Recommendations for the extraction, analysis, and presentation of results in scoping reviews

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ABSTRACT

Scoping reviewers often face challenges in the extraction, analysis, and presentation of scoping review results. Using best-practice examples and drawing on the expertise of the JBI Scoping Review Methodology Group and an editor of a journal that publishes scoping reviews, this paper expands on existing JBI scoping review guidance. The aim of this article is to clarify the process of extracting data from different sources of evidence; discuss what data should be extracted (and what should not); outline how to analyze extracted data, including an explanation of basic qualitative content analysis; and offer suggestions for the presentation of results in scoping reviews.

Keywords: evidence synthesis; methodology; methods; scoping reviews

JBI Evid Synth 2023; 21(3):520–532.

Introduction

Scoping reviews have been defined as a "type of evidence synthesis that aims to systematically identify and map the breadth of evidence available on a particular topic, field, concept, or issue, often irrespective of source (ie, primary research, reviews, non-empirical evidence) within or across particular contexts."[1(p.950)] Scoping reviews can clarify key concepts/definitions in the literature and identify key characteristics or factors related to a concept, including those related to methodological research.[2] Scoping reviews can also identify gaps in the literature and be precursors to systematic reviews. While scoping reviews share common elements and steps in their conduct with systematic reviews and other types of evidence syntheses,[2,3] scoping reviews are able to address broader research questions in

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DP, CS, and ZM are paid employees of JBI, The University of Adelaide. DP, MDJP, HK, PM, LA, ACT, CE, EBdM, CMG, DP, AS, and ZM are members of the JBI Scoping Review Methodology Group. ACT is a member of the editorial advisory board, CE is an associate editor, and CS is a senior associate editor of JBI Evidence Synthesis. *No authors were involved in the editorial processing of this manuscript.*

DOI: 10.11124/JBIES-22-00123

comparison to the more precise, targeted questions of feasibility, appropriateness, meaningfulness, or effectiveness of a particular issue more suitable for systematic reviews. For example, a scoping review may look at what outcomes are being reported and how these outcomes are being measured for children who have grommet insertion due to chronic ear infections (ie, how is hearing measured?), whereas a systematic review will assess the effectiveness of grommets on reported outcomes, such as hearing, speech, and language development.[2] Beyond the kinds of questions that should be addressed by scoping reviews, a key difference between scoping and systematic reviews is the approach to the extraction, analysis, and presentation of data and results.[2]

The process of extraction, analysis, and presentation of results in scoping reviews has been noted to be challenging for scoping review authors.[4] Inconsistencies and inappropriateness in the analytical approaches undertaken in the analysis and presentation of the data within scoping reviews have been recurrent issues.[5] In part, this may be due to scoping review guidance being unclear and not describing a practical approach to how to extract, analyze, and present data within scoping reviews. Additionally, scoping reviews can include a variety of evidence sources, such as peer-reviewed primary research, and gray literature, such as guidelines, organizational reports, policies, government documents, and blogs.[6]

Seminal scoping review guidance referred to the process of extraction, analysis, and presentation as "data charting,"[7,8] and this terminology is used in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR).[9] The term "charting" is seen as a higher level of extraction, which is theoretically appropriate for scoping reviews, and was used to differentiate from the term "extraction." Extraction may suggest that review authors always extract the study outcome results; however, guidance from JBI states that, to be consistent with other evidence synthesis approaches, the term "extraction" is most appropriate, and will be used throughout this guidance. Arksey and O'Malley[7] suggested that, for scoping reviews, an analytical framework, "basic numerical analysis," be used in conjunction with "thematic constructions." However, Arksey and O'Malley[7] were clear that scoping reviews do not synthesize evidence or "aggregate findings." Levac *et al.*[8] agreed with Arksey and O'Malley[7] on the importance of a descriptive numerical summary analysis; however, they argued that there was a need for more guidance on the methodological approach to thematic presentation of data. Levac *et al.*[8] proposed the use of qualitative content analysis. JBI guidance recommends the use of frequency counts, tabular/graphical presentation and, where appropriate, "basic" qualitative content analysis; however, to date, the methodological approach has not been thoroughly described for scoping reviews. Therefore, the JBI Scoping Review Methodology Group has developed guidance using best-practice examples of scoping reviews to provide clarity on the following:

i) data extraction process: what type of data should be extracted from the included evidence sources and the level of detail required during extraction
ii) data analysis: how to analyze the data collected from evidence sources, including a detailed approach of how to conduct basic qualitative content analysis
iii) data presentation: suggestions for the presentation of results in scoping reviews.

Using a team approach

As with many other rigorous evidence syntheses, best-practice recommends that scoping reviews use a team approach.[10] The team should meet regularly throughout the entirety of the review process, including data extraction, analysis, and presentation. Team check-ins, either through face-to-face meetings or email, during the extraction and analysis phases are particularly important to discuss the process, issues encountered during data extraction, if there are any changes to tools used to guide the extraction of data (extraction forms or tables), and any other review issues and results that are encountered. Knowledge users are those who have a vested interest in the research and its outcomes and impacts, and can also be a part of the review team and included in all stages of the review process.[11] Knowledge users are people who are most likely to be directly impacted by the research and its outcomes, and may include those with lived experience (eg, patients, clients, consumers, public), other researchers, health care providers, or policy decision-makers.[11] Review teams can include knowledge users at all stages to inform the analysis plan; review the completed

extractions, categories, and subcategories; and offer insight into the results.[12]

Principles of data extraction

As in systematic reviews, scoping review authors should only extract data items that are relevant to the scoping review questions. The PCC framework (population, concept, and context) is recommended as a guide to construct clear and meaningful objectives and eligibility criteria for a scoping review.[6] Therefore, potential data items of interest can be structured around the PCC framework. Further items for data extraction will depend on the purpose and reasoning behind conducting the review. For example, the individual items could be related to the study design, such as whether it was a randomized controlled trial (RCT), the methods used for conduct, and outcome measurement approaches. Alternatively, items for extraction could include definitions, statements, or arguments surrounding a concept. Data items could also include interventions studied, their application, dose, duration, and frequency. Data extraction, analysis, and presentation are all dependent on each other and require prior planning to ensure consistency. There are broad principles of data extraction that should be followed within a scoping review to ensure its conduct is transparent and rigorous. These principles are as follows:

- Create a standardized data extraction form and guidance for the form, which describes each point that will be extracted (see Table 1 for a sample extraction form). The development of the initial data extraction form is guided by the review question and usually includes the population, concept, and context. It is recommended that an extraction guidance form (see Table 2 for an example) be developed and accompany the extraction form detailing each item to be extracted and shared with each scoping reviewer.

Table 1: Example of a data extraction table in a scoping review

Author **Year**	Crawshaw 2010[12]	Levy *et al.* 2009[13]
Country	UK	UK
Aim	To compare the effectiveness of subacromial corticosteroid injection combined with timely exercise and manual therapy (injection plus exercise) or exercise and manual therapy alone (exercise only) in patients with subacromial impingement syndrome	To investigate recreational participants' experiences of adhering to a sport injury rehabilitation program
Study type/source	RCT – 2 arm	Qualitative
Population	Aged 40 and older, have unilateral shoulder pain, subjectively rate their pain as moderate or severe on a 3-point scale (mild/moderate/severe), and have a non-capsular pattern of restriction	Recreational sport participants, tendonitis-related overuse injury
Sample size	Total (n = 232): injection + exercise (n = 115) Exercise only (n = 117)	6
Age (yrs)	Injection + exercise = M (57.2), SD (10.3) Exercise only = M (54.9), SD (10)	Range 24–38
Gender	Injection + exercise = 57% F, Exercise only = 52% F	4 M, 2 F
Other demographics	Median weeks of shoulder pain, started after injury, employed, diabetic	Reason for injury
Setting	Clinic	Mixed
Concept – Ex type	Flexibility: stretching, Flexibility: PNF, Strength: isometric, Other: scapular stabilisation or motor control, Strength: progressive resistance exercise	Group exercise class and social dancing class
Ex adherence	Treatment logs	Lack of motivation and confidence had negative effect on home ex; ineffective coping strategies, over support and pain affected clinic adherence
Outcomes (health domain)	SPADI (Disability); GROC (Participant/patient rating overall condition)	NA
Results	Disability and GROC: short-term benefit from injection, but no difference at 12 or 24 weeks	5 themes: motivation, confidence, coping, social support, and pain

Table 2: Example extraction guidance sheet for a scoping review

Author	Eg, Smith; Smith & Hunt; Smith *et al.* (for more than 2 authors)
Title of source	What is the title of this article, guideline, etc? Write the full title (eg, The experience of mothers and fathers in cases of stillbirth in Spain: a qualitative study)
Publication	Where was this article published (eg, *Midwifery; Birth; Women and Birth*). If it is an organization guideline, write the organization (eg, American College of Obstetrics and Gynaecology). Where there may be multiple dates on an article (eg, preprints or an article made available online before it then gets published), use the date on the article that you have.
Year	The year the article was published.
Date data were collected	The article may have collected data at another time point prior to publication. In this section write the time period (eg, 1990–2000) data were collected. If this date was not stated or no data were collected (eg, discussion paper), then write NA.
Type of evidence source (primary research/evidence synthesis/conference abstract/discussion article)	• Primary research: peer-reviewed research articles • Epidemiology: articles that have used population-level datasets • Evidence syntheses: narrative reviews, systematic reviews, scoping reviews, rapid reviews, etc. • Conference abstracts: abstracts presented within conferences • Discussion articles • Editorials • Theses

- Describe the planned data extraction approach in an a priori protocol and include a draft data extraction form. This draft extraction form is usually formatted as a table and should be developed specifically for the review topic at hand, be detailed, and include more than a basic plan (ie, more than just the population, concept, and context) for the items that will be extracted.
- Best practice is to have at least 2 scoping review authors extracting data independently from each evidence source. However, if this is not possible, 1 scoping reviewer per evidence source with another person reviewing either all or a proportion of the extraction to ensure it is accurate and complete can be considered.[13]
- Pilot-test the data extraction form on each type of evidence source, such as primary research articles, evidence syntheses, guidelines, policy statements, or blog posts, included in the review. Aim for each scoping reviewer to independently complete at least 2 to 3 items per evidence source type; however, this will depend on the complexity of the topic and the variety of evidence sources. During pilot-testing, scoping review authors should reflect on the following questions:
  - Was there anything missing from the extraction form?
  - Was there anything redundant included in the extraction form?
  - Was there anything on the extraction form that you did not understand or that could be further clarified?
  - Was there any unclear information in the accompanying guidance form?
  - How long did it take you to extract the necessary information? This information will help guide further time allocation.
- Have a review group discussion with all scoping review authors after piloting to agree on all aspects of the tool, data to be extracted, and reach agreement on queries or conflicts.
- Only extract data that are relevant to the stated review questions of the scoping review.
- If scoping review authors need any additional information or to clarify doubts about some of the study's information, the authors of the evidence sources should be contacted as soon as possible. Further follow-up of these authors may be necessary.
- Ensure and plan for regular team meetings and/or communication during the extraction process to discuss progress and assess if the data extraction form is capturing the necessary information to answer the review questions.

Data extraction as an iterative process

Given the breadth of scoping review questions and the varied sources of evidence that can be included, additional relevant data items may be identified by

scoping review authors during the process of extraction from included sources. This means that data extraction can evolve to capture new and different data items, requiring an iterative approach; for example, if collecting data on education courses, details on assessment methods used may not have been considered initially, but may then be deemed important throughout the process. It is not uncommon to add additional items to the data extraction form during the process. If additional items are extracted that were not prespecified, it should be made clear in the final report that there was a deviation from the protocol and a rationale provided as to why it occurred.

Identifying the relevant information in the evidence source

In systematic reviews that analyze primary research articles, data are typically extracted from the methods and results of included sources. This may not be strictly the case for scoping reviews. This is due to the varied types of data included within scoping reviews. Scoping reviews do not typically pose analytical questions where extracting the results of primary research (such as effect sizes or qualitative results) is necessary.[2] Hence, authors may be required to examine other sections of a source, including the introduction, discussion, conclusions, and even supplementary information. For example, a scoping review might be conducted to identify and report on the methodological approaches that have been used to investigate a particular topic, and in this case, the methods section would be the primary place where extraction will occur. In the review by Khalil and Huang,[14] the authors extracted both the methodology and methods associated with each study as part of their review to map the work that has been undertaken in the area of medication adverse events in primary care. In another scoping review, Hoppe *et al.*[15] mapped the research addressing prescription drug monitoring programs and extracted from the discussion section of primary research articles to determine what they perceived their results to be, as well as the gaps and areas in need of further research.

Depending on the purpose and review questions posed, scoping review authors may or may not aim to extract the results of primary studies. For example, in a scoping review addressing medication safety programs, the authors extracted information about the types of programs, the personnel involved in the programs, and the outcome measures used to measure the efficacy of the programs. Despite extracting some results information, the authors did not gather information about the effectiveness of the programs.[16]

Scoping reviews that serve as precursors to systematic reviews could, with clear rationale and justification, focus on the extraction of results, as seen in a scoping review performed to inform the feasibility and appropriateness of a health technology assessment.[17] In scoping reviews exploring barriers and facilitators, reviewers may extract from the results of qualitative primary studies and then subsequently categorize these as barriers or facilitators.[18,19] However, in each of these cases, we suggest that scoping review authors be explicit regarding the inability to draw conclusions regarding the effectiveness (or prevalence, meaningfulness, accuracy, or costs) of a practice or phenomenon due to the absence of a risk of bias assessment or advanced data synthesis techniques, such as meta-analysis or meta-synthesis. Scoping review authors can, however, recommend that subsequent specific systematic reviews be undertaken based on the results of their scoping review.

We advocate for extreme caution in cases where a scoping reviewer would want to extract the results of evidence sources. In most instances, a systematic review approach will be the more suitable methodology for dealing with review questions that require the extraction of the results (eg, effect measures and variance, meaning of phenomena) of included sources. Systematic reviews typically include methodological quality assessment and utilize, where appropriate, formal methods of data synthesis or aggregation.

Extracting and presenting results (for example, a relative risk with associated confidence intervals and *P* values or themes from a qualitative thematic analysis) may lead to misplaced conclusions regarding the effectiveness (or not) of an intervention, the prevalence of a condition, the accuracy of a test, or the experience of a condition/phenomenon. This is due to the included sources of evidence not having undergone a process of critical appraisal (or risk of bias appraisal) and, also, not having undergone a process of pooling or aggregation that considers the combination of all study results. Without this assessment of methodological quality and pooling or

aggregation, authors and readers may be susceptible to making false assumptions based on a naïve or incomplete reading of the results and be more inclined to apply vote counting of results. In this instance, a systematic review is likely the more suitable methodology for dealing with review questions that require the extraction of the results (eg, effect measures and variance) of included sources.

Analysis in scoping reviews

Scoping review authors should present the intended analytical approach that will be used within their scoping review in the protocol. Scoping review authors should clearly articulate how they intend to analyze and present each review question, as this may vary. The detail provided by authors should be more than a general statement that they will undertake descriptive statistics, tables, and a narrative summary. Rather, there should be a comprehensive description of the analyses undertaken in order to address each individual review question/objective.

Scoping review authors may be tempted to perform more advanced statistical or qualitative analysis within a scoping review.[6] The intention of synthesis methods, such as meta-analysis, meta-ethnography, thematic analysis, realist synthesis, or meta-aggregation, among others, is to answer questions or inform understandings regarding the feasibility, appropriateness, meaningfulness, and effectiveness of a particular intervention or phenomenon.[6] Therefore, for these questions, the most appropriate review type is a systematic review where the findings/results have undergone critical appraisal, and approaches to establish certainty of those results have been applied to generate conclusions that can inform practice and policy recommendations.

Scoping reviews do not address questions of feasibility, appropriateness, meaningfulness, or effectiveness, and, as such, will not and should not apply advanced analysis methods. If scoping review authors feel that they are unable to answer their review question without the use of a meta-analysis, for example, then the question they are asking is possibly best suited for a quantitative systematic review.[2]

Most scoping reviews will analyze data items by quantifying text and doing frequency counts of data extraction items. These are relatively easy to manage, and should only require the use of descriptive statistics, such as percentages/proportions. For example, common frequencies seen in scoping reviews are the number of evidence sources that used a particular method (eg, numbers of RCTs, surveys, or evidence syntheses) or the location/country/context where the evidence source was conducted. Furthermore, scoping review authors can extract relevant information aligning to a framework with single-word responses such as "yes," "no," or "unsure," or even through the use of a Likert scale. For example, in a recent scoping review, the authors mapped exercise interventions to the Template for Intervention Description and Replication (TIDieR) checklist.[20] For the 9 items on the checklist, reviewers classified each as either fully reported, partially reported, or not reported for each included evidence source.[21]

Using basic qualitative content analysis

In scoping reviews that include qualitative evidence, it is not uncommon for authors to use qualitative synthesis approaches that go beyond the scope of a scoping review, such as thematic synthesis or a meta-aggregative approach. These approaches are not appropriate within a scoping review, as they are better suited to examining questions of experiences and meaningfulness, and require a level of interpretation, which would align more appropriately with a systematic review. Synthesis approaches that aim to reinterpret evidence are not consistent with the purposes of a scoping review. Scoping reviews are descriptive in nature; they aim to map the available evidence or identify characteristics or factors. For the most part, there will be no need for scoping review authors to go beyond basic descriptive analysis. However, there may be times when it would be appropriate to use a basic qualitative content analysis, such as if the scoping review is identifying key characteristics or factors related to a concept. This may be necessary when a scoping review has the objective of informing the development of a conceptual framework or theory.

When performing basic qualitative content analysis, categorization is required to map the results to aid their simplification to address the scoping review question. For example, in a scoping review by Hoppe *et al.*,[22] the authors mapped the evidence associated with community pharmacists' views toward drug misuse management, categorizing the results into

pharmacists' knowledge, training and education, attitudes, and practice strategies.[22]

JBI scoping review guidance recommends using basic qualitative content analysis,[6] which is a descriptive approach to analysis and involves a process of open coding to allocate concepts or characteristics into overall categories. This can be applied to any evidence source or study design in any scoping review; it is not limited to primary qualitative studies. In previous guidance, including from JBI, there has been no definitive description of what basic qualitative content analysis involves, and it is acknowledged that there are many different analytical approaches that could be undertaken. However, the present paper describes one approach that could be undertaken by scoping review authors.

A basic qualitative content analysis approach for scoping reviews

Elo and Kyngäs[23] describe 3 phases of qualitative content analysis for the results of primary qualitative research: i) preparation, ii) organizing, and iii) reporting. These phases could also be used to describe a basic process of qualitative analysis within scoping reviews. A fourth "abstraction" phase is also described by Elo and Kyngäs[23]; however, this technique would be beyond the realm of a scoping review, in which we do not seek to synthesize or reinterpret evidence. Figure 1 shows the process of conducting the analyses of qualitative data within a scoping review.

Preparation phase

Scoping review authors should first determine if there is a need to conduct a basic qualitative content analysis during the protocol stage of their scoping review. If the aim of the review were to explore experiences or the meaningfulness of an issue, then a qualitative systematic review would be more appropriate.[2] If a basic qualitative content analysis approach is deemed necessary (eg, as the characteristics of a particular issue or definitions of a concept are being mapped), then it would be appropriate to use this method within scoping reviews.

Depending on the research question and the field of research, an inductive or deductive approach will need to be chosen by the scoping review team during the protocol development stage and subsequently reported within the protocol. These terms will be familiar to qualitative researchers. An inductive approach may be useful where there is a dearth of evidence on the topic, or the goal is to develop or inform a conceptual framework or theory.[23] The deductive approach is typically used to map the data to an established framework or theory within the literature.[23] There may be times, however, when a deductive approach is chosen without using a pre-existing framework (eg, when no suitable framework or theory can be found). In such situations, the review team needs to select a framework during

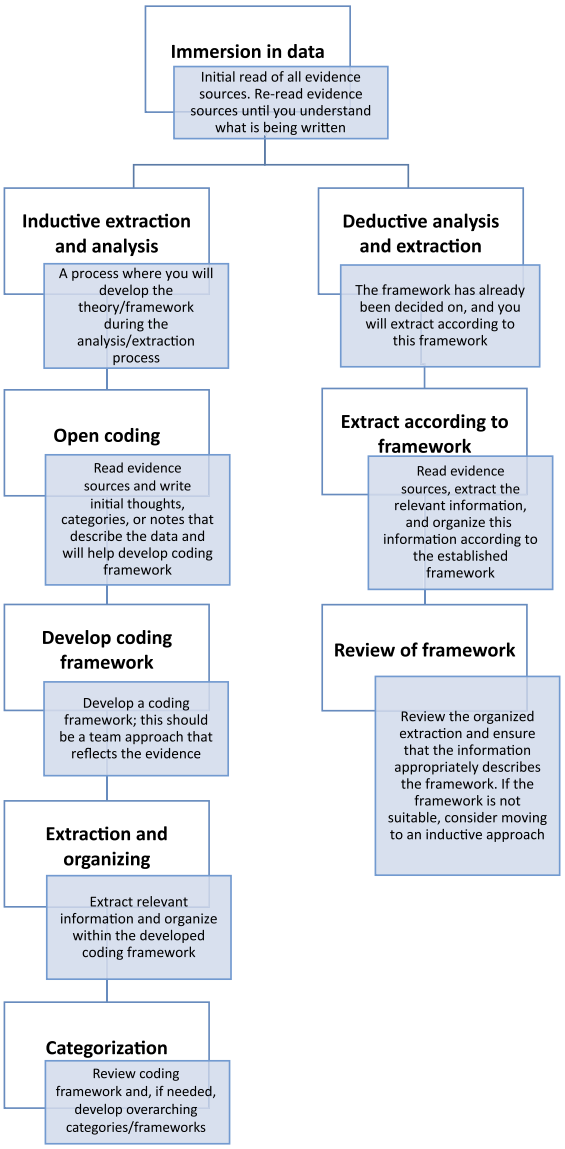

Figure 1: The process of conducting the analyses of qualitative data within a scoping review

the protocol stage and, ideally, will have consulted on the suitability of the framework.

Organizing phase

The organizing phase during qualitative data analysis within scoping reviews will differ depending on whether the scoping review is following an inductive or deductive approach.[23] The first step in the organization stage is for the review authors to familiarize themselves with the data. This includes reading and comprehending all the included evidence sources and understanding how the data are relevant to the objective and questions of the scoping review.[23]

Inductive approach

When the authors have become familiar with the sources of evidence and relevant data, review authors can then carry out open coding of the data. A code can be described as a label and can be an initial descriptor that is a few words long. The process of open coding involves reviewing the evidence sources again and listing initial thoughts, possible categories, or notes that help describe what is occurring within the data, which explains the objective and review question. During this stage, there are no limitations as to how many high-level categories can be listed. This is an initial process that will be refined. Once the open coding process has occurred, the coding framework can be developed. This will involve gathering all the information in the previous stage to develop a coding framework to help describe and answer the review questions and allow the organization of extracted data.

At this stage, the coding framework may include higher order categories or subcategories. It is also beneficial to provide a definition of these categories and subcategories to help extractors, as well as to show transparency in the decision-making that has occurred throughout this process. The coding framework should be reviewed by all members of the review team. Once the coding framework has been reviewed, extractors are then able to go through the included evidence sources, extract the relevant information, and organize it within the coding framework. Categorization involves exploring the organized extractions and assessing whether the initial coding framework adequately answers the review question. It is common for the categories and subcategories within the initial coding framework to be changed during this stage to accommodate new understandings of what was stated within the evidence sources. These categories can form a conceptual framework or theory.

Case study of inductive qualitative data extraction and analysis

A scoping review was undertaken to assess the available literature that documents or utilizes patient journey mapping methodologies and examine their reporting processes.[24] After an extensive searching and selection process, there were 81 included evidence sources within this scoping review. The scoping review authors chose to extract information about why primary authors would use patient journey mapping. The scoping review authors extracted 76 justifications. During the analysis stage, the scoping review team met several times to examine each of these justifications. The process of analysis included listing initial thoughts, possible categories, or notes (which help describe what is occurring within the data), with the eventual goal to make a smaller list of common justifications of why researchers choose patient journey mapping. After meeting several times as a group, 10 categories were identified, including comprehensiveness of care, how people were navigating the system, patient satisfaction with services, and comparing patient experiences with standards of practice. An example of this process of developing categories is presented in Figure 2; however, this is not a linear process and it may be necessary to reexamine the categories and establish whether they could be further refined.

Once the framework had been developed, 2 scoping review authors individually went through the extracted data and assigned it to a category. These review authors then came together and assessed if there were any discrepancies. All discrepancies were discussed and consensus was achieved; however, a third reviewer had agreed to manage any discrepancies that could not be resolved through discussion.

Deductive approach

As described above, in the deductive approach, the framework has already been developed during the protocol stage. Therefore, the review authors can extract data according to that framework by extracting the verbatim text, which maps to the decided framework and answers the proposed questions. Once this is completed, the extractions should then be reviewed by the members of the review team to

Figure 2: Example of the process of inductive analysis

ensure that they reflect the understanding of the framework. There may be a scenario where scoping review authors initially utilize a deductive framework and then recognize that this would not be the best fit for the extracted data and its ability to provide a descriptive map of the available evidence. Therefore, the scoping review authors can switch to an inductive approach during the extraction and analytical steps of a scoping review and document this deviation from the protocol in the final review.

Case study of deductive qualitative data extraction and analysis

A scoping review was conducted to identify barriers and facilitators in the prevention of type 2 diabetes mellitus and gestational diabetes in vulnerable groups.[2] After searching several databases, 125 evidence sources were included. A preexisting framework had been developed prior to the extraction of the data, which included 8 categories: i) language, ii) economic factors, iii) family and friends, iv) work, v) social support, vi) religion, vii) culture, and viii) knowledge. During extraction, scoping review authors extracted barriers and facilitators and then sorted them into prearranged categories. Other barriers that did not fit into these prearranged categories were found, and they included insufficient time, problems with traveling, and insufficient motivation; however, these were minimal and the framework did not change.[25]

Including other forms of evidence synthesis and the issue of double counting

An issue seen within systematic reviews is ensuring that the same data set is not counted across multiple studies. Double counting issues can arise in scoping reviews for numerous reasons, such as when evidence synthesis and primary articles are included (ie, there is the potential for overlap). There may also be a scenario where multiple evidence synthesis sources are included in the scoping review and the primary article is included within them all or there are several reports of the same primary study. This may become problematic if, for example, the review question is attempting to determine the type and frequency of outcomes being used within a particular field of work, as scoping review authors may count the same outcome from both the original study and any evidence synthesis source that also included the original study, thus skewing the prominence.

While there is no formal guidance on how to manage this issue, scoping review authors should be aware of the risk and make efforts to avoid counting the same data items multiple times from different sources. Authors may decide to still include the evidence synthesis within the scoping review to be able to map the available evidence and to report the number of evidence syntheses mapped. Guidance for systematic reviews and overviews (reviews of reviews/umbrella reviews)[26] might also apply. However, scoping review authors should clearly report which other included sources of primary evidence were included within that evidence synthesis. The final scoping review report should clearly state how other types of evidence synthesis were handled in the review and what data were extracted from them and from the primary studies (if appropriate).

Presentation of data

There are a multitude of ways that scoping reviews can present data and answer the proposed review questions. Scoping reviews commonly include tables that present the available data. Although tables are

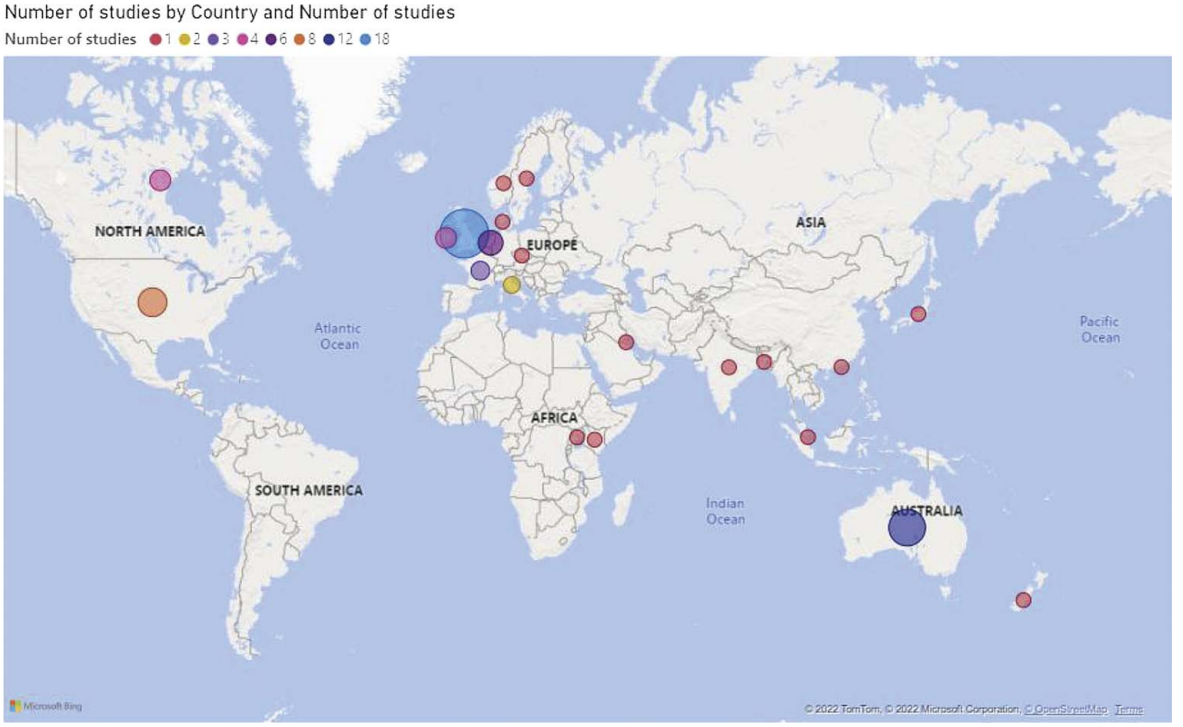

Figure 3: Example of data presentation in a scoping review: world heat map showing the number of included studies conducted in each country

useful, as they can summarize a large amount of information and show how extraction has occurred, authors should also consider how to communicate the results of the scoping review to the wider community. Further, scoping review results with many included sources may result in tables that are too large to easily present in the standard fashion of a journal article. There are many creative approaches that scoping reviews can include to convey results to the reader in an understandable way. For example, Tricco and Lillie[5] visualized the different terminology of scoping reviews through a word cloud. Kynoch and Ramis[27] used a honeycomb to visualize the outcomes in the included evidence sources and the number of relevant studies. The author team, using Power BI (Microsoft, Redmond, USA), developed 4 further examples of how scoping review results can be visualized. In Figure 3, the authors have created a world heat map with the size of the circle indicating how many evidence sources were conducted in that country. Figure 4 is a tree graph indicating the illness categories seen within the included evidence. Figure 5 uses iconography to represent the different types and number of populations included within the evidence sources. Finally, Figure 6 uses waffle charts to indicate the type of methodology used by the evidence sources included within a scoping review.

Alongside any visual presentation, a supporting narrative must be provided describing the results. A further option for the presentation of scoping review results is the use of interactive resources. An example of this is the searchable interactive map of outcome tools and International Scientific Tendinopathy Symposium Consensus health domains relative to tendinopathy types presented as supplementary files in a scoping review of exercise for tendinopathy.[21]

Reporting scoping reviews

PRISMA-ScR provides a checklist for reporting a scoping review. It has clear guidance on how to report the extraction (called "data charting" within PRISMA-ScR), analysis (called "data synthesis"), and presentation of data. Items 10, 11, 14, 17, 18, 20, and 21 are applicable for these sections and should be referred to while writing the scoping review report to ensure a transparent and rigorous

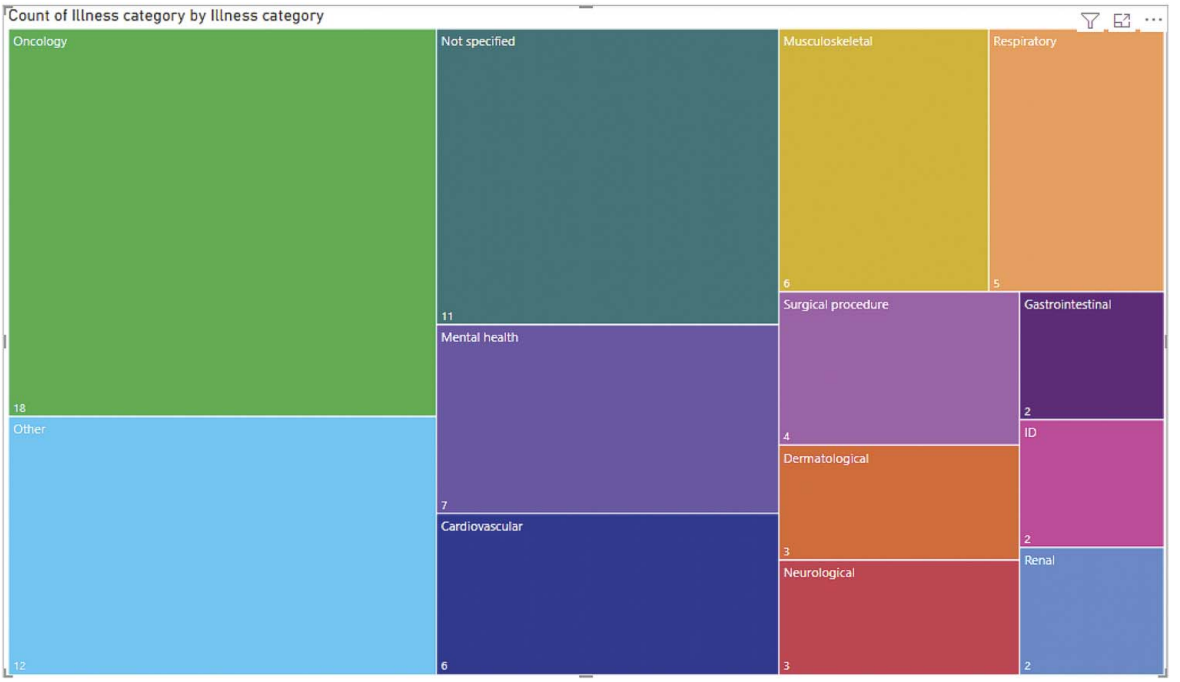

Figure 4: Example of data presentation in a scoping review: tree graph of illness categories identified within the included evidence sources

process. A completed PRISMA-ScR checklist that documents page numbers where each of these actions have been addressed should also be included as a supplementary file to the scoping review report. Because the checklist requires authors to indicate the page numbers, authors should ensure that these page numbers are accurate in the final proofs of your scoping review if it is to be published, otherwise they will not match up.

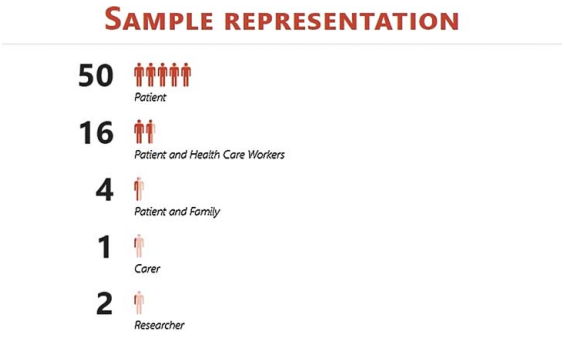

Figure 5: Example of data presentation in a scoping review: a visual representation of the different types of populations included within the evidence sources

PRISMA-ScR also provides an appendix (PRISMA extension for Scoping Reviews explanation and elaboration) that describes each section, details which sections need to be reported within a scoping review, and provides a written example of how this can be achieved within a report.

Software

There are many software programs that can be used to assist in the extraction, analysis, and presentation of scoping review data. These include Google Sheets (Alphabet Inc., California, USA), as this allows for real-time editing and can manage version control issues; however, Microsoft Excel (Redmond, Washington, USA) is also appropriate for data extraction and can facilitate basic descriptive analyses. NVivo (QSR International, United Kingdom) is also often used in the extraction, analysis, and presentation of qualitative information. Further, data visualization programs can include Microsoft Power BI or Tableau (Salesforce, California, USA). For mapping, EPPI-Mapper (Digital Solution Foundry and EPPI-Centre, London, UK) and EndNote (Clarivate Analytics, PA, USA) are useful tools, among others.

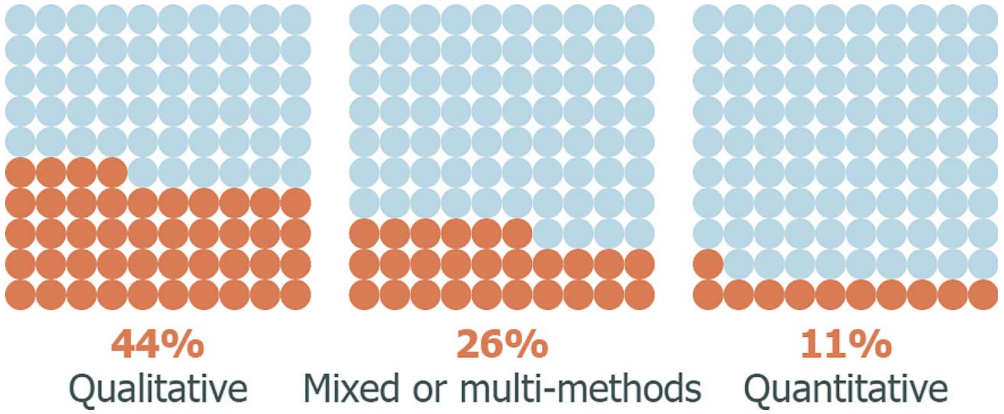

Figure 6: Example of data presentation in a scoping review: waffle chart of the methodology used within the included evidence sources

Author familiarity with the software and its application helps facilitate the data extraction, analysis, and presentation of results.

Conclusion

Scoping reviews aim to systematically identify and map the breadth of evidence available on a particular topic, field, concept, or issue within or across particular contexts, and this requires a different analytical approach from systematic reviews. The extraction, analysis, and presentation of results within a scoping review can be challenging due to the variety of evidence sources that scoping reviews can include and the absence of specific guidance for reviewers. This article has partially addressed this gap by providing guidance on how to extract, analyze, and present data within scoping reviews. It is hoped that scoping review authors will be able to use this guidance to improve the quality and clarity of published scoping reviews and to make conducting and reporting scoping reviews easier.

Funding

ACT is funded by a Tier 2 Canada Research Chair in Knowledge Synthesis. ZM is supported by an NHMRC Investigator Grant, APP1195676. The funding bodies did not have any input into the paper.

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