REFLECTIONS

Scoping reviews in health professions education: challenges, considerations and lessons learned about epistemology and methodology

Aliki Thomas[1,2,3] · Stuart Lubarsky[3,4] · Lara Varpio[5] · Steven J. Durning[5] · Meredith E. Young[3,6]

Abstract

Scoping reviews are increasingly used in health professions education to synthesize research and scholarship, and to report on the depth and breadth of the literature on a given topic. In this Perspective, we argue that the philosophical stance scholars adopt during the execution of a scoping review, including the meaning they attribute to fundamental concepts such as *knowledge* and *evidence,* influences how they gather, analyze, and interpret information obtained from a heterogeneous body of literature. We highlight the principles informing scoping reviews and outline how *epistemology*—the aspect of philosophy that "deals with questions involving the nature of knowledge, the justification of beliefs, and rationality"—should guide methodological considerations, toward the aim of ensuring the production of a high-quality review with defensible and appropriate conclusions. To contextualize our claims, we illustrate some of the methodological challenges we have personally encountered while executing a scoping review on clinical reasoning and reflect on how these challenges could have been reconciled through a broader understanding of the methodology's philosophical foundation. We conclude with a description of lessons we have learned that might usefully inform other scholars who are considering undertaking a scoping review in their own domains of inquiry.

✉ Aliki Thomas
  aliki.thomas@mcgill.ca

1   School of Physical and Occupational Therapy, McGill University, 3654 Sir William Osler, Room 45, Montreal, QC H3G 1Y5, Canada

2   Centre for Interdisciplinary Research in Rehabilitation of Greater Montreal, Montreal, QC, Canada

3   Institute of Health Sciences Education, McGill University, Montreal, QC, Canada

4   Department of Neurology, Faculty of Medicine, Montreal, QC, Canada

5   Department of Medicine, Uniformed Services University of the Health Sciences, Bethesda, MD, USA

6   Department of Medicine, McGill University, Montreal, QC, Canada

Introduction

Because research in health professions education (HPE) has steadily advanced over the last 20 years (Doja et al. 2014), HPE scholars are increasingly exploring ways to review and synthesize this growing body of evidence. Given the range of review methodologies available, HPE scholars must make judicious and defensible decisions about which review type is most appropriate to address their research question. Each kind of knowledge synthesis has a unique purpose and is able to answer different kinds of research questions (Maggio et al. 2019). For instance, the primary purpose of a scoping review is to explore and describe the breadth of knowledge related to a specific topic in a given field or literature. Scoping reviews are a means to map the literature (research and broader knowledge base) in a particular area (Arksey and O'Malley 2005; Peters et al. 2017; Tricco et al. 2016a, b) and to identify key concepts, gaps in the literature and types and sources of evidence. In contrast, the primary purpose of a systematic review is to identify, evaluate, and integrate the body of pre-existing literature related to a specific topic in order to answer a specific research question. Comprehensive summaries contrasting the different approaches to reviews are available (Steinert and Thomas 2016; Maggio et al. 2019; Cook 2016; McGaghie 2015) and clearly describe the nature and purpose of different review types. Moreover, a helpful body of literature provides methodological guidance on how to execute a review (for example, see Arksey and O'Malley 2005; Levac et al. 2010; Thomas et al. 2017, for scoping reviews; Wong et al. 2012; for realist reviews; Cooper 2010; Cooper and Koenka 2012; Lang 2004, for systematic reviews). These summaries outline the diversity of review types at a researcher's disposal, but successful completion of a synthesis of any kind remains challenging.

While the various approaches to syntheses may feel daunting, or could perhaps be perceived as slightly altered versions of each other, important and foundational differences exist. Consider the two synthesis types listed above: systematic reviews and scoping reviews. These two review types differ in terms of purpose, methods, and indicators of quality. These differences emerge from different philosophical orientations; therefore, standards of quality for one review type cannot, and should not, be applied to another. For scholars to successfully engage in rigorous knowledge synthesis, they must understand the foundational principles, or epistemology, that uphold the purpose and inform the methodology of the review type being executed.

Several notable twentieth-century scholars, including Karl Popper (1959), Paul Meehl (1967), and Donald Campbell (1987) have argued that epistemology is at the heart of research methodology. Epistemology is the aspect of philosophy that "deals with questions involving the nature of knowledge, the justification of beliefs, and rationality" (Godfrey-Smith 2003, p. 235).

Every researcher constructs a research question or study based on a particular epistemology; it is the foundation upon which the researcher decides what kind of knowledge is possible, adequate, and legitimate (Crotty 1998). Every study has embedded within it, answers to specific epistemological questions (Crotty 1998) including: What kinds of data are legitimate and meaningful? What kinds of data are trustworthy? Do we deem objective, quantifiable measures to be more legitimate than subjective, qualitative constructions? Is there an external, objective truth that we can identify? Not every researcher espouses the

same epistemology, nor is every study constructed from the same epistemological base. Similarly, not all types of syntheses rest on the same epistemological underpinnings.

It is widely accepted—though rarely articulated—that in order to adopt, engage with, or innovate within a given methodology, it is important to understand and appreciate its epistemological foundations. Several seminal methodological papers on knowledge syntheses exist (Arksey and O'Malley 2005; Cook and West 2012; Grant and Booth 2009; Kastner et al. 2016; Tricco et al. 2011; Tricco et al. 2016b), including papers that focus specifically on such syntheses in HPE (Maggio et al. 2019; McGaghie 2015; Thomas et al. 2017). Furthermore, the field of health professions education has recently been grappling with the nature of integrative versus interpretive knowledge syntheses (Bearman and Dawson 2013) and the axiological perspectives of the studies that the review teams include in their synthesis (Kelly-Blake et al. 2018). Just like epistemological and methodological considerations require reflection and careful deliberation in any synthesis, so do axiological ones. Axiology is the study of values (Pole 1961). Axiological integrity is defined as "the ability to retain values in transferring, translating, or synthesizing axiological evidence" (Kelly-Blake et al. 2018; p. 835; Varpio and MacLeod in press). These ongoing debates draw attention to the epistemologies that can inform research and how those orientations shape the investigations we engage in. However, few of the manuscripts addressing these debates explicitly explain or illustrate how an investigator's worldview about the fundamental nature of knowledge and reality can influence their decisions to adopt or adapt particular methods for reviewing and synthesizing bodies of literature.

This manuscript explores the vital relationship between epistemology and methodology in the context of scoping reviews, one type of knowledge synthesis. We describe how the philosophical underpinnings of scoping reviews shape how researchers gather, analyze, and interpret knowledge obtained from a heterogeneous corpus of literature. Our objectives are twofold: (1) to describe the foundational principles informing scoping reviews, and (2) to describe how these principles guide methodological considerations. Drawing from our own experiences, we illustrate some of the methodological challenges we have encountered while executing a scoping review on clinical reasoning and reflect on how these challenges might have been reconciled through a broader understanding of the methodology's philosophical foundation, and through a greater appreciation of our own personal reflexivity. Our intention is neither to propose a new approach to conducting scoping reviews, nor to represent our own work as the exemplar against which other scoping reviews should be measured (Jeong et al. 2018; Kelly-Blake et al. 2018; Lawrence et al. 2018; Ossenberg et al. 2018; Webster et al. 2015). Rather, our aim is to share some of the lessons we've learned for avoiding pitfalls in scoping reviews—particularly those relating to the epistemological foundations of scoping reviews.

Philosophical underpinnings of scoping reviews

Scoping reviews originated in the social sciences in response to a need to draw from, and synthesize, a broad body of knowledge derived from various methodological and epistemological traditions addressing complex phenomena. The heterogeneity of data and epistemologies present in the literature to be synthesized means that the research findings presented therein are not easily amenable to objectivist-rooted epistemologies. Scoping reviews are primarily aligned with the epistemology that Crotty (1998) labels as "subjectivism", and that Lincoln and Guba (1985) label as "transactional/subjectivist" (henceforth

called subjectivism). This epistemology rejects the idea that there is a single objective truth to discover and measure. Instead, subjectivism asserts that individuals construct their own understanding of reality based on interactions with others and with the surroundings (Lincoln and Guba 1985). From this orientation, data and research findings are developed via the interactions between the researcher, the context, and the phenomenon being studied (Crotty 1998). Given this, researchers cannot stand apart from the phenomenon being studied. Such objectivity simply doesn't exist. Instead, we—as researchers—"are shaped by our lived experiences, and these will always come out in the knowledge we generate" (Lincoln and Guba 1985, p. 213) and in the data we collect throughout the research process—whether drawn from participants or relevant texts.

When rooted in the subjectivist epistemological foundation, scoping reviews set out to map the available knowledge on a given topic (Arksey and O'Malley 2005; O'Brien et al. 2016; Tricco et al. 2016a). Scoping reviews are often exploratory and involve searching, collecting, and charting data but do not strive to produce a single answer that is objectively true (Arksey and O'Malley 2005). Instead, they bring together the myriad of information on the topic that is available, allowing researchers to offer a subjective interpretation of what is known about that topic. Scoping reviews do not favour a narrow scope of inclusion for the literature to be synthesized; instead, they include a wide range of literature including, for example, peer-reviewed journal articles, opinion pieces and commentaries, and the grey literature (Hagg et al. 2018; Williams et al. 2017). As Arksey and O'Malley (2005) indicate "The process is not linear but interactive, requiring researchers to engage with each [scoping review] stage in a reflexive way and, where necessary, repeat steps to ensure that the literature is covered in a comprehensive way." In reviewing and synthesizing such expansive literature, the researcher actively builds an interpretation that is shaped by personal experiences, expertise, and knowledge (Arksey and O'Malley 2005).

It should be noted that scoping reviews are usually conducted from a subjectivist epistemology, but not exclusively so. It is possible to engage in scoping reviews from an objectivist epistemology—particularly from the relative objectivist epistemology espoused by post-positivist researchers. This orientation acknowledges that knowledge is conjectural, based on hypotheses that have yet to be falsified (Bergman et al. 2012). Given that this epistemological position recognizes the impossibility of ever truly developing objective knowledge about reality, a researcher working from this orientation can also harness the power of scoping reviews to synthesize a body of knowledge. However, in so doing, the scoping review resulting from that work will be modified to align with an objectivist epistemology.

To summarize, the epistemological orientation embraced by the researcher will shape the way the scoping review is conducted. In this manuscript, we address scoping reviews that have their epistemological roots in subjectivism (The Joanna Briggs Institute 2015).

Authors' positionality

The philosophical approach that a researcher adopts must align with the selected synthesis methodology; different methodologies conceive of legitimate *knowledge* and *evidence* in distinct ways. If the philosophical underpinnings of the chosen knowledge synthesis are misunderstood or inappropriately operationalized because a researcher's philosophical approach is misaligned with the intended epistemology of the synthesis method,

researchers risk engaging in low-quality syntheses and drawing erroneous or inappropriate conclusions.

We, ourselves, are scholars in HPE who have engaged with several different types of syntheses (scoping: Thomas et al. 2014; Pelaccia et al. 2019; Varpio et al. 2018; Young et al. 2018, 2019); umbrella: Maggio et al. 2019). Our team is comprised of scholars from different disciplinary backgrounds (Education, English, Cognition), professions (occupational therapists, medical doctors, researchers) and data types (qualitative, quantitative, mixed methods); this inevitably necessitates that we engage in reflexivity when working collaboratively on a synthesis. Throughout the execution of various syntheses including the ones on clinical reasoning (Young et al. 2018, 2019, under review) which we discuss later in this paper, we have paused on several occasions to engage in discussion on how our different disciplinary backgrounds and epistemological views and by extension, methodological traditions, were shaping the decisions we were making in the context of executing a large review project (for a detailed discussion see Young et al. 2018).

In the synthesis work described in this manuscript, we adopted a subjectivist epistemology. That said, in any individual project, we move across epistemologies to align the research methodologies to fit the kinds of research questions being addressed. In other words, we don't ascribe to or favour one particular ontological or epistemological viewpoint over all others. Instead, we wrestle with our epistemological leanings in every study when we are confronted with, and have to address, issues such as: what knowledge can legitimately be extracted from the literature, how are we justified in our claims that the knowledge has some inherent value, how do the methods we use align with the purpose of the synthesis, and how the knowledge is synthesised in a manner that is defensible and leads to reasonable conclusions on a complex topic.

How epistemology shapes methodological considerations of scoping reviews

To illustrate how these philosophical moorings shape scoping review methodology, we offer our experiences studying clinical reasoning (Young et al. 2018, 2019 in review). In that research, we consciously embraced subjectivism through each step of the review process but needed to overcome the challenges of staying grounded in the underpinnings of this methodology. Through our synthesis experience, we have curated a list of perspectives to embrace while engaging in a scoping review, in addition to potential pitfalls to avoid, which are summarized in Table 1. In the following discussion, we deconstruct each of the six formal steps of the scoping review process (Arksey and O'Malley 2005) and explain how the execution of each step embodies subjectivism.

Step 1 Identifying the research question

Given the subjectivist foundations of scoping reviews, questions amenable to this kind of knowledge synthesis are those where researchers map, explore, and document the range of knowledge available regarding a phenomenon. Scoping review questions are broad, open, exploratory, and answerable through a narrative description and inductive analysis—reflecting the epistemological foundations of constructivism. Questions that ask *what* [e.g. What outcomes have been found in relation to the use of different tools and approaches to

promote reflection in nursing education (e.g. dialogues, diaries, case studies [e.g. Schumann Scheel et al. 2017))], or *how* [e.g. How have online lectures been integrated into medical school curricula? (e.g. Tang et al. (2018)] are well suited to scoping reviews, more so than those that ask narrower questions about *why* something works, or *when* and/or *where* a phenomenon occurs, as in the case of realist reviews (e.g. Wong et al. 2012).

Our scoping review focusing on the clinical reasoning literature set out to address the following question: "How is clinical reasoning (and associated terms) defined and conceptualized in the HPE literature?" We chose a scoping methodology because of the exploratory nature of the project, and of the breadth and depth of the literature we expected to uncover. We embraced the possibility of discovering multiple understandings of clinical reasoning, rather than seeking to obtain a singular 'truth' (i.e. a single definition) about the concept.

Step 2 Identifying relevant studies

Decisions about what counts as legitimate and acceptable sources of information to be included in the synthesis are also informed by its underlying epistemology. Questions asked in scoping reviews tend to require the inclusion of a broad range of sources including but not limited to primary research (i.e. qualitative, quantitative, mixed methods), other types of syntheses (e.g. narrative, realist), commentaries, editorials, newspaper articles, and conference proceedings. This breadth of inclusion provides a comprehensive portrait of the phenomenon under study, allowing for consideration of research evidence as well as theory-oriented manuscripts or lay literature. Inclusion of commentaries, editorials, grey literature and non-traditional academic sources reflects a broad conceptualization of what can be considered legitimate evidence reflective of a subjectivist stance and aligned with a research question focused on understanding breadth and scope.

This broader scope of inclusion raises a number of important considerations. Scholars must decide, for example, whether the grey literature (Hagg et al. 2018; Williams et al. 2017) (i.e. materials developed external to traditional academic journals and/or books) should be included in the synthesis. Should editorials, opinion pieces, and position papers also be included? Are we justified in including such sources of information? What purpose will this literature serve (i.e. what is expected to be understood and what information is to be gained by including these kinds of data sources)? Should published literature using all kinds of data collection methods (e.g. surveys, interviews, patient chart excerpts, drawings, etc.) be included? How will findings from these diverse contexts be synthesized? At the root of these questions lie important epistemological questions about what ought to be considered sources of knowledge and how can these various forms (often included in one same scoping review) be aggregated to answer one overarching question. These decisions about inclusion of various forms and sources of knowledge need to be informed by the study's research question—i.e. can the question be answered by these various sources? Other considerations include a purposeful inclusion of research team members with different perspectives, and with sufficient methodological and content expertise, to be able to appropriately analyze the data included in the review.

Our scoping review on clinical reasoning, for example, included publications from a variety of sources (e.g. primary literature, review papers, opinion pieces, theses), and attended to extracting quotes that described how the concept of clinical reasoning was being used throughout these works. The prioritization of qualitative data, in the form of

excerpts, resulted in the need for expertise in qualitative analysis approaches, in addition to content expertise, to help analyze and appropriately contextualize the data.

Step 3 Selecting studies

A clearly described, well justified description of the literature for inclusion in the synthesis is vital for the trustworthiness of scoping review findings. It is common practice to have teams of two or more reviewers indicate whether a study should be included or not, through the application of agreed-upon inclusion criteria (e.g. a question focused on how simulation is used in nursing education is unlikely to include studies based only on physician populations). This requires the review team to develop inclusion and exclusion criteria that align with the research question. However, teams are frequently confronted with disagreement at this stage of the review. This disagreement can come from a variety of sources—e.g. an unclear wording of inclusion criteria; a body of unexpected work may necessitate re-crafting of the inclusion criteria following team discussion; or team members' epistemological stances and methodological traditions colour their interpretation of a paper and their decision to include or exclude it. As a result, an important methodological question arises: Should scoping review teams compute and strive for high levels of agreement (whether in the form of percent agreement or Kappa) as a marker of rigor, as in other synthesis methodologies (e.g. systematic reviews)? If we consider the epistemological stances that underpin scoping reviews, calculating consensus in this manner may reflect an inappropriate expectation for the convergence of multiple perspectives, or the prioritization of one perspective over another. We propose that teams need to consider the epistemological grounds of the scoping review methodology and to justify decisions for including (or not) a computational consensus approach to agreement. Given that subjectivism is the epistemological foundation of scoping reviews, is an inter-rater agreement calculation an appropriate measure of rigor? If disagreements occur between raters, should they be resolved by 'tie-breaking' or consensus? Where do the disagreements lie? Where do disagreements in interpretation come from? Are the disagreements due to differential expertise across team members (e.g. some team members may be better versed in certain methodological distinctions) or due to different understandings of a concept (i.e. do people understand or define a key concept differently)? It is possible that the disagreement itself marks an important element of the state of current knowledge on a given topic.

We encountered several difficulties with establishing consensus, and have described a pause and reflect exercise that we engaged in as a response to an uncharacteristically low level of agreement between reviewer dyads in selecting the papers for our review on clinical reasoning (Young et al., 2018). A deeper analysis of the disagreement revealed that there were multiple different understandings and definitions of clinical reasoning within the team; team members were disagreeing as to what was considered a legitimate component of the concept. After much debate, we opted not to calculate agreement but instead to include all papers that had been identified as relevant for a definitional review. Since the purpose of our review was to map differences in understandings of clinical reasoning in the literature, a consensus definition for the purposes of study selection would have run counter to the purpose of the synthesis.

Table 1 Epistemological considerations for each step of the review

Step	Methodological considerations given the epistemological foundations of scoping review	
	Embrace…	Avoid…
Step 1 Identifying the research question	Questions that focus on description, mapping, with a focus on breadth A question that doesn't prioritize a given study or literature type	Questions that confer 'solutions' or definitive answers about whether an intervention works Questions that try to find a 'truth' or are only answerable with one type of study
Step 2 Identifying relevant studies	Being broad with considering what materials might be relevant, so long as it is appropriate for your research question Making sure your search strategy is allowing for the inclusion of multiple literature types	Selecting a single type of study to synthesize (unless directly related to the research question) Discarding certain types of literature (theses, editorials) without a clearly documented rationale
Step 3 Selecting studies	Verifying that the included literature reflects a variety of epistemologies, research methods, and data collection techniques Team discussion and consensus on which papers to be included Reaching some common understanding of where disagreements may lie, why and how these can be used to strengthen the review	Insisting on a computational approach to agreement without consideration for the research question and goals "Forcing" a quality appraisal particularly in the presence of a heterogenous corpus of papers
Step 4 Charting the data	Capturing the breadth present within your included literature as related to your research question Collecting sufficient data/information to answer your research question	Only selecting 'data' from the results section. Rich sources can also include the introduction and discussion sections "Over-charting" as assurance of capturing everything without a specific plan for how it will inform your research question
Step 5 Collating and reporting findings	Reporting descriptive data in a way that contributes towards answering your question (historical trends, evolution in the literature over time) Providing thick (whether quantitative, qualitative, or mixed) descriptions of identified data and literature	Making recommendations (e.g. policy or educational) based on your data Simplistic underrepresentation or single approaches to analysis and data presentation Avoid 'averaging' all findings
Step 6 Consultations with stakeholders and potential knowledge users	Engaging appropriate stakeholders in all components of the process	Tokenistic engagement, or 'here it is' presentation of findings at study completion

Step 4 Charting (extracting) the data

In this step, the scoping team determines what information should be extracted from the included literature to answer the research question. Low inference data (e.g. authors, research question, country of origin, participants) are fairly straightforward to extract and allow for a description of the papers included in the synthesis. In our experience, however, they do not result in a rich mapping of the concept at hand. Data extracted from the introduction, results, and discussion sections of papers are those that tend to generate most disagreement among reviewers. Review teams are confronted with questions such as: What results are worthy of extraction? How are different components of a concept discussed or described? How can the data be mobilized to respond to and inform the review question? How much of the original text should be extracted? Here is where epistemological orientation must be clearly understood. When working from a subjectivist position, the broad scope of inclusion for the manuscripts included in the review means that the data to be extracted will be highly variable. The research team must engage in the hard work of developing a means of extracting information from manuscripts that will enable comparison, amalgamation, and insight generation.

In our review of clinical reasoning, we engaged in an iterative process of developing, testing, revising, and retesting our extraction forms. To develop and refine this tool, we needed to answer several key questions. Chief among these was determining what types of studies offer insight into how clinical reasoning is conceptualised—a challenging question as traditional designs (e.g. case control, quasi experimental, etc.) and validation studies, or observational ethnographic work can meaningfully contribute to understanding clinical reasoning. It was during the pilot testing of the extraction form that we realised that our reviewer dyads interpreted studies differently. Rather than report on study design, to ensure that the data generated through extraction could be meaningfully interpreted, our subjectivist epistemological stance allowed us to shift our approach to extracting the stated purpose of the study, and reporting the type of data collected.

Step 5 Collating and reporting findings

Remaining true to a subjectivist perspective requires that review teams acknowledge (1) the diverse ways of aggregating and analysing data to answer an overarching research question answered through a scoping review; and (2) that team members' perspectives will enrich and deepen their understanding of the phenomenon under study. There is a need to mobilize diverse analytical procedures that draw from bibliometric, descriptive, quantitative, qualitative, and mixed methods traditions in order to engage in the mapping of the literature that is at the heart of scoping review methodology. Considerations for multiple stances—in the team and in the extracted data—should be built early into the review process and considered explicitly in a plan for analysis or intended approach to the data generated by the review process.

Teams must synthesize, analyse, and report a heterogeneous body of literature in a rigorous and reproducible manner. There is often a lack of clarity when researchers describe how data in scoping reviews were collated and reported; as a result, it can be challenging to differentiate poor reporting from poor design and execution (Davis et al. 2009; O'Brien et al. 2015). Given the multiple legitimate types of data, approaches to analysis, and intentions behind synthesis, it is important for a review team to be able to articulate how they are generating a map of the literature or synthesizing the data collected, in a way that is seen as rigorous, transparent, and a legitimate contribution to the literature.

For our work on clinical reasoning (Young et al. 2019, in review), collating and reporting our findings using a subjectivist approach resulted in the analytical process evolving in response to our growing understanding of findings. Our original question focused on how clinical reasoning was defined in the health professions; however, we found and collected other terms (i.e. other language used to describe clinical reasoning) with the hope that these other terms would provide a richer perspective on the concept and inform our subsequent work. We identified a total of 110 different terms, an unexpectedly high number, and these findings required adaptations to our analysis plan and continued consideration of our research goals and stance. Our subjectivist perspectives allowed for this broader inclusion of terms and definitions, and consequently, we were able to contribute to the literature on clinical reasoning through mapping multiple terminologies used to describe clinical reasoning (Young et al. 2019).

Step 6 Consultations with stakeholders and potential knowledge users

Though this step is optional, review teams should consider consulting stakeholders who are most likely to make use of the results of the review (e.g. to inform educational planning or policy). True engagement and recognition of the subjectivist nature of scoping reviews require stakeholders to be equal partners in the review; they must see a clear role for themselves in shaping the review to ensure that it will produce meaningful and useful knowledge. Importantly, this type of collaboration and co-construction of meaning acknowledges the value and utility of the stakeholder's expertise and the multiple ways of knowing that are the root of scoping reviews' epistemological foundations.

As part of our on-going research into clinical reasoning in medicine, we have engaged with a policy decision-making body [i.e. the Royal College of Physicians and Surgeons of Canada (RCPSC)] as a knowledge user. In this work, the College plays a central role in helping to shape the study, ensuring that results of our work can inform policy development and refine discussions around important aspects of clinical reasoning. Our goal in working with the RCPSC is to facilitate co-construction of knowledge emerging from a vast literature to better support teaching and assessment practices. A process of co-construction can help to shape policy documents, if this is the goal, and identify weak links or gaps in the literature that need to be considered as policies are revised and enacted. If the purpose of the review is to inform our basic understanding of a concept, as is the case with our clinical reasoning reviews in the broad health professions education literature, a consultation may not be necessary.

Lessons learned

We have learned many lessons as a result of conducting scoping reviews. The lessons are organised in four main themes: communication, transparency and documentation, embracing iteration and methodological adaptations, and expecting (and coping with) surprises. These are not meant to be prescriptive, nor are they an exhaustive list of our attempts to grapple with scoping review methodology. We present these as food for thought for colleagues who are thinking about embarking on a review, or who are similarly struggling with the execution of a challenging review of a broad topic.

Communication among team members during the scoping review process, as in any academic endeavour, is crucial as teams advance through the steps of the review and are

confronted with a variety of challenges. We have found that this helped us achieve an agreed upon meaning or informal definition of the key concepts and core research targets through deliberate and explicit conversations that value multiple perspectives and stances. We have also found that documentation of our discussions and decisions has been very useful at the writing for publication stage, and a resource if we need to adapt our approach to emerging surprises. Given the iterative nature of scoping reviews, it is wise to keep a detailed record of decisions made along the way.

Teams must make sound, and well documented, methodological decisions along the way in a straightforwardly executed review, or in the face of unexpected results. Teams must also respect the foundations and recommendations of the methodology and ensure a high quality knowledge 'product'. While the flexibility of the method is one of its strengths, flexibility and adaptations to the scoping review methodology require that teams clearly articulate and defend why certain methodological choices are made, particularly when deviating from what might be expected as more traditional operationalizations of the scoping review method. We advise review teams to anticipate and embrace methodological adaptations when needed, and when well justified. In the spirit of respecting the epistemological base of the methodology and remaining true to its subjectivist roots, review teams are advised to recognise disciplinary and epistemological differences amongst team members, discuss how these may influence the review process and outcomes, and be prepared to articulate and defend why certain decisions are made.

Lastly, scoping review methodology has at its core an assumption of iteration; when mapping a broad, emerging, or new area of work, little guidance is likely available regarding the specifics necessary of a research question, inclusion or exclusion criteria, or data that may be legitimately informative. An iterative process involves the occasional pausing, re-examination and reflecting on the rigorous nature of the synthesis process "Analyze as you go" approach: pausing the extraction process at various points during the review to conduct preliminary analyses and ensure that the data being collected are aligned with the current plan for analysis, and are able to make a legitimate contribution to answering your research question.

Conclusion

This manuscript has focused primarily on the epistemological considerations of scoping reviews, one method increasingly finding its way in many HPE journals. We recognise discussions on the epistemological foundations of reviews are not unique to this one type of knowledge synthesis and may be relevant to all types of reviews.

Our experiences in executing scoping reviews on complex concepts have refined our appreciation of the methodological and epistemological aspects of scoping reviews. Scoping reviews provide teams with a unique opportunity to map a large body of literature to uncover and construct a new understanding of a particular topic. Scoping review teams must be mindful of how different perspectives may colour, enrich, and broaden findings from the review, and be prepared to purposefully engage with these differences to strengthen the review process. Teams that encounter surprises should attempt to find the beauty in the differences and strive to build a new understanding of why and how these distinct foundational philosophies enhance rather than constrain the conclusions derived from a well-executed synthesis.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval Not applicable.

References

Arksey, H., & O'Malley, L. (2005). Scoping studies: Towards a methodological framework. *International Journal of Social Research Methodology, 8,* 19–32. https://doi.org/10.1080/1364557032000119616.

Bearman, M., & Dawson, P. (2013). Qualitative synthesis and systematic review in health professions education. *Medical Education, 47*(3), 252–260. https://doi.org/10.1111/medu.12092.

Bergman, E., de Feijter, J., Frambach, J., Godefrooij, M., Slootweg, I., Stalmeijer, R., et al. (2012). AM last page: A guide to research paradigms relevant to medical education. *Academic Medicine, 87*(4), 545. https://doi.org/10.1097/ACM.0b013e31824fbc8a.

Campbell, D. (1987). Evolutionary epistemology. In: Evolutionary epistemology, rationality, and the sociology of knowledge, pp. 47–89.

Cook, D. (2016). Tips for a great review article: Crossing methodological boundaries. *Medical Education, 50*(4), 384–387. https://doi.org/10.1111/medu.12983.

Cook, D. A., & West, C. P. (2012). Conducting systematic reviews in medical education: A stepwise approach. *Medical Education, 46*(10), 943–952. https://doi.org/10.1111/j.1365-2923.2012.04328.x.

Cooper, H. (2010). *Applied social research methods series: Research synthesis and meta-analysis: A step-by-step approach* (4th ed., Vol. 2). Thousand Oaks: SAGE.

Cooper, H., & Koenka, A. C. (2012). The overview of reviews: Unique challenges and opportunities when research syntheses are the principal elements of new integrative scholarship. *American Psychologist, 67*(6), 446–462. https://doi.org/10.1037/a0027119.

Crotty, M. (1998). *The foundations of social research: Meaning and perspective in the research process.* London: Sage Publications.

Davis, K., Drey, N., & Gould, D. (2009). What are scoping studies? A review of the nursing literature. *International Journal of Nursing Studies, 46*(10), 1386–1400. https://doi.org/10.1016/j.ijnurstu.2009.02.010.

Doja, A., Horsley, T., & Sampson, M. (2014). Productivity in medical education research: An examination of countries of origin. *BMC Medical Education, 14,* 243. https://doi.org/10.1186/s12909-014-0243-8.

Godfrey-Smith, P. (2003). *Theory and reality: An introduction to the philosophy of science.* Chicago: University of Chicago Press.

Grant, M. J., & Booth, A. (2009). A typology of reviews: An analysis of 14 review types and associated methodologies. *Health Information and Libraries Journal, 26*(2), 91–108. https://doi.org/10.1111/j.1471-1842.2009.00848.x.

Hagg, E., Dahinten, V. S., & Currie, L. M. (2018). The emerging use of social media for health-related purposes in low and middle-income countries: A scoping review. *International Journal of Medical Informatics, 115,* 92–105. https://doi.org/10.1016/j.ijmedinf.2018.04.010.

Jeong, D., Presseau, J., ElChamaa, R., Naumann, D. N., Mascaro, C., et al. (2018). Barriers and facilitators to self-directed learning in continuing professional development for physicians in canada: A scoping review. *Academic Medicine, 93*(8), 1245–1254. https://doi.org/10.1097/acm.0000000000002237.

Kastner, M., Antony, J., Soobiah, C., Straus, S. E., & Tricco, A. C. (2016). Conceptual recommendations for selecting the most appropriate knowledge synthesis method to answer research questions related to complex evidence. *Journal of Clinical Epidemiology, 73,* 43–49. https://doi.org/10.1016/j.jclinepi.2015.11.022.

Kelly-Blake, K., Garrison, N. A., Fletcher, F. E., Ajegba, B., Smith, N., et al. (2018). Rationales for expanding minority physician representation in the workforce: A scoping review. *Medical Education, 52*(9), 925–935. https://doi.org/10.1111/medu.13618.

Lang, T. A. (2004). The value of systematic reviews as research activities in medical education. *Academic Medicine, 79*(11), 1067–1072.

Lawrence, C., Mhlaba, T., Stewart, K. A., Moletsane, R., Gaede, B., et al. (2018). The hidden curricula of medical education: A scoping review. *Academic Medicine, 93*(4), 648–656. https://doi.org/10.1097/acm.0000000000002004.

Levac, D., Colquhoun, H., & O'Brien, K. (2010). Scoping studies: Advancing the methodology. *Implementation Science*. https://doi.org/10.1186/1748-5908-5-69.

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. Beverly Hills, CA: SAGE.

Maggio, L., Thomas, A., & Durning, S. (2019). Knowledge syntheses. In T. Swanwick, K. Forrest, & B. C. O'Brien (Eds.), *Understanding Medical Education: Evidence, Theory and Practice, 3rd edition*. Edinburgh, UK : Association for the Study of Medical Education. (in review).

McGaghie, W. C. (2015). Varieties of integrative scholarship: Why rules of evidence, criteria, and standards matter. *Academic Medicine, 90,* 294–302. https://doi.org/10.1097/ACM.0000000000000585.

Meehl, P. E. (1967). Theory-testing in psychology and physics: A methodological paradox. *Philosophy of Science, 34*(2), 103–115.

O'Brien, K., Colquhoun, H., Levac, D. & Straus, S. (2015). *Advancing the field of scoping study methodology: Meeting final report*. Toronto, ON. Retrieved 8–9th June, 2015. http://cihrrc.hivandrehab.ca/docs/Scoping-Study-Meeting-Final-Report-CIRCULATED-Sept-22-15.pdf

O'Brien, K. K., Colquhoun, H., Levac, D., Baxter, L., Tricco, A. C., et al. (2016). Advancing scoping study methodology: A web-based survey and consultation of perceptions on terminology, definition and methodological steps. *BMC Health Services Research, 16*(1), 305. https://doi.org/10.1186/s12913-016-1579-z.

Ossenberg, C., Henderson, A., & Mitchell, M. (2018). What attributes guide best practice for effective feedback? A scoping review. *Advances in Health Sciences Education: Theory and Practice*. https://doi.org/10.1007/s10459-018-9854-x.

Pelaccia, T., Plotnick, L. H., Audétat, M.-C., Nendaz, M., Lubarsky, S., Torabi, N., et al. (2019). A scoping review of physicians' clinical reasoning in emergency departments. *Annals of Emergency Medicine*. https://doi.org/10.1016/j.annemergmed.2019.06.023.

Peters, M. D. J., Godfrey, C., McInerney. P., Baldini, S. C., Khalil, H., & Parker, D. (2017). Chapter 11: Scoping reviews. In E. Aromataris, & Z. Munn (Eds.), *Joanna Briggs Institute Reviewer's manual*. The Joanna Briggs Institute, 2017. Available from https://reviewersmanual.joannabriggs.org/

Pole, D. (1961). *Conditions of rational inquiry: A study in the philosophy of value*. London: University of London, Athlone Press.

Popper, K. R. (1959). *The logic of scientific discovery*. Oxford: Basic Books.

Schumann Scheel, L., Peters, M. D. J., & Meinertz Mobjerg, A. C. (2017). Reflection in the training of nurses in clinical practice settings: a scoping review protocol. *JBI Database of Systematic Reivews and Implementation Reports, 15*(12), 2871–2880. https://doi.org/10.11124/jbisrir-2017-003482.

Steinert, Y., & Thomas, A. (2016). When I say… literature reviews. *Medical Education, 50*(4), 398. https://doi.org/10.1111/medu.12998.

Tang, B., Coret, A., Qureshi, A., Barron, H., Ayala, A. P., et al. (2018). Online lectures in undergraduate medical education: scoping review. *JMIR Medical Education, 4*(1), e11. https://doi.org/10.2196/mededu.9091.

The Joanna Briggs Institute. (2015). *'Joanna Briggs Institute Reviewers' Manual' 2015 edition/supplement*. Adelaide: The University of Adelaide. Available at: http://joannabriggs.org/assets/docs/sumari/Reviewers-Manual_Methodology-for-JBI-Scoping-Reviews_2015_v2.pdf. Accessed 5 March 2019.

Thomas, A., Lubarsky, S., Durning, S. J., & Young, M. E. (2017). Knowledge syntheses in medical education: Demystifying scoping reviews. *Academic Medicine, 92*(2), 161–166. https://doi.org/10.1097/ACM.0000000000001452.

Thomas, A., Menon, A., Boruff, J., Rodriguez, A. M., & Ahmed, S. (2014). Applications of social constructivist learning theories in knowledge translationfor healthcare professionals: A scoping review. *Implementation Science*. https://doi.org/10.1186/1748-5908-9-54.

Tricco, A. C., Lillie, E., Zarin, W., O'Brien, K., Colquhoun, H., et al. (2016a). A scoping review on the conduct and reporting of scoping reviews. *BMC Medical Research Methodology*. https://doi.org/10.1186/s12874-016-0116-4.

Tricco, A. C., Soobiah, C., Antony, J., Cogo, E., MacDonald, H., et al. (2016b). A scoping review identifies multiple emerging knowledge synthesis methods, but few studies operationalise the method. *Journal of Clinical Epidemiology, 73,* 19–28. https://doi.org/10.1016/j.jclinepi.2015.08.030.

Tricco, A. C., Tetzlaff, J., & Moher, D. (2011). The art and science of knowledge synthesis. *Journal of Clinical Epidemiology, 64*(1), 11–20. https://doi.org/10.1016/j.jclinepi.2009.11.007.

Varpio, L., Bader, K. S., Meyer, H. S., Durning, S. J., Artino, A. R., & Hamwey, M. K. (2018). Interprofessional healthcare teams in the military: A scoping literature review. *Military Medicine, 183*(11–12), e448–e454. https://doi.org/10.1093/milmed/usy087.

Varpio, L., & MacLeod, A. (in press). Introduction to the philosophy of science series: Harnessing the multidisciplinary edge effect by exploring paradigms, ontologies, epistemologies, axiologies, and methodologies. *Academic Medicine*.

Webster, F., Krueger, P., MacDonald, H., Archibald, D., Telner, D., et al. (2015). A scoping review of medical education research in family medicine. *BMC Medical Education, 15,* 79. https://doi.org/10.1186/s12909-015-0350-1.

Williams, B., Reddy, P., Marshall, S., Beovich, B., & McKarney, L. (2017). Simulation and mental health outcomes: A scoping review. *Advances in Simulation (London), 2,* 2. https://doi.org/10.1186/s41077-016-0035-9.

Wong, G., Greenhalgh, T., Westhorp, G., & Pawson, R. (2012). Realist methods in medical education research: What are they and what can they contribute? *Medical Education, 46*(1), 89–96. https://doi.org/10.1111/j.1365-2923.2011.04045.x.

Young, M., Thomas, A., Lubarsky, S., Ballard, T., Gordon, D., et al. (2018). Drawing boundaries: The difficulty in defining clinical reasoning. *Academic Medicine, 93*(7), 990–995. https://doi.org/10.1097/acm.0000000000002142.

Young, M., Thomas, A., Lubarsky, S. E., Gordon, D., Gruppen, L., et al. (2019). Mapping clinical reasoning literature across the Health Professions. *BMC Medical Education* (in review).