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Invited Review Article

Practical Guidance for Knowledge Synthesis: Scoping Review Methods

Craig Lockwood,[1,*] Kelli Borgess dos Santos,[2,3] Robin Pap[4]

[1] Implementation Science, The Joanna Briggs Institute, North Adelaide, Australia
[2] School of Nursing, University Federal of Juiz de Fora, Juiz de Fora, Brazil
[3] The Brazilian Centre for Evidence-based Healthcare: A Joanna Briggs Centre of Excellence, São Paulo, Brazil
[4] School of Science and Health, Western Sydney University, Sydney, Australia

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SUMMARY

Scoping reviews are a useful approach to synthesizing research evidence although the objectives and methods are different to that of systematic reviews, yet some confusion persists around how to plan and prepare so that a completed scoping review complies with best practice in methods and meets international standards for reporting criteria. This paper describes how to use available guidance to ensure a scoping review project meets global standards, has transparency of methods and promotes readability though the use of innovative approaches to data analysis and presentation. We address some of the common issues such as which projects are more suited to systematic reviews, how to avoid an inadequate search and/or poorly reported search strategy, poorly described methods and lack of transparency, and the issue of how to plan and present results that are clear, visually compelling and accessible to readers. Effective pre-planning, adhering to protocol and detailed consideration of how the results data will be communicated to the readership are critical. The aim of this article is to provide clarity about what is meant by conceptual clarity and how pre-planning enables review authors to produce scoping reviews which are of high quality, reliability and readily publishable.

Introduction

Systematic reviews (SR) are widely accepted as high level evidence and an important strategy for identifying, critiquing and synthesizing the best available evidence on topics related to care and therapeutics [1,2]. The objective of a SR is to provide a comprehensive, unbiased synthesis of relevant studies using rigorous and reproducible scientific method, and when conducted and reported in accordance with international standards, they offer a valuable contribution to knowledge for informing clinical decision making. This is reflected in the definition by Munn et al which describes a systematic review as a robust, reproducible, structured critical synthesis of existing research [3]. Others have indicated the aim of a SR is to retrieve international evidence and synthesize the results of evidence to inform practices and policies, while Munn et al indicated that other types of synthesis, including literature reviews, evidence maps, rapid reviews and scoping reviews (ScR) are not included in this definition [3]. Scoping reviews have become an increasingly popular approach for synthesizing research evidence although the objectives are slightly different to that of systematic reviews [1,4,5]. A scoping review is considered by some authors to be a type of systematic review, however the level of complexity that is required across multiple phases in order to produce a high quality and hence publishable ScR is not well acknowledged [4,5].

As with any research project, a scoping review should not be undertaken without significant pre-planning in order to ensure those involved understand what a scoping review is, why they are useful, how to manage each step and phase, and what to expect as the output or results. A scoping review as described in the JBI methodology is a type of synthesis, rather than a type of systematic review, yet many of the steps and processes undertaken in a systematic review are mirrored in a scoping review; the differences are subtle, relating to the objectives, and to aspects of method. For example, ScR do not usually include critical appraisal, nor are the results used to create recommendations for policy or practice as these are reviews that describe rather than analyze and report [2,6].

Craig Lockwood: https://orcid.org/0000-0003-3722-676X; Kelli Borgess dos Santos: https://orcid.org/0000-0001-8423-9147; Robin Pap: https://orcid.org/0000-0002-7058-0341

* Correspondence to: Craig Lockwood, PhD, Director, Implementation Science, The Joanna Briggs Institute, Level 3/55 King William Road, 5006 North Adelaide, Australia.

E-mail address: craig.lockwood@adelaide.edu.au

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As described in this paper, there are key resources to guide authors, in relation to method and methodology as well as the minimum reporting criteria; and both types of guidance should be included in project planning so that each step of the review is based upon sound guidance. However, the other key resource that may be overlooked in guidance is the people who will conduct the review [2,6]. Each scoping review project will benefit from a range of experience, knowledge and expertize; it should not be assumed that previous experience with systematic reviews is fully transferable to scoping review projects, or that following previously published examples will lead to a publishable article. Methods change over time, therefore this paper presents the view that knowing which guidance to access and from where is critical. Equally having topical, methodological and searching expertize in a review team will consistently lead to a better report than if an individual completes a scoping review by themselves [1,4,5].

A range of common pitfalls have been noted in previous literature on scoping reviews, we advocate for following open access methodology to promote consistency and quality of submissions for publication. This paper addresses some of the common issues such as projects that have a limited objective which is more suited to systematic reviews, an inadequate search and/or poorly reported search strategy, poorly described methods and lack of transparency, and the issue of how to plan and present results that are clear, visually compelling and accessible to readers. These issues can be avoided through effective pre-planning, adhering to protocol and detailed consideration of how the results data will be communicated to the readership. The aim of this article is to provide clarity about what is meant by conceptual clarity and how pre-planning enables review authors to produce ScR which are of high quality, reliability and readily publishable.

Phase 1: Pre-planning

Conceptual clarity when planning a review project has been described as the difference between success and failure [3]. In our experience conceptual clarity involves knowing which methods are best suited to particular types of review questions, and ensuring that the inclusion criteria and methods are appropriate for the question. The methods have been described as the engine room which drives and guides research. A structured question and detailed inclusion criteria are the basis of all empirical inquiry, including ScR. It should be based upon the key, contemporary resources and knowledge to guide authors in the processes and decisions made when undertaking a scoping review [2,6,7]. The pre-planning phase begins with the identification of fundamental resources that can be relied upon to guide both the development of the review, and to help ensure that best practice standards are maintained and to facilitate publication of the completed scoping review report. The two most recent forms of guidance with active methodological groups (active methodological support is a critical indictor for up-to- date methods) are the PRISMA-ScR reporting guidelines and the JBI Methodological Guidelines for the conduct of scoping review [2,6,7].

PRISMA is the work of a group of international experts who identified the minimum reporting criteria for systematic reviews that would represent a high quality scientific publication. The PRISMA checklist is one of the most globally recognized reporting instruments and is now supplemented by an extension specific to scoping reviews. PRISMA-ScR is the extension which has been created to support author teams in adhering to best practice when preparing their scoping projects for publication [7]. The other premier resource for scoping reviews is the JBI Reviewer's Manual, with a full chapter on scoping reviews to provide authors with a comprehensive guide to conducting JBI ScR. It describes in detail the planning, undertaking and reporting using JBI methods, and is congruent with PRISMA-ScR [2,6].

The fundamental approach to ScRs of these two documents, which in our view provide the most current and contemporary advice for potential authors, forms the basis of this paper. It is important to understand the difference between these two key resources. The JBI guidance provides direction and advice on methods, on what to do, and why to do it, while the PRISMA-ScR checklist is to help clarify minimum reporting standards when developing a publication. Both resources should be used extensively when planning a scoping review project.

Pre-planning is based around the development of a protocol that describes the review question and methods, this may include publication or registration of a protocol in databases such as PROSPERO, or in journals, or online repositories. The place of publication of a protocol is less important than the principal of enabling open access to the review question and methods so that readers can be confident that a scoping review followed a rigorous and transparent process. Examples of protocols are freely available from the Joanna Briggs Institute website.

Effective pre-planning means the review team will be able to confirm that a scoping review is the best approach for the particular question, ensure that the knowledge needs that started the project are congruent with the kinds of outputs a scoping review produces, and that a systematic review is not a better option for the knowledge needed by key stakeholders [3]. The reasons a scoping review might be planned are illustrated in Figure 1.

When the above objectives do not apply, it is likely that a scoping review is not going to be the preferred approach. If the objective of a review project is to measure effectiveness in a specific and often narrowly defined population using statistical analysis to identify whether an intervention or practice is effective or not, a scoping review is not the right method. Instead a quantitative systematic review method should be chosen [2]. If the objective is to understand a phenomena of interest through the experiences of patients, staff or others involved in healthcare, qualitative synthesis using meta-aggregation would be the preferred methodology [2]. If one of these (1-7) reasons is the primary objective for your project, a scoping review might be the right approach [6]. Establishing a 'fit for purpose' objective can be difficult. The following two examples are drawn from published work to illustrate how the objectives of a project inform the choice of methods, and align with questions best suited to a scoping review.

Objective one

Some scoping reviews are planned to enable identification of research or systematic review topics. For example a scoping review of barriers to safe injection practices and interventions that have been used to reduce unsafe injection practices by anesthesia providers in developed countries was proposed and described in an a-priori protocol [8]. The stated purpose of their project was to establish whether there was sufficient literature to develop systematic reviews in the future, and is therefore a good fit with objective one for scoping review methods.

Objective four

Øyeflaten et al wanted to identify the different types of eHealth interventions workplaces and healthcare settings can use to facilitate work participation [9]. The authors were seeking to collate all available types of eHealth interventions that facilitate work participation to identify which areas have eHealth resources, whom are they for, and in which settings have they been implemented [9]. This was aligned with objective four above as it intended to

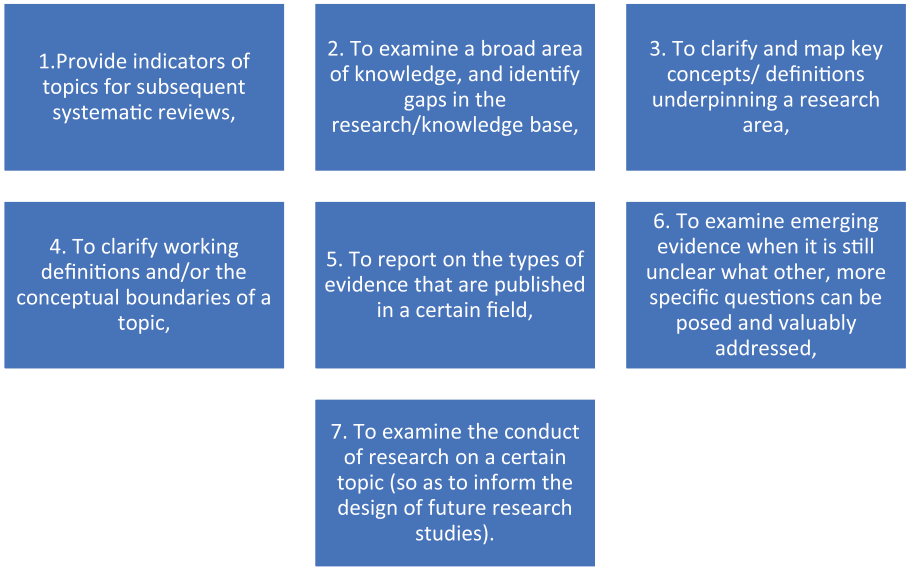

Figure 1. Objectives that indicate the rationale for conducting a scoping review [1,4,5].

describe rather than quantitatively analyze the range of work-related outcomes available in the literature.

If the objective of a project is to establish diagnostic test accuracy, reliability of measurement instruments, to measure risks associated with an exposure, or present a summary of the quality of published literature, a scoping review is not the optimum methodology. Once the group (scoping reviews should done by teams, including a librarian, people with topical expertize and people with experience in scoping reviews; not by individuals) has established that a scoping review is the right approach, and become familiar with guidance and reporting criteria, the next step (phase 2) is to develop a protocol. The protocol describes in detail the objective(s), question(s), inclusion criteria and how the steps in the review will be completed. A protocol is considered to be the optimum way to preserve rigor and promote transparency in scoping reviews [2].

Phase 2: The Protocol Phase

Some early sources do not recommend or require a protocol; however, more recent guidance suggests a protocol is preferred. PRISMA-ScR recommends authors state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number [7]. A protocol will take time and effort to prepare but will increase the scientific transparency of the final report, making it more likely to be considered publishable in reputable journals. Once the scoping review report is completed, it should cite (reference) the protocol; citing the protocol acts to increase awareness that the project was guided by an a-priori protocol, increases the transparency of reporting, and thus the alignment with quality reporting criteria [7].

Peters et al identified 9 steps in the process for a scoping review, and each of these should be described in the protocol [6]. The protocol, as with a primary research protocol describes processes used, decisions and how they will made and the types of resources that guided the scoping project. During a scoping review, the protocol is the guide that all team members rely upon to make clear, consistent decisions, how each of the steps will be managed should be described in the protocol [6].

There may be one, or multiple questions in a scoping review, the questions need to be aligned to the stated objective(s) for the project, and be characterized by at least one of the purposes illustrated in Figure 1. While systematic reviews of the effects of interventions require questions that use a highly structured mnemonic (such as PICO: population, intervention, comparator, outcome) to describe and guide what papers will be considered relevant, a scoping review uses broader criteria (PCC: Participants, Concept and Context) that avoids a narrow focus, and instead enables a wider range of papers to be considered for inclusion. The wording of each question is important, it needs to be congruent with the purpose, and clearly illustrate the participant, concept and context of interest to the review team. For example de Goumoens et al aims and core questions were linked via clear descriptions of the population/participants, plus concept and context of interest [10].

The aim of this scoping review was to examine the range and nature of family-oriented interventions that have been developed and/or tested for people with acquired brain injury (ABI) and their families in all settings by answering the two following questions:

1. What are the aims and characteristics (type, delivery mode and duration, provider) of family-oriented interventions available for people with ABI and their families?
2. What types of outcomes have been reported in the literature when testing or implementing family-oriented interventions?

In the above example the aim of the review aligns with purposes three and five in Figure 1. The wording is important, note how the authors stated they were going to 'examine the range and nature … ' i.e. … look at all available interventions and describe their characteristics [10]. This purpose was then expanded on by defining the Participants, Concept and Context.

Participants

The participants were people with ABI and their families, note that this does not include requirements related to age, gender, type or location of injury, influence of injury on quality of life, or impact on physical, cognitive or psychosocial functioning. In a traditional systematic review, far more detail on the participants would be required in the protocol, such as age range, mode by which ABI was acquired, extent of injury and impact on the individual participants.

Concept

The concept described in this review was any family orientated intervention. Note how the authors did not limited the definition of 'family' by cultural characteristics or any other feature, this means the descriptions from papers identified in the search could use any definition of family and still be included. The authors also avoided limiting the type of family-orientated intervention or outcomes.

Context

The setting is the context in this example. There were no limits put on setting, which means papers from primary healthcare, community, acute hospital services and any other type of health service in any location such as metropolitan, rural or remote locations could be included.

These additional descriptors would have narrowed the inclusion criteria and limited how much literature would be included, which is not congruent with the intention of a scoping review. The benefit of narrower inclusion criteria in a systematic review is the ability to more precisely answer a question, but in a scoping review that may be less desirable.

Phase 3: Conducting and reporting a scoping review

Methods

Conducting a scoping review builds on the pre-planning phase and operationalizes the protocol. By this stage the review group has confirmed alignment between objectives, questions and inclusion criteria (population, concept and context). The next steps relate to how these characteristics guide the sequence for development of search strategies, the conduct of the search and the process for selecting the evidence. For illustrative purposes, we are using examples from published scoping review reports that have referenced an a-priori protocol (we recommend comparing a protocol with a published scoping review as a self-guided learning activity for novice reviewers); and have been through a rigorous peer review process.

We are describing the general characteristics of searching, not the specific techniques and technical considerations; those specialized knowledge needs are best informed by working with an information scientist as part of the review group. The PCC mnemonic provides the core detail on the inclusion criteria related to the scoping review topic, but further detail is needed to specify what kinds of papers will be considered for inclusion and how the search strategies will attempt to locate them, enabling screening and study selection to be completed [6]. The word studies is often used, but it has connotations suggesting that the literature consists of research; the review team should consider whether their specific topic of interest should be searched more widely, or limited to research papers. Note that in Figure 1, the terms research, knowledge and evidence are used, but are not interchangeable. In JBI, evidence and knowledge are broader terms that includes research, but also includes policy and sources of expert opinion, textual and narrative data while research is limited to empirics (which can be qualitative, quantitative, economic etc).

Searching

Øyeflaten et al described a search strategy that focused on empirics (research) and excluded broader types of knowledge such as narrative, text and opinion [9]. The objective of their scoping review was to identify types of eHealth interventions used in workplace settings, which did not require the exclusion of non-research papers and usually a rationale would be recorded for why this decision was made. Their description of the types of studies is both succinct and encompassing. They stated:

> 'The current scoping review will include empirical studies with either qualitative or quantitative data published in English, Norwegian, Swedish or Danish. The review will exclude all types of reviews, protocols, book chapters, editorial letters, guidelines and website' [9].

Empirics being research, these authors intend to focus on research studies, but also clarify that this is across multiple language groups. Note the types of content that will be excluded are generally not sources of research evidence. Other scoping reviews have described highly detailed lists of the specific types of studies that will be included, and this more descriptive model is preferred as it removes uncertainty about what exact kinds of papers will be included, it also helps readers of the published scoping review to evaluate whether any important and relevant study designs were not included. de Goumoens et al for example listed 12 different methods for quantitative research, as well as qualitative and mixed-methods papers for their scoping review [10].

The methods section of a scoping review reports in detail how the methods described in the protocol were actioned, they also give the rationale for any variations from protocol (i.e. changes that vary from what was originally described in the protocol). The level of detail reporting the search process is central to the quality and usefulness of the completed review. PRISMA-ScR reporting requirements are the optimal guide at this point of a scoping review project [7]. Items seven, eight, nine and ten of the ScR checklist include the following descriptions related to the information sources, the search and study selection:

- Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.
- Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.
- State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.
- Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.

These four points require significant attention to detail, and groups doing a scoping review are encouraged to read published examples of scoping reviews, and to follow the JBI guidance, as this getting these steps correct is crucial to publication [2,6]. Knowledgeable readers will carefully review the methods before proceeding to the results — thus carefully following guidance and matching the PRISMA-ScR requirements is important to not only the quality of your work, but also whether or not it will be read. The presentation of the results is important, getting a clear, easy to read summary of many studies is a skill that takes time to develop, the remainder of this section focuses on worked examples of data presentation that improve readability and facilitate access to the data identified and extracted from the included papers.

Results

Results sections have a defined sequence which is based upon reporting firstly about the numbers and characteristics of studies

before moving into what the included studies had to say about the topic based upon the extracted data. Given the volume of data in scoping reviews, it is tempting to create numerous Tables, and write large swathes of text, and in some cases, these may be the best options for presenting data; however, visual options are powerful methods for communicating and should be considered. Data in scoping reviews is generally descriptive, this may include frequencies, measures of central tendency, plots indicating concepts or aspects of population characteristics or context. While advocating for innovative presentation of data, a word of caution: use visuals to effect by not over-using them. Reporting on study characteristics visually can include aspects of quality such as methods of validity testing of instruments across the included studies (Figure 2) [11]. The ability to report data visually requires pre-planning of data extraction, so that spreadsheets can be set up and data extraction while time consuming is only done once rather than going back to the papers for further data.

Presentation of results data

Results data can also be usefully presented as graphs, particularly where the concept or context of the review is broad and has multiple characteristics (Figure 3) [10]. Equally, Tables can be used to good effect, but must be thoughtfully put together — considering the knowledge needs and interests of potential readers and how to best communicate key findings with them. In Table 1 for example, the authors have summarized four separate factors related to interventions for along with the number of studies reporting the factors in the review of family-oriented interventions for adults with acquired brain injury and their families [10].

Categories of data that can be summarized concisely across multiple studies are well suited to presentation in Tables. If a review includes multiple Tables that report data on a per paper basis, the authors have probably not given adequate consideration on how to present their data. Table 1 is a good example of communicating complex textual data concisely across multiple studies to convey and clarify meaning [10].

Figure 4 presents the areas of topic coverage, showing areas with low research availability and those areas with larger numbers of studies and uses color codes to visually separate data for the population, concept and categories identified in the review [12]. This is an excellent model for presenting complex data across studies and clearly indicating the type of data and availability of research; it is a good fit with most of the core objectives which indicate a scoping review is the method of choice (Figure 1).

Discussion

Scoping reviews offer value to health researchers, post-graduate students academics and policy makers who want to establish baseline data about the availability of research on a topic, or to plan for future research and reviews; however, the reporting and presentation of data often mean their results are difficult to read and use. Pre-planning and conceptual clarity of the entire review project is essential for a good quality, publishable scoping review report [4]. A scoping review is a group project that requires expertize on searching, as well as availability of a wide range of data sources, searching a single database such as Pubmed should not be considered adequate for a scoping review.

The core processes when doing a scoping review is to explore and summarize data [2]. The reasons as outlined in Figure 1 provide guidance as to whether a scoping review should be considered, or whether another approach is better suited to the review teams aims. Any objective that is based around understanding the range or scope of a concept or field of inquiry, or where future research planning requires a clear picture of the availability and gaps in existing research is a useful indicator for a scoping review [6]. These are broad objectives that are well suited to the approach. If the objective in terms of population, concepts or context, type of literature or scope for searching is narrow then a scoping review may not be the best approach.

Once the author team have discussed the objectives of the project formal confirmation should include that there is alignment with one or more indications for a scoping review. With the approach established, the author team should familiarize with key guidance and reporting standards in the field, these include the PRISMA-ScR and JBI methodological guidance [6,7]. Having access to (both are open access resources) and familiarity with guidance will help the review team avoid many fundamental mistakes or omissions that could adversely affect publication. Pre-planning informs protocol development, including the review parameters, methods and where the protocol will be made available to the research community, open access sources are recommended when planning to release a protocol. A protocol that describes the question, objectives and inclusion criteria may meet minimum reporting standards; however, it will lack transparency as there are many decisions that need to be reported in this phase of a scoping review project, including what data sources, how they will be searched, how the paper selection process will be managed, and what data will be reported in which formats. In this paper we have advocated for use of visual reporting with Figures and Tables that condense

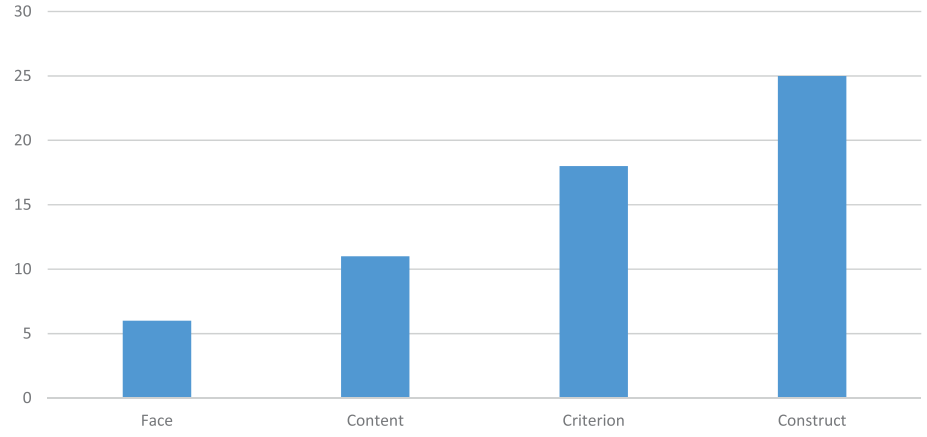

Figure 2. Overview of types of validation in included studies (y-axis [vertical]: number of studies; X-axis [horizontal]: type of validation) [11].

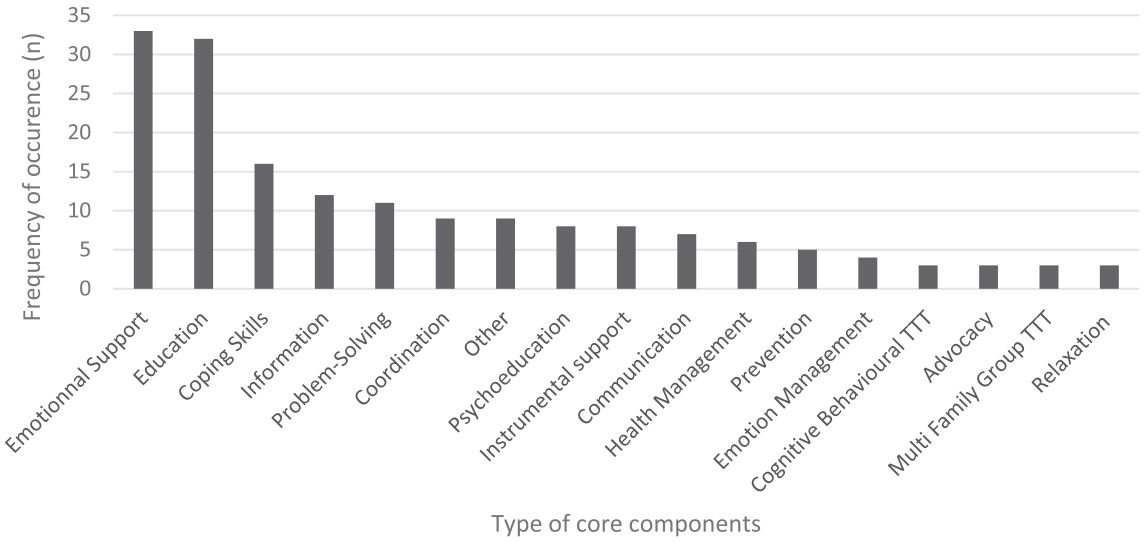

Figure 3. Type of core components, frequency of occurrence in the interventions included [10].

Table 1 *Frequency, Duration, Delivery Mode and Moment of Delivery for the Interventions Included [10].*

Frequency	n	Duration	n	Delivery mode	n	Moment	n
Weekly to bi-weekly	18	<3 months	30	Meetings	33	Acute phase	5
Monthly to bi-monthly	13	3-6 months	12	Phone calls	3	Discharge period	12
Irregular	25	6months – 1 year	11	Technology	6	Rehabilitation	9
One episode	3	1 year	6	Combined	17	Chronic phase	36
Others	5	No detail	5	Not applicable	5	Not applicable	2

data across studies; the review team should discuss and plan how this will be done and report the details in the protocol. Plan to use a range of visual strategies, and aim to avoid a text dense results section, similarly plan to avoid using Tables which extend for pages unless the team is able to communicate to readers why this data presentation format is important. As described earlier, pre-planning that includes what data will be extracted and how it will be presented to communicate the key messages is a scoping review that will have greater clarity and hence increased readability [7].

A flawed approach to planning a scoping review would be to read and follow previously published scoping reviews. This increases the likelihood of replicating another authors mistakes, rather than producing a high quality scoping review report that carefully follow recent methodological guidance. The two core guidance documents authors of scoping reviews should consider have important yet distinct functions. The JBI guidance provides the logical, step-wize description of how to conduct a scoping review, it provides insights in to what decisions to make, when and why in the process; it is the work of an active, international methods group and therefore is up to date [7]. Guidance can be pre-read by the review group in order to facilitate planning, to share workload and to ensure the project keeps on track. The PRISMA-ScR has been extensively referred to in this paper, and is an expert-developed checklist with supporting evidence for optimal reporting criteria for scoping reviews [7]. The checklist is open access, and should guide how the write up for publication proceeds, author teams will ideally ensure each item in the checklist is included in their manuscript when preparing for publication. The primary lesson from this paper should be that author teams follow current methodological guidance (rather than previously published scoping reviews) and prepare their manuscripts for publication following the reporting requirements of PRISMA-ScR, noting this is important for publication in contemporary journals [12,13]. The key aspects of a scoping review project highlighted in this paper include:

- Ensuring a team-based approach with representative expertize in the topic, methods and literature search requirements;
- Including a pre-planning phase to confirm the methodology is a good fit for the project objectives (Figure 1);
- The development of objectives that match the participants, concept and context using the PCC mnemonic;
- Identification and reliance upon up to date guidance and reporting criteria;
- Involvement of an information scientist in all phases of the project and its publication;
- Develop an a-priori protocol that is registered or publicly available, and later, referenced in the scoping review paper submitted for publication;
- Plan in advance how the data will be presented, use visual reporting to increase impact.

This paper presents an overview on how to plan, prepare and conduct a high-quality scoping review that meets reporting requirements, using published methodological guidance and examples from literature, beginning with types of questions scoping reviews are intended to address. The use of a pre-planning phase is important for project management, and if incorporated well, will lead to a better quality scoping review, which is more likely to be suited to publication [13]. Ensuring alignment between the objectives, title and inclusion criteria is essential in any review project, arguably moreso in a scoping review due to the increased volume of data that the review team have to manage, the

Figure 4. Visual representation of outcomes of scoping review and number of relevant studies [12].

alignment between objectives, title and inclusion criteria will help ensure the review team focus on the review question, without getting side-tracked [4,6].

Conflict of interest

The authors declare there are no financial or other actual or potential conflicts of interest. This paper was written in our own time, no funding was provided and no financial incentives/rewards will be received. All authors are deeply interested in the topic and have therefore contributed equally.

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