Conceptual recommendations for selecting the most appropriate knowledge synthesis method to answer research questions related to complex evidence

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Conceptual recommendations for selecting the most appropriate knowledge synthesis method to answer research questions related to complex evidence

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Running Title: Conceptual recommendations for selecting knowledge synthesis methods
1. Introduction

We aimed to make sense of conflicting information about emerging knowledge synthesis methods (e.g., meta-narrative review, realist review) by conducting a scoping review [1] across multidisciplinary fields (including health, education, and psychology). Our goal was to compare and contrast different knowledge synthesis methods and map their specific steps to gain a better understanding of how to select the most appropriate knowledge synthesis method to answer research questions related to complex evidence. Our protocol has been published elsewhere [2], and we described the methods and main results in an earlier paper in the current series [3]. In this, the fifth paper in the series, we summarise our findings and offer conceptual recommendations.

2. Summary of scoping review

In a commentary for this series [4], we described the impetus for our work, namely, the recent evolution of knowledge synthesis methods. The growing complexity of health care issues has increased the need for investigation of complex questions, which in turn has highlighted the need to move beyond simply understanding “what works” (through traditional systematic reviews of effectiveness) to consider “why, for whom, and under what contexts” it works (through other knowledge synthesis methods, such as realist review).

We suggest that knowledge syntheses exist on a continuum, whereby a traditional systematic review of an intervention can be used to identify what innovation works, with other emerging knowledge synthesis methods being used to integrate qualitative and quantitative evidence to elucidate a more in-depth understanding of the contextual and theoretical underpinnings of the innovation. Decision-makers are increasingly seeking to better understand how various
interventions work in different settings. Such understanding can be achieved in different ways, so it is crucial to match the most appropriate knowledge synthesis method to each question posed. For example, investigators might conduct a realist review after, concurrently with, or independent of an effectiveness review, or they might decide that a meta-narrative approach is more appropriate. The choice of method depends largely on the purpose of the knowledge synthesis and the needs of its end-users (e.g., generating knowledge to identify gaps in the literature or to directly inform decision-making). Mays et al. [5] suggested that other factors, such as the “nature and balance of available evidence and the stage that policy development has reached,” may also influence the choice. For example, a policy question in the early stages of development may best be answered by a knowledge synthesis designed to develop theory, while a more well developed policy question may require a combination of cost-effectiveness modelling and meta-ethnography [5]. However, with little guidance available, selection of the knowledge synthesis method most appropriate to answer a particular question remains challenging.

In the second paper of the series [3], we presented the main findings of our scoping review. Of the 25 unique knowledge synthesis methods identified, 12 provided guidance on the full or complete conduct of the review (i.e., operationalised the steps to conduct the review), whereas 13 provided guidance on analysis techniques only. The knowledge synthesis methods with the highest frequency of reported use were meta-synthesis (25% of identified articles), meta-ethnography (19%), meta-study (11%), integrative review (10%), and realist review (8%); the knowledge synthesis method most dispersed across the disciplines included in our literature search was meta-ethnography. We found that “exploration of a phenomenon” was the most common objective among the complete knowledge synthesis methods, except for meta-narrative
review, meta-summary, and narrative synthesis. These three methods, along with mixed studies review, focused on the study or analysis of methodological aspects. The exploration of perceptions (i.e., how people perceive and experience a phenomenon, disease, or health state) was most commonly investigated using meta-ethnography, meta-summary, meta-synthesis, and mixed studies review. Two distinct purposes of full knowledge synthesis methods emerged from our scoping review: they are used either to integrate qualitative and quantitative data (meta-narrative review, meta-summary, and mixed studies review) or to establish or refine a theory, perspective, or phenomenon (concept synthesis, meta-ethnography, meta-interpretation, meta-study, and meta-synthesis); critical interpretive synthesis, integrative review, narrative synthesis, and realist review were used for both. These distinctions were further explored in subsequent papers.

In our third paper [6], we compared and contrasted the seven knowledge synthesis methods that can be used to integrate qualitative and quantitative evidence, and in the fourth paper [7], we compared the nine knowledge synthesis methods that can be used to generate or refine theory. We identified the strengths and weaknesses of the methods, similarities and differences among them, and the knowledge and skills required for their conduct, to help in identifying selection criteria for choosing a method. We noted that most of the differences among methods were related to how data are synthesised rather than how steps are operationalised. However, we found many gaps in the literature that make it difficult to definitively match specific knowledge synthesis methods with particular research questions. We also observed that emerging knowledge synthesis methods are not as well developed as traditional systematic reviews. For example, we found no studies that completely explained how to reproducibly integrate qualitative and quantitative evidence.
Following the presentation here of recommendations arising from these analyses, we will describe, in the final paper of the series, the volume and attributes of the original research that emerged from our scoping review. This bibliometric analysis was based on 608 records, among which we observed a steady increase since 2003 in the number of studies using knowledge synthesis methods, with the largest number published in 2011 ($n = 105$). This literature is widely dispersed (across 330 journals) and represents many disciplines and authors. This diversity may explain, in part, the inconsistencies in terminology and in guidance on how to conduct such studies. Inconsistency of indexing by Medical Subject Headings (MeSH terms) makes it difficult for researchers and knowledge users to locate relevant articles. Overall, these inconsistencies and the increasing number of publications using various knowledge synthesis methods suggest not only growing interest but also the realisation that traditional systematic reviews may be insufficient to answer complex or context-dependent questions.

3. Implications and recommendations

Our work has several implications. We have advanced the knowledge of different knowledge synthesis methods, which has to date been scattered in the literature. Moreover, we have identified the need to enhance the description of these methods. In her 1959 account, Isabella Leitch recognised the value of knowledge synthesis: “the technique of the research review, by virtue of the assembly and use of scattered records, appears to be unequalled as an instrument for retrieval of buried work. It gives a new value to the small experiment … and in the analysis may reveal truths which might not be reached in a lifetime of direct investigation” [8, 9]. She also identified different types of knowledge synthesis methods: the “statistical review,” the “review of concepts,” the “service or interpretive review,” and the “creative review,” which “has the
highest manifestation of such endeavour because it deliberately sets out to effect a synthesis between phenomena previously unrelated” [8, 9].

Over the past decade, several investigators have endeavoured to organise different knowledge synthesis methods, including Barnett-Page and Thomas [10], who explored which method might be used to synthesise qualitative research; Ring et al. [11], who presented methods for synthesising qualitative research in health technology assessment; Dixon-Woods et al. [12], who critiqued strategies for synthesising qualitative and quantitative evidence; and Mays et al. [5], who described approaches to synthesising qualitative and quantitative evidence to inform management and policy-making decisions in health care. Gough et al. [13, 14] indicated the need for clarity in understanding the differences between review designs and their methods, and suggested looking across three dimensions: aims, structure and components, and the extent of engagement with the research issue. More recently, investigators from the Joanna Briggs Institute have proposed a mixed methods approach to systematic reviews (i.e., “the class of research in which the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study”) [15] and have offered methodological guidance for conducting meta-aggregation of qualitative evidence [16]. However, none of these investigators searched the literature across multidisciplinary fields to identify any knowledge synthesis method for any type of evidence, with the aim of identifying similarities and differences among methods, nor did they map the specific steps in conducting these methods, and most did not attempt to analyse their objectives to develop guidance on selecting the best knowledge synthesis method to answer research questions related to complex evidence. Mays et al. [5] provided some general guidance on selecting a “suitable” knowledge synthesis method based on the aim and the strengths and weaknesses of various review.
approaches, but these authors focused on identifying methods to synthesise diverse evidence
rather than searching for “complete” knowledge synthesis methods. As such, their recommendations were based on a subset of the complete knowledge synthesis methods that we captured in our scoping review (i.e., meta-ethnography, narrative synthesis).

To clarify the implications of our findings, in terms of guiding selection of the optimal methods for particular questions, we organised the 12 complete knowledge synthesis methods according to their purpose, outputs, and applicability for practice and policy, as well as general guidance on formulating the research question (Appendix A). Three of the methods appeared to have a unique purpose that did not overlap with that of other methods, and these may offer the most clarity for reviewers in the selection process. The first of these, concept synthesis, can be used to identify concepts, viewpoints, or ideas informed by qualitative evidence aimed at developing a synthesis model or to identify attributes of a phenomenon. As such, this method can be applied in areas where there has been little or no concept development to date or where observations of the phenomenon are available but not yet classified or named (for example, What are the attributes of family-centred care and partnership in care?) [17]. The second method with a unique purpose is realist review, which considers qualitative and quantitative evidence and can be used to investigate complex questions to inform what works for whom, under what circumstances, and why. It can provide explanations or hypotheses across interventions or programs that share similar underlying “theories of change” as to why they work (or do not work) for particular end-users in particular contexts [18]. These explanations, in the form of context–mechanism–outcome configurations, can directly inform policy or clinical decisions (for example, in the enabling of evidence-informed health care, what change agency interventions and strategies are effective, for whom, in what circumstances, and why?) [8, 19]. Meta-narrative
review, the third method with a unique purpose, is used primarily for investigating a disciplinary paradigm or the “story” of a discipline as it evolves. It focuses on explaining contradictions in the literature and treats such data as “higher-order constructs” [10, 20]. The purpose of critical interpretive synthesis (to synthesise findings of multiple disciplines and diverse evidence) may be considered similar to that of meta-narrative review, but this method does not have explicit methods for explaining contradictions in findings.

The remainder of the knowledge synthesis methods overlap in purpose. For example, 6 of the 12 methods can be used to investigate patients’ experience (in addition to other purposes): meta-ethnography, meta-interpretation, meta-study, meta-summary, meta-synthesis and mixed studies review. However, meta-study is unique in considering the experiences of patients with chronic illness, and it employs a highly systematic process that is not apparent in the other methods. The output of a meta-study is similar (i.e., a new interpretation or theoretical claim), but this new interpretation is derived from bringing together ideas from the deconstruction of its three major analysis components (meta-data, meta-method, and meta-theory). More specifically, “meta-method” involves interrogating the influences of study quality on the interpretation of findings, and “meta-theory” involves investigating how theoretical frameworks underpinning individual studies influence their interpretation, so that these components may contribute to a more credible and trustworthy interpretation of findings overall. There is also some similarity in purpose between meta-ethnography and critical interpretive synthesis; the latter uses synthetic constructs to create a “synthesising argument” to derive a line of argument (i.e., a new interpretation that both links and explains a set of parts), similar to the third-order interpretation of meta-ethnography (i.e., a new interpretation of the researcher based on the original authors’ interpretations). We also observed a similarity between narrative synthesis and realist review in
terms of identifying central theories or causal mechanisms, and a similarity between meta-
narrative review and narrative synthesis and, both of which attempt to build a narrative
explanation from the body of identified research.

There are other ways of conceptualising the differences among various knowledge synthesis
methods. Barnett-Page and Thomas [10] suggested that contrasting methods according to
specific epistemological positions might help to explain their differences. Critical interpretive
synthesis, meta-narrative review, and meta-study have a “subjective idealist” approach to
knowledge (i.e., there is no shared reality independent of multiple alternative human
constructions) [10]. For example, in meta-study, there is an assumption that no single objective
reality will be found, so the creation of “grand theories” is not a goal, while meta-ethnography
has an “objective idealism” approach (i.e., there is a world of collectively shared
understandings), which emphasises commonalities rather than discrepancies between accounts
[10]. Investigation of context is another important consideration for knowledge syntheses,
particularly in knowledge translation and health services research. Critical interpretive synthesis,
meta-narrative review, meta-study review, and realist review can be used to examine all aspects
of the context in which knowledge is produced [10]. For example, realist review can identify the
specific circumstances under which an intervention operates through context–mechanism–
outcome configurations [18], and meta-study uses one of its elements, “meta-theory,” to
determine the theories that shape a body of research, which can then be “used to examine the
historical evolution of each theory and to put it in its socio-political context” [10]. Knowledge
synthesis methods can also be distinguished as using either aggregative or configurative logic (or
both) [13]. Aggregative reviews collect empirical data to describe and test predefined concepts,
while configurative reviews attempt to interpret and understand the world [13]. For example,
aggregative reviews (including systematic reviews) can investigate the effect of a health or social intervention, the accuracy of a diagnostic tool, or the cost–benefit ratio of an intervention, while configurative reviews can generate theory (e.g., critical interpretive synthesis and meta-ethnography) or can be used to understand the development of a research tradition (e.g., meta-narrative review). Realist review is described as an approach that uses both aggregative and configurative logic [13].

As a first step toward making sense of the overlap across the 12 knowledge synthesis methods, we used the purpose, output, and applicability data from Appendix A to derive a conceptual algorithm to elucidate the process for selecting the optimal knowledge synthesis methods for particular research questions (Figure). Appendix A data revealed five major categories of purpose: to generate or refine a theory or hypothesis; to explore experiences, perceptions, preferences, beliefs, and values; to identify gaps in the literature or the need for future research; to explore methodological aspects of a method or topic; and to develop or describe frameworks, guidelines, models, measures, scales, or programs. For each of these, we suggest that different knowledge synthesis methods could be considered, including their outputs and applicability of findings to practice and policy. We did not consider the integration of quantitative and qualitative evidence as a purpose category as these types of evidence need not necessarily be integrated to define a particular purpose; they can inform a particular purpose regardless of whether the evidence is quantitative, qualitative, or both. Additionally, we acknowledge “effectiveness” as an important purpose category. However, we deliberately omitted this from our conceptual algorithm, as there is clear understanding that systematic review is the most appropriate knowledge synthesis method to address questions of effectiveness. Our intention was to identify purpose categories for knowledge synthesis methods
that are less well understood. In an attempt to further distill the nuances of overlapping methods, we provide a table of the 12 knowledge synthesis methods with multiple examples to illustrate the concepts of purpose, output, and applicability (Appendix B).

4. Knowledge translation and next steps

We synthesised diverse, often conflicting evidence from multidisciplinary fields to identify 12 unique knowledge synthesis methods and 13 analysis methods. These findings represent a preliminary understanding on which we will base further advancement of knowledge in this field. Currently, we cannot provide guidance beyond our conceptual recommendations, which highlight gaps in the literature, particularly in terms of elucidating the purpose and conduct of emerging knowledge synthesis methods. Indeed, less than 5% of studies included in our scoping review represented influential papers outlining steps of a particular knowledge synthesis method, and for only two methods (integrative review and realist review) were all steps fully operationalised; furthermore, none of the included studies completely explained how to reproducibly integrate qualitative and quantitative evidence. There was significant overlap in terminology to describe both knowledge synthesis and analysis methods, which could further hinder their application. Notably, 81% of the included studies were published after the year 2005, which highlights that emerging knowledge synthesis methods are not as well developed or as well represented in the literature as traditional systematic reviews.

We recognise the conceptual nature of our recommendations and the need for further scrutiny, refinement, and validation if these recommendations are to be useful to reviewers in selecting the most appropriate knowledge synthesis method for a particular question. As one of our next steps, we will convene a meeting of international leaders in the field with the aim of
clarifying emerging knowledge synthesis approaches. During the meeting, we will present our findings and a preliminary conceptual algorithm (Figure) and will work with participants to identify and clarify the nuances of each method that might help in further distinguishing, consolidating, or reclassifying their respective purposes, outputs, and applicability. For example, to help elicit these nuances, subgroups of participants could apply different knowledge synthesis methods in attempting to answer the same research question. We would then compare the results from the various synthesis approaches and determine whether the answers differ according to the method used. The goal of this exercise would be to identify methods that are truly unique, to help inform a final algorithm with the potential to optimise reviewers’ selection of knowledge synthesis methods suitable for their research questions. We encourage readers to contact the corresponding author (Dr. Sharon Straus) if they are interested in participating in this stakeholder meeting and to provide feedback on our conceptual algorithm, which is considered a preliminary step forward in the knowledge synthesis field.

**FIGURE LEGEND**

Figure: Conceptual algorithm to optimise selection of a knowledge synthesis method for answering a research question
Competing interests

The authors have no competing interests to declare.

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Authors’ contributions

MK conceived the study, obtained funding for the study, screened citations and full-text articles, abstracted analysed, and interpreted the data, and wrote this manuscript. JA and CS coordinated the study, screened citations and full-text articles, abstracted data, developed the qualitative analysis, coded and analysed data, and edited the manuscript. SES conceived the study, obtained funding for the study, analysed and interpreted the data, and edited the manuscript. ACT conceived the study, obtained funding for the study, screened citations and full text articles, abstracted data, analysed and interpreted the data, and edited the manuscript.
References


Conceptual algorithm to optimize selection of a knowledge synthesis (KS) method for answering a research question of complex evidence

<table>
<thead>
<tr>
<th>KS Method</th>
<th>Outputs</th>
<th>Applicability</th>
</tr>
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| Critical interpretive synthesis (Qual + Quant) | • Synthesizing argument or theoretical proposal  
• Comprehensive critical narrative grounded in the data | • Findings can inform new typologies, concepts, models or theory but it may require a further process of interpretation by policy makers and practitioners to inform practice |
| Integrative review (Qual + Quant)            | • Rich, contextual data  
• Results capture the depth and breadth of the topic and contribute to a new understanding of the phenomenon under investigation | • Findings have direct applicability to practice and policy |
| Narrative synthesis (Qual + Quant)            | • A mosaic or map derived from descriptive data and exemplars from studies  
• Draws out central theories or causal mechanisms and builds an explanation by telling the story of the field or inquiry | • Can produce outputs that more easily translate messages and more applicable to policy makers and designers of interventions |
| Realist review (Qual + Quant) | • Hypotheses and explanations about what works for whom depending on the context and why (C-W-0 configurations)  
• Theory-driven evaluations/assessments | • Relevant for evaluating or assessing public health interventions and programs |
| Meta-ethnography (Qual)                  | • New theory or line of argument  
• Rich contextual data | • Findings can be complex and conceptual, requiring a further process of interpretation by policy makers and practitioners to inform practice |
| Meta-interpretation (Qual)                   | • New insights that are not observed in original studies  
• Broader understanding of the processes and dynamics of human behavior and experience in a particular research area  
• The synthesis will contain “a truth” rather than “the truth”, and thus will result in a “truth of truths” | • Can inform public health decisions |
| Meta-summary (Qual + Quant)                  | • Quantitatively oriented summary of qualitative findings – synthesized statements that are practical and usable  
• Findings can be used to develop a map of qualitative studies, which can serve as a basis for a further synthesis | • Can help clinicians to evaluate the utility of synthesis results for practice |
| Meta-study (Qual)                           | • A new interpretation  
• Derives questions from each of its components and inductively generates a number of theoretical claims related to it  
• Reveals similarities and discrepancies among accounts of a phenomenon  
• Derives a middle range theory | • The middle range theory has direct applications for particular defined areas of practice  
• Can be complex and conceptual, requiring a further process of interpretation by policy makers and practitioners to inform practice |
| Meta-synthesis (Qual)                             | • An explanatory theory or model to explain findings of similar qualitative studies  
• Interpretive themes and key metaphors  
• Rich contextual data | • Can be used to inform policy or clinical decisions  
• Potential to enrich understanding of complex, multi-faceted health experiences and environments |
| Mixed studies review (Qual + Quant)            | • Rich, highly practical understanding of complex public health interventions and programs  
• Recommends that the conclusions reflect the experiences of the target groups for intervention | • Relevant for public health  
• It can provide a rich and highly practical understanding of complex public health interventions and programs and highly context-sensitive interventions |
### Purpose

**To identify gaps in the literature or the need for future research**
- **Integrative review (Qual + Quant)**
  - Rich, contextual data
  - Results capture the depth and breadth of the topic and contribute to a new understanding of the phenomenon under investigation

**To explore the methodological aspects of a topic or knowledge synthesis method**
- **Meta-ethnography (Qual)**
  - New theory or line of argument
  - Rich contextual data
- **Meta-study (Qual)**
  - A new interpretation
  - Derives questions from each of its components and inductively generates a number of theoretical claims related to it
  - Reveals similarities and discrepancies among accounts of a phenomenon
  - Derives a middle range theory (testable theory)
- **Meta-synthesis (Qual)**
  - An explanatory theory or model to explain findings of similar qualitative studies
  - Interpretive themes and key metaphors
  - Rich contextual data
- **Realist review (Qual + Quant)**
  - Hypotheses and explanations about what works for whom depending on the context and why (C'MO configurations)
  - Theory-driven evaluations/assessments
- **Meta-narrative review (Qual + Quant)**
  - Unfolding storylines resulting in maps of 'meta-narratives' which can reveal dimensions or themes
  - Storyline of the evolution of concepts over time
  - Theories to explain conflicting findings
- **Meta-summary (Qual + Quant)**
  - Quantitatively oriented summary of qualitative findings - synthesized statements that are practical and usable
  - Findings can be used to develop a map of qualitative studies, which can serve as a basis for a further synthesis
- **Mixed studies review (Qual + Quant)**
  - Rich, highly practical understanding of complex public health interventions and programs
  - Recommends that the conclusions reflect the experiences of the target groups for intervention
- **Narrative synthesis (Qual + Quant)**
  - A mosaic or map derived from descriptive data and exemplars from included studies
  - Draws out central theories or causal mechanisms and builds an explanation by telling the story of the field or inquiry
  - Hypotheses and explanations about what works for whom depending on the context and why (C'MO configurations)
  - Theory-driven evaluations/assessments
- **Concept synthesis (Qual)**
  - A synthesis model developed from concepts that represent ordered information about attributes of one or more things that enables differentiation among them

**To develop or describe frameworks, guidelines, models, measures/scales or programs**
- **Meta-synthesis (Qual)**
  - Use of complex and conceptual, requiring a further process of interpretation by policy makers and practitioners to inform practice
- **Realist review (Qual + Quant)**
  - Potential to enrich understanding of complex, multi-faceted health experiences and environments
  - Relevant for evaluating or assessing public health interventions and programs
- **Narrative synthesis (Qual + Quant)**
  - Can inform complex policy-making questions, but it may require a further process of interpretation by policy makers and practitioners to inform practice
  - Can help clinicians to evaluate the utility of synthesis results for practice
  - Can help researchers recognize the theoretical and methodological trends that have shaped the study
  - Useful for the posteriori analyses of reports
  - Relevant for public health
  - It can provide a rich and highly practical understanding of complex public health interventions and programs and highly context-sensitive interventions
  - Can produce outputs that more easily translate messages and more applicable to policy makers and designers of interventions
- **Purpose**
  - Can be used to inform policy or clinical decisions
  - Relevant for public health
  - It can provide a rich and highly practical understanding of complex, multi-faceted health experiences and environments
  - Can produce outputs that more easily translate messages and more applicable to policy makers and designers of interventions

**Applicability**
- Findings have direct applicability to practice and policy
- Findings can be complex and conceptual, requiring a further process of interpretation by policy makers and practitioners to inform practice
- The middle range theory has direct applications for particular defined areas of practice
- Can be used to inform policy or clinical decisions
- Relevant for evaluating or assessing public health interventions and programs
- Can help clinicians to evaluate the utility of synthesis results for practice
- Can help researchers recognize the theoretical and methodological trends that have shaped the study
- Useful for the posteriori analyses of reports
- Relevant for public health
- It can provide a rich and highly practical understanding of complex public health interventions and programs and highly context-sensitive interventions
- Can produce outputs that more easily translate messages and more applicable to policy makers and designers of interventions
- Useful in areas where there is little or no concept development, where there is concept development but no real impact on theory of practice
- Useful in areas where observations of phenomena are available but not yet classified