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PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation

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ABSTRACT

Scoping reviews, a type of knowledge synthesis, follow a systematic approach to map evidence on a topic; identify main concepts, theories and sources; and determine where the gaps are. Though increasing in numbers, the methodological quality and reporting quality of scoping reviews need improvement. This document presents the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for scoping reviews (PRISMA-ScR) checklist and explanation. Developed by a 26-member expert panel according to published guidance by the EQUATOR (Enhancing the QUAlity and Transparency Of health Research) Network, the checklist contains 20 essential items plus 2 optional items. A rationale, along with an example of good reporting, is provided for each item. The intent of the PRISMA-ScR is to help readers, including researchers, publishers, commissioners, policy-makers, healthcare providers, guideline developers, and patients/consumers develop a greater understanding of relevant terminology, core concepts and key items to report for scoping reviews.

1. INTRODUCTION

Scoping reviews can be conducted to meet various objectives. They may examine the extent (i.e., size), range (i.e., variety) and nature (i.e., characteristics) of the evidence on a topic or question; determine the value of undertaking a systematic review; summarize findings from a body of knowledge that is heterogeneous in terms of methods or discipline; or identify gaps in the literature to aid planning and commissioning of future research (1, 2). A recent scoping review by members of our team showed that while the number of scoping reviews in the literature is increasing steadily, evidence suggests that both their methodological quality and reporting quality need to improve to facilitate complete and transparent reporting (1). Results from our survey on scoping review terminology, definitions and methods revealed a lack of consensus on how to conduct and report scoping reviews (3).

The Joanna Briggs Institute (JBI) published guidance for the conduct of scoping reviews in 2015 (4) (which was updated in 2017) (5), based on earlier work by Arksey and O'Malley (6) and Levac et al. (7). However, a reporting guideline for scoping reviews currently does not exist.

Reporting guidelines outline a minimum set of items to include in research reports and have been shown to increase methodological transparency and uptake of research findings (8, 9). Although a reporting guideline exists for systematic reviews, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement (10), scoping reviews serve a different purpose than systematic reviews (11). Systematic reviews are useful for answering clearly defined questions (such as, Does this intervention improve specified outcomes when compared to a given comparator in

this population?), whereas scoping reviews are useful for answering much broader questions (such as, What is the nature of the evidence for this intervention? Or What is known about this concept?). Given the difference in objectives, and therefore, in the methodological approach (e.g., presence vs. absence of a risk of bias assessment or meta-analysis), the reporting items considered to be essential for systematic reviews would differ for scoping reviews – i.e., some PRISMA items may not be appropriate, while other important considerations may be missing (12-14). We deemed that a PRISMA extension for scoping reviews is needed to provide reporting guidance for this specific type of knowledge synthesis. This extension is also intended to be applicable to evidence maps (15, 16), which share similarities with scoping reviews, and involve a systematic search of a body of literature to identify knowledge gaps, with a visual representation of results (e.g., a figure, graph, etc.).

2. METHODS

The PRISMA extension for scoping reviews (hereafter, the PRISMA-ScR) was developed according to published guidance by the EQUATOR (Enhancing the QUAlity and Transparency Of health Research) Network for the development of reporting guidelines (9).

2.1 Protocol, advisory board and expert panel

Our protocol was drafted by the research team and revised, as necessary, by the advisory board prior to being listed as a reporting guideline on the EQUATOR (17) and PRISMA (18) websites. The research team included two leads (ACT, SES) and two

research coordinators (EL, WZ); all of whom did not participate in the scoring exercises, and a 4-member advisory board (KOB, HC, DL, DM) with extensive experience with scoping reviews and/or the development of reporting guidelines. We aimed to have a representative expert panel in terms of geography and stakeholder type; including individuals with experience in the conduct, dissemination, or uptake of scoping reviews.

2.2 Survey development and round 1 of Delphi

The initial step to developing the Delphi survey via Qualtrics (an online survey platform) (19) involved identifying potential modifications to the original 27-item PRISMA checklist. The modifications were based on a research program carried out by members of the advisory board to better understand scoping review practices (1, 3, 20) and included: a broader research question and literature search strategy, optional risk of bias assessment and consultation exercise (whereby relevant stakeholders contribute to the work, as described in the Arksey and O'Malley framework (6)), and the inclusion of a qualitative analysis. For round 1 of scoring, we prepared a draft of the PRISMA-ScR (see Supplement 1) and asked expert panel members to rate the extent to which they agreed with the inclusion of the list of items in using a 7-point Likert scale (1=entirely disagree, 2=mostly disagree, 3=somewhat disagree, 4=neutral, 5=somewhat agree, 6=mostly agree, 7=entirely agree). Each survey item included an optional text box where comments about the respective item(s) could be provided. The research team pilot-tested the survey for content and clarity prior to administering it, and we also sent bi-weekly reminders to optimize participation.

2.3 Survey analysis

An 85% consensus rule was selected *a priori* to signify agreement amongst the expert panel, to be conservative. This rule required that at a minimum, 85% of the panel *mostly or entirely agreed* (i.e. corresponding to the scoring values of 6 or 7 on the Likert scale used for each of the survey items) with the inclusion of the item in the PRISMA-ScR. If less than 85% agreement was observed, we considered the item to be discrepant. This standard was used for all three rounds of scoring to inform the final checklist. For ease and consistency with how the survey questions were worded, we did not include a provision for agreement on exclusion (i.e., 85% scoring values of 1 or 2 on the Likert scale). We summarized all of the submitted comments to help explain the scorings and identify any issues. For the analysis, the results were stratified by group (i.e., in-person meeting vs. online, hereafter e-Delphi participants) given the possibility that discrepant items could differ between the arms.

2.4 In-person arm (round 2 of Delphi)

We established the Chatham House rule (21) at the beginning of the meeting, whereby participants are free to use information that is shared but may not reveal the identity or the affiliation of the speaker. Expert panel members were provided the following: their individual results, the overall group distribution, median and interquartile range and a summary of the JBI methodological guidance (4), as well as preliminary feedback from the E-Delphi arm (described below). These data were used to generate and inform the discussion about each of the discrepant items from round one. ACT and SES facilitated the discussion using a modified nominal group technique (22), a consensus-building

method and panel members were subsequently asked to re-score the discrepant items using sli.do (23), a live audience-response system in a format that resembled the round one survey. For items that failed to meet the threshold for consensus, working groups were assembled (described below). The meeting was audio-recorded and transcribed using Transcribe Me (24), and 3 note-takers independently documented the main discussion points. The transcript was annotated to complement a master summary of the discussion points, which was compiled using the 3 note-takers' files.

2.5 E-Delphi arm (round 2 of Delphi)

Those who were unable to attend the in-person meeting participated via an online discussion exercise using Conceptboard (25), a visual collaboration platform that allows users to provide feedback on 'whiteboards' in real-time. We presented the discrepant items from round one as a single board in Conceptboard (25) with questions (e.g., "After reviewing your survey results with respect to this item, please share why you rated this item the way you did") assigned to participants as tasks, to facilitate the discussion. E-Delphi panel members were provided with the same materials as those distributed at the meeting and were encouraged to respond to others' comments and interact through a chat feature. The second round of scoring was conducted in Qualtrics using a similar format as in round one. We shared a summary of the Conceptboard (25) discussion, as well as the annotated meeting transcript and master summary document so that participants could learn about the perspectives of the in-person group before re-scoring.

2.6 Working groups and round 3 of Delphi

To enable panel-wide dialogue and refine the checklist items prior to the final round of scoring, we created working groups that collaborated by teleconference and email. Their task was to discuss the discrepant items; in terms of the key issues and considerations (relating to both concepts and wording) that had been raised in earlier stages, across both arms. To unite the data from the two arms, we conducted a third round of scoring using Qualtrics (19). This step involved the full panel scoring an updated list of items that had failed to reach consensus in the first two rounds across both arms, with the suggested modifications (relating to both concepts and wording) from all previous stages incorporated.

2.7 Interactive workshop (testing)

A workshop led by ACT and facilitated by members of the advisory board/expert panel (SES, CMG, CG, TH, MTM, and MDJP) was held as part of the Global Evidence Summit in Cape Town, South Africa in September 2017. The PRISMA-ScR was applied to a scoping review on a health-related topic (26) by participants (e.g., researchers, scientists, policy makers, managers, and students) to test the checklist .

3. RESULTS

3.1 Expert panel

A total of 37 individuals were invited to participate – of these, 31 people completed round 1 and 24 completed all 3 rounds of scoring. Results of the modified Delphi,

including the number of items that met agreement at each stage are presented in Figure 1.

3.2 Round 1 of Delphi

For the in-person arm, which involved 16 individuals, 9 of the 27 items reached agreement. For the discrepant items, agreement ranged from 56% for item 15 (risk of bias) to 81% for items 3 (rationale), 16 (additional analyses), 20 (results of individual sources) and 23 (additional analyses). For the E-Delphi arm, which involved 15 individuals, 8 of the 27 items met the 85% agreement threshold. For the discrepant items, agreement ranged from 40% for item 12 (risk of bias) to 80% for items 3 (rationale), 25 (limitations) and 26 (conclusions).

3.3 In-person meeting and round 2 of Delphi

The 16 panel members who attended the in-person meeting in Toronto on November 29th, 2016 were largely from North America, along with others from Australia, Lebanon, and the United Kingdom. Of the 18 discrepant items from round 1, 11 were re-scored after discussion. All reached the 85% threshold of agreement, except for one – item 7, information sources, which had 83% agreement. For the remaining seven items, the group felt that notable changes to the items were required, which formed the basis of action by the working groups.

3.4 E-Delphi online discussion and round 2 Delphi

Fifteen panel members were invited to participate in the online discussion exercise, from countries including Canada, United Kingdom, Switzerland, Norway, and South

Africa. Overall, 50% of panelists participated in at least one discussion on Conceptboard (25) (7/14) and 1 dropped out. Eleven individuals completed the second scoring exercise of the 19 discrepant items, whereby 5 items reached 85% agreement.

3.5 Working groups and round 3 of Delphi

There were 6 working groups (with one call per group), ranging in size from three to eight participants, with an average of five people per group. For round 3 of the Delphi, the 11 items that reached consensus during either round one or round two across both the in-person and E-Delphi arms were not included. The survey focused on the remaining 16 items that failed to reach consensus across both arms, to ensure that decisions made by one arm did not take precedence over the other.

A total of 27 people were invited to participate in round 3 of the Delphi; 16 from the in-person meeting arm and 11 from the E-Delphi arm. Overall, 24 out of 27 completed the final round of scoring and 3 individuals withdrew (2 from the in-person arm and 1 from the E-Delphi). Two of the 16 applicable items failed to meet the 85% agreement threshold; items 10 (data collection process) and 15 (risk of bias across studies). Item 15 was subsequently removed from the checklist, though item 10 was retained but revised to exclude the optional consultation exercise step described by Arksey and O'Malley and Levac et al., which was the source of the disagreement. Furthermore, it was decided that the consultation exercise could be considered a knowledge translation activity, which could be conducted for any type of knowledge synthesis.

3.6 Interactive workshop (testing)

A total of 30 participants attended an interactive workshop at the Global Evidence Summit in September 2017 in Cape Town, South Africa, where minor revisions were suggested for wording of the items.

3.7 PRISMA-ScR checklist

The final checklist, with 20 items plus two optional items, is presented in Table 1. It consists of 10 items that reached agreement in rounds 1 and 2 (1,3,5,6,8,9,17,25-27), along with the 10 items that were agreed upon in round 3 (2,4, 7,10,11,14,18,20,21,24). Five items from the original PRISMA were deemed not relevant. They included: items 13 (summary measures, excluded after round 1) and the following 4 items, which were excluded after round 3: 15 (risk of bias across studies), 16 (additional analyses), 22 (risk of bias across studies results), and 23 (additional analyses results). See Figure 1 for an illustration of the process. In addition, because scoping reviews can include many different types of evidence (e.g., documents, blogs, websites, studies, interviews, opinions) and are not conducted to examine the risk of bias of the included sources, items 12 (risk of bias in individual studies) and 19 (risk of bias within studies results) from the original PRISMA are treated as optional in the PRISMA-ScR.

3.8 PRISMA-ScR Explanation and Elaboration

Each of the PRISMA-ScR checklist items is elaborated upon in Supplement 2. In this document, each item is defined and accompanied by examples of good reporting from

existing scoping reviews to provide authors with additional guidance on how to use the PRISMA-ScR.

4. DISCUSSION

The PRISMA-ScR is intended to provide guidance on the reporting of scoping reviews. To develop this PRISMA extension, we adapted the original PRISMA Statement and made the following revisions: five items were removed (as they were deemed not relevant to scoping reviews), two items were deemed optional, and the wording was modified for all of the items. Our reporting guideline is consistent with the JBI guidance for scoping reviews, as the JBI guidance is detailed and highlights the importance of methodological rigor in the conduct of scoping reviews. We hope that the PRISMA-ScR will improve the reporting of scoping reviews and increase their relevance for decision-making, and that adherence to our reporting guideline will be evaluated in the future, which will be critical to measure its impact.

The PRISMA-ScR will be housed on the websites of the EQUATOR Network's library of reporting guidelines and the Knowledge Translation Program of St. Michael's Hospital (27). To promote its uptake, we will create 1-minute YouTube videos to outline how to operationalize each of the items; offer webinars for organizations that conduct scoping reviews, and create 1-page tip sheets for each item. In the future, we will consider creating an automated email PRISMA-ScR dissemination tool, as well as an online tool similar to Penelope, which verifies manuscripts for completeness and provides feedback to authors as they prepare to submit their work to the BMJ Open journal (28). We will share the PRISMA-ScR widely within our networks, including the Alliance for Health

Policy and Systems Research, the World Health Organization (WHO) (29) and the Global Evidence Synthesis Initiative (30). We will also l collect and review readers' suggestions to improve uptake of the PRISMA-ScR via an online feedback form on the Knowledge Translation Program of St. Michael's Hospital's website (27).

Study Protocol: Available at EQUATOR and PRISMA websites.

Data Set: Available from corresponding author.

CONTRIBUTIONS

ACT developed the original idea, oversaw all stages of the project, facilitated the in-person meeting, wrote the manuscript draft, and is the guarantor for this manuscript. EL wrote sections of the manuscript and coordinated and operationalized all stages of the project with WZ. KOB, HC, DL, DM, MDJP, TH, LW, SH, EAA, CC, JM, LS, LH, AA, MGW, CG, SL, CMG, MTM, EVL, KS, JM, TC, and OT completed round 1 of scoring. KOB, HC, DL, MDJP, TH, LW, SH, EAA, CC, JM, LS, LH, AA, and MGW attended the in-person meeting and completed round 2 of scoring. CG, SL, CMG, EVL, and KS provided feedback on Conceptboard. DM, CG, SL, CMG, MTM, EVL, KS, JM, TC, and OT completed the E-Delphi round 2 of scoring. KOB, HC, DL, DM, MDJP, TH, LW, SH, EAA, CC, JM, LS, LH, AA, CG, SL, MTM, and KS participated in the working group discussions. KOB, HC, DL, DM, MDJP, TH, LW, SH, EAA, CC, JM, LS, LH, AA, MGW, CG, SL, CMG, MTM, EVL, KS, JM, TC, and OT completed the final round of scoring. SES developed the original idea, oversaw all stages of the project and facilitated the in-person meeting. All authors critically reviewed the manuscript and approved the final version.

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COMPETING INTERESTS

DM led the development of PRISMA, has been involved in the development of several PRISMA extensions, is an executive member of the EQUATOR Network, and is the director of the Canadian EQUATOR Centre. MDJP is the chair of the Joanna Briggs Institute Working Group for Scoping Review Methodology and is the lead author of the Joanna Briggs Institute Scoping Review Guidance chapters and articles. CMG is a contributing author on the Joanna Briggs Institute manuscript Guidance for conducting systematic scoping reviews. KS is a full-time employee of Cochrane. All other authors have no potential (or perceived) conflicts of interest to declare. SES is an associate editor for the Annals of Internal Medicine; she was not involved in the peer review process or decision-making of the manuscript.

ETHICAL APPROVAL

Research ethics approval (REB 16-176) for this study was granted by the St. Michael's Hospital Research Ethics Board on August 15th, 2016.

DATA SHARING

The results from the three rounds of scoring are available from the corresponding author upon reasonable request.

TRANSPARENCY STATEMENT

The lead author affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been

omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

SUPPLEMENTARY FILES

Supplement 1: PRISMA-ScR round 1 survey (with information sheet)

Supplement 2: The PRISMA Extension for Scoping Reviews (PRISMA-ScR): Explanation and Elaboration

Supplement 3: Letters of Permission

FIGURES

Figure 1: Methods flow

TABLES

Table 1: PRISMA-ScR checklist

Table 1: PRISMA-ScR Checklist

Section	Item	PRISMA-ScR checklist item	Reported on page #
Title			
Title	1	Identify the report as a scoping review.	
Abstract			
Structured summary	2	Provide a structured summary including, as applicable: background, objectives, eligibility criteria, sources of evidence, charting methods, results and conclusions that relate to the review question(s) and objective(s).	
Introduction			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review question(s)/objective(s) lend themselves to a scoping review approach.	
Objectives	4	Provide an explicit statement of the question(s) and objective(s) being addressed with reference to their key elements (e.g., population or participants, concepts and context), or other relevant key elements used to conceptualize the review question(s) and/or objective(s)).	
Methods			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., web address), and, if available, provide registration information including registration number.	
Eligibility criteria	6	Specify the characteristics of the sources of evidence (e.g., years considered, language, publication status) used as criteria for eligibility, and provide a rationale.	
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with authors to identify additional sources) in the search, as well as the date the most recent search was executed.	
Search	8	Present the full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	
Selection of sources of	9	State the process for selecting sources of evidence (i.e., screening, eligibility) included	

Section	Item	PRISMA-ScR checklist item	Reported on page #
evidence		in the scoping review.	
Data charting process	10	Describe the methods of charting data from the included sources of evidence (e.g., piloted forms; forms that have been tested by the team before their use, whether data charting was done independently, in duplicate) and any processes for obtaining and confirming data from investigators.	
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	
Critical appraisal of individual sources of evidence	12	***If done,*** provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	
Summary measures	13	*Not applicable for scoping reviews.*	
Synthesis of results	14	Describe the methods of handling and summarizing the data that were charted.	
Risk of bias across studies	15	*Not applicable for scoping reviews.*	
Additional analyses	16	*Not applicable for scoping reviews.*	
Results			
Selection of sources of evidence	17	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	
Characteristics of sources of evidence	18	For each source of evidence, present characteristics for which data were charted and provide the citations.	
Critical appraisal within sources of evidence	19	***If done***, present data on critical appraisal of included sources of evidence (see item 12).	
Results of individual sources of evidence	20	For each included source of evidence, present the relevant data that were charted that relate to the review question(s) and objective(s).	
Synthesis of	21	Summarize and/or present the charting results as they relate to the review	

Section	Item	PRISMA-ScR checklist item	Reported on page #
results		question(s) and objective(s).	
Risk of bias across studies	22	*Not applicable for scoping reviews.*	
Additional analyses	23	*Not applicable for scoping reviews.*	
Discussion			
Summary of evidence	24	Summarize the main results (including an overview of concepts, themes, and types of evidence available), explain how they relate to the review question(s) and objectives, and consider the relevance to key groups.	
Limitations	25	Discuss the limitations of the scoping review process.	
Conclusions	26	Provide a general interpretation of the results with respect to the review question(s) and objective(s), as well as potential implications and/or next steps.	
Funding			
Funding	27	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	

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Mini-glossary of PRISMA-ScR terms
Charting – The process of data extraction in a scoping review is referred to as 'data charting', as per the Arksey and O'Malley (2005) and Levac et al. (2010) frameworks and the JBI guidance (2015, 2017). **Critical appraisal** – Refers to the process of systematically examining research evidence to assess its validity, results and relevance before using it to inform a decision. This terminology is used for items 12 and 19, instead of 'risk of bias' (which is more applicable to systematic reviews of interventions) to be inclusive and acknowledge the various sources of evidence that may be included in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, policy documents). **Information sources** - This is where *sources of evidence* (see definition) are compiled from such as, bibliographic databases, social media platforms, websites, etc. **Sources of evidence** – A more inclusive/ heterogeneous term is used to account for the fact that different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, policy documents) may be eligible in a scoping review, as opposed to only studies. This is not to be confused with *information sources* (see definition).

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