprises four key elements, each of which are addressed by employing particular tools and techniques (Popay et al., 2006). The important thing is to carefully consider which tool would be appropriate for fulfilling the purpose of the review question and the evidence being synthesized.

**Transforming Data**

Different statistical counts and measurements are used in presenting the data from research studies, and, in quantitative studies, the type of data is predominantly numerical. The initial figures may be in the form of raw data, which may be calculated into summary data or expressed in different statistical figures. In order to enhance the accuracy of the description of the effects, devising a common system of measures to transform the data is necessary. For example, dichotomous data may be converted or transformed into odds ratio, risk ratio, relative risk, and risk difference. Continuous data may be presented in the form of weighted mean difference or standard mean difference. For the purposes of meta-analysis, results from studies may be combined to produce an estimate of effect (Popay et al., 2006; Rodgers et al., 2009). Transforming data helps present results in easy-to-understand ways, and the range of effects from research interventions can be measured and calculated more accurately. This statistical technique is not applicable to narrative synthesis.

**Vote-Counting**

Vote-counting provides another tool for producing descriptive summary data and involves counting up and calculating the frequency of different types of research results from the studies included in the review. Vote-counting can be used to establish patterns across the studies. In reviews relating to evaluation of intervention effects, vote-counting may be used for tabulating significant and non-significant results (Popay et al., 2006). Thus, this tool is useful for recording findings that may be tabulated according to the direction of the effect. More current techniques of vote-counting continue to be proposed, and the idea of counting and calculating by categories and allocation of weights and scores have emerged as alternative concepts. Despite its potential usefulness, this tool tends to be considered questionable, overly simplistic, and not very informative to provide adequate statistical detail and may not be chosen for high-level synthesis. Nonetheless, some prefer to use it as a way of establishing occurrence or non-occurrence and for counting frequencies. Therefore, it may be useful in supporting specific observations made in the studies.

Similar to the different practices of vote-counting, varied interpretations of the counts have also been proposed.
In relation to vote-counting by categories, the interpretation is based on the number of studies in each category so that the category with the highest count of studies is placed topmost. The top category is considered as showing the true size of effect estimate and carrying a higher level of statistical significance as compared to the other categories with a lesser number of studies (Popay et al., 2006; Rodgers et al., 2009). However, this concept is questionable because of equal weighting of studies with dissimilar sample sizes and effect sizes. Contrariwise, the category with the least vote-counts is considered as carrying low statistical significance and is therefore placed at the bottom. Thus, interpretation of results from vote-counting should be considered only tentatively in the synthesis of data.
The quantitative element of content analysis requires that research findings, which should be carried out methodically, the purpose of arranging, categorizing, and summarizing the rules and coding system (Popay et al, 2006; Rodgers et al, 2009). The textual descriptive data is condensed for condensing the amount of content in a text into much clearer and meticulously explained in the researcher’s report (Noyes et al., 2011; Popay et al., 2006; Rodgers et al., 2009).

Some systematic reviewers question the degree of transparency in thematic analysis because it may not be entirely straightforward to determine how the themes and concepts were developed or at what stages of the study. The results of the synthesis involving thematic analysis may not be similar enough to synthesize based on a theory-guided approach. Therefore, to strengthen the transparency of thematic analysis, details of the entire analysis must be clearly and meticulously explained in the researcher’s report (Noyes et al, 2011; Popay et al., 2006; Rodgers et al., 2009).

Content analysis has been explained as a technique for condensing the amount of content in a text into much reduced content. The textual descriptive data is condensed and structured into fewer categories by applying specific rules and coding system (Popay et al., 2006; Rodgers et al., 2009). In this way, the technique of content analysis serves the purpose of arranging, categorizing, and summarizing the research findings, which should be carried out methodically. The quantitative element of content analysis requires that the data should be converted into frequencies. However, familiarity with the related theorization and concepts enables the researcher to apply qualitative principles in determining and describing the relevant categories of the key elements in the findings (Flemming, 2010b).

Table 3-4 lists the main tools and techniques that can be used for exploring relationships within and among studies.

Multiple Terminologies and Models of Synthesizing Qualitative Research Evidence

There is an assumption that the different approaches to synthesizing share the common principle of pooling findings from primary qualitative research studies (Finfgeld-Connett, 2010). However, while some approaches focus simply on the process of synthesizing the data, others adopt a wider scope. The latter approaches tend to encompass the essential elements and processes from problem identification to appraisal of the quality of research studies and writing a full report. Some consider the idea of synthesizing the findings from several qualitative research studies as questionable and not possible to achieve. They maintain that the varied methodologies with different theoretical basis that typify qualitative research could present potential flaws in the process of synthesizing.

Systematic reviewers and professional practitioners are encouraged to read Barnett-Page and Thomas’s (2009) critical review of the methods for the synthesis of qualitative research. Synthesizing and integrating the findings from mixed and varied qualitative methodologies can prove useful for making and supporting clinical decisions (Finfgeld-Connett, 2010).

Alternative Approaches to Qualitative Research Synthesis

The various descriptive terms applied to the different approaches are quite numerous and may prove to be confusing, and as many as 15 have been proposed. Some approve
the characteristics of qualitative methodology while others advocate converting qualitative results and findings to quantitative form such as content analysis. However, this practice is considered unnecessary. Some terms are used ambiguously or interchangeably, such as meta-synthesis and meta-study to describe any form of qualitative synthesis. In particular, the use of the term meta-synthesis is challenged because it is not specific to qualitative research and often used incorrectly. Experts argue that this depends on the level at which this term is applied, whether the synthesizing or the level of included studies (Dixon-Woods, Agarwal, Jones, Young, & Sutton, 2005). Despite all these considerations, the choice of practice or the process should be guided by the review question, the quantity of relevant studies, and the knowledge and competence within the team for conducting systematic reviews and synthesis of the research findings. A range of practices are explored in Table 3-5.

The challenge of qualitative research synthesis in systematic reviews is choosing an approach that will help to produce pertinent conclusions that are convincing. It is crucial that findings from the synthesis are presented in a way that would be easy for policy makers, decision-makers, and practitioners to make sense of and translate into the context of clinical practice.

<table>
<thead>
<tr>
<th>Alternative Approach</th>
<th>Examples/Notes</th>
</tr>
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<tbody>
<tr>
<td><strong>Meta-ethnography</strong></td>
<td>Comparing and synthesizing study results to establish if the same concepts occur in different studies</td>
</tr>
<tr>
<td>(reciprocal translation analysis)</td>
<td></td>
</tr>
<tr>
<td><strong>Grounded theory synthesis</strong></td>
<td>Develop concepts from the qualitative data by carrying out simultaneous coding and analyzing</td>
</tr>
<tr>
<td>(constant comparative method)</td>
<td>Four stages:</td>
</tr>
<tr>
<td></td>
<td>1. Comparing occurrences that relate to individual categories</td>
</tr>
<tr>
<td></td>
<td>2. Integrating the categories according to their properties</td>
</tr>
<tr>
<td></td>
<td>3. Delimiting the emerging theory</td>
</tr>
<tr>
<td></td>
<td>4. Reporting in detail</td>
</tr>
<tr>
<td><strong>Meta-study</strong></td>
<td>Three phases:</td>
</tr>
<tr>
<td></td>
<td>1. Meta-theory</td>
</tr>
<tr>
<td></td>
<td>2. Meta-method</td>
</tr>
<tr>
<td></td>
<td>3. Meta-data analysis</td>
</tr>
<tr>
<td><strong>Critical interpretive synthesis</strong></td>
<td>Draws on meta-ethnography and incorporates elements of grounded theory</td>
</tr>
<tr>
<td><strong>Thematic synthesis</strong></td>
<td>Three stages:</td>
</tr>
<tr>
<td></td>
<td>1. Developing codes of themes from the word-based findings</td>
</tr>
<tr>
<td></td>
<td>2. Organizing the codes into appropriate categories of descriptive themes</td>
</tr>
<tr>
<td></td>
<td>3. Producing analytical themes</td>
</tr>
<tr>
<td><strong>Textual narrative</strong></td>
<td>Suitable for organizing the studies into homogenous sets</td>
</tr>
<tr>
<td><strong>Meta-narrative</strong></td>
<td>Synthesize research findings addressing a variety of theories</td>
</tr>
<tr>
<td><strong>Meta-summary</strong></td>
<td>Involves converting qualitative findings into quantitative form and applying statistical techniques for analyzing data</td>
</tr>
<tr>
<td><strong>Meta-interpretation</strong></td>
<td>Ultimate goal is to establish meaning through methodical interpretation</td>
</tr>
<tr>
<td><strong>Qualitative cross-case analysis</strong></td>
<td>A typical feature of this approach it the use of tables or matrices to summarize the data across qualitative and quantitative research studies</td>
</tr>
<tr>
<td><strong>Realist synthesis</strong></td>
<td>Applications of this approach focus on complex social interventions to establish the reasons why these may be successful or unsuccessful in certain contexts</td>
</tr>
<tr>
<td><strong>Framework synthesis</strong></td>
<td>Organizes qualitative data using numerical codes for indexing and presents the data in graphs or diagrams</td>
</tr>
<tr>
<td><strong>Ecological triangulation</strong></td>
<td>Aims to establish associations between individuals, population groups, behaviors, age, gender, ethnicity, interventions, outcome, environments, and specific settings</td>
</tr>
</tbody>
</table>
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The following references provide additional sources for more detail on approaches to synthesizing qualitative research evidence:


Conclusion

Systematic reviews, meta-analysis, and synthesis of qualitative research evidence are crucial for the implementation of research findings to substantiate all aspects of evidence-based practice. Many healthcare practitioners share the view that systematic reviews are intended to advise, update, and substantiate policy decisions and professional practice. Recommendations to guide professional practice are based on extensive and thoroughly examined evidence from high-quality empirical studies and are therefore considered to be trustworthy for supporting decisions about care and service provision. However, many practitioners are challenged by a deluge of new research evidence, new information, and new additional professional knowledge.

This chapter set out to explore systematic reviews and the synthesizing of quantitative and qualitative research evidence. A range of related methods and processes have been examined including meta-analysis and content analysis applied to quantitative and mixed-method research as well as different approaches to qualitative research synthesis. It is important that the methods selected for exploring, explaining, planning, implementing, and evaluating systematic reviews are carefully selected to produce practical and realistic conclusions and recommendations.

Clearly, efficient implementation of evidence-based practice is crucial and it is important that practitioners adopt EBP with adequate understanding and familiarity with the related concepts, principles, and processes. This practice should be in place for examining all in-house reports from systematic reviews and meta-analysis as well as published complete reports that have relevance to the particular field and area of practice.

The need to pursue appropriate training has become inevitable in contemporary professional practice for acquiring adequate knowledge and insight about systematic reviews linked to evidence-based practice. Review teams and their colleagues in multidisciplinary settings should engage in formally organized and informal reflective activities prior to and following every in-house systematic review project. Therefore, the significance of appropriate preparation and efficient implementation must also receive careful consideration.

REFERENCES


**SUGGESTED FURTHER READING**

For additional detailed information, readers may wish to explore other useful sources related to the references listed here. The following may also prove to be useful texts for further reading and additional resources.

CHAPTER 3 Systematic Reviews: Consolidating Research Evidence for EBP


Robson, C. (2011). Real world research (4th ed.). Chichester, United Kingdom: John Wiley and Sons Ltd.


