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Tricco, Andrea C, Lillie, Erin, Zarin, Wasifa et al. (25 more authors) (2018) PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Annals of Internal Medicine*. pp. 467-473. ISSN 0003-4819

<https://doi.org/10.7326/M18-0850>

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103 **Keywords:** knowledge synthesis, scoping reviews, reporting guidelines, research
104 methodology

105 **Running Title:** The PRISMA-ScR statement

106 **Trial registration** - EQUATOR registration: [http://www.equator-](http://www.equator-network.org/library/reporting-guidelines-under-development/#55)
107 [network.org/library/reporting-guidelines-under-development/#55](http://www.equator-network.org/library/reporting-guidelines-under-development/#55)

108 **Word Count:** 147/200 (Abstract); 2583/3,500 words (Manuscript); 59/75 References; 1
109 Figure; 1 Table; 3 Supplements

110 **ABSTRACT**

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

124

125 1. INTRODUCTION

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

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

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

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

160

161 **2. METHODS**

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

166 **2.1 Protocol, advisory board and expert panel**

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

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

175 **2.2 Survey development and round 1 of Delphi**

176 The initial step to developing the Delphi survey via Qualtrics (an online survey platform)
177 (19) involved identifying potential modifications to the original 27-item PRISMA
178 checklist. The modifications were based on a research program carried out by members
179 of the advisory board to better understand scoping review practices (1, 3, 20) and
180 included: a broader research question and literature search strategy, optional risk of
181 bias assessment and consultation exercise (whereby relevant stakeholders contribute to
182 the work, as described in the Arksey and O'Malley framework (6)), and the inclusion of a
183 qualitative analysis. For round 1 of scoring, we prepared a draft of the PRISMA-ScR
184 (see Supplement 1) and asked expert panel members to rate the extent to which they
185 agreed with the inclusion of the list of items in using a 7-point Likert scale (1=entirely
186 disagree, 2=mostly disagree, 3=somewhat disagree, 4=neutral, 5=somewhat agree,
187 6=mostly agree, 7=entirely agree). Each survey item included an optional text box
188 where comments about the respective item(s) could be provided. The research team
189 pilot-tested the survey for content and clarity prior to administering it, and we also sent
190 bi-weekly reminders to optimize participation.

191 **2.3 Survey analysis**

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

204 **2.4 In-person arm (round 2 of Delphi)**

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

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

220 **2.5 E-Delphi arm (round 2 of Delphi)**

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

233 **2.6 Working groups and round 3 of Delphi**

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

243 **2.7 Interactive workshop (testing)**

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

249 **3. RESULTS**

250 **3.1 Expert panel**

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

253 including the number of items that met agreement at each stage are presented in Figure
254 1.

255 **3.2 Round 1 of Delphi**

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

263 **3.3 In-person meeting and round 2 of Delphi**

264 The 16 panel members who attended the in-person meeting in Toronto on November
265 29th, 2016 were largely from North America, along with others from Australia, Lebanon,
266 and the United Kingdom. Of the 18 discrepant items from round 1, 11 were re-scored
267 after discussion. All reached the 85% threshold of agreement, except for one – item 7,
268 information sources, which had 83% agreement. For the remaining seven items, the
269 group felt that notable changes to the items were required, which formed the basis of
270 action by the working groups.

271 **3.4 E-Delphi online discussion and round 2 Delphi**

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

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

277 **3.5 Working groups and round 3 of Delphi**

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

284 A total of 27 people were invited to participate in round 3 of the Delphi; 16 from the in-
285 person meeting arm and 11 from the E-Delphi arm. Overall, 24 out of 27 completed the
286 final round of scoring and 3 individuals withdrew (2 from the in-person arm and 1 from
287 the E-Delphi). Two of the 16 applicable items failed to meet the 85% agreement
288 threshold; items 10 (data collection process) and 15 (risk of bias across studies). Item
289 15 was subsequently removed from the checklist, though item 10 was retained but
290 revised to exclude the optional consultation exercise step described by Arksey and
291 O'Malley and Levac et al., which was the source of the disagreement. Furthermore, it
292 was decided that the consultation exercise could be considered a knowledge translation
293 activity, which could be conducted for any type of knowledge synthesis.

294 **3.6 Interactive workshop (testing)**

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

298 **3.7 PRISMA-ScR checklist**

299 The final checklist, with 20 items plus two optional items, is presented in Table 1. It
300 consists of 10 items that reached agreement in rounds 1 and 2 (1,3,5,6,8,9,17,25-27),
301 along with the 10 items that were agreed upon in round 3 (2,4, 7,10,11,14,18,20,21,24).
302 Five items from the original PRISMA were deemed not relevant. They included: items
303 13 (summary measures, excluded after round 1) and the following 4 items, which were
304 excluded after round 3: 15 (risk of bias across studies), 16 (additional analyses), 22 (risk
305 of bias across studies results), and 23 (additional analyses results). See Figure 1 for an
306 illustration of the process. In addition, because scoping reviews can include many
307 different types of evidence (e.g., documents, blogs, websites, studies, interviews,
308 opinions) and are not conducted to examine the risk of bias of the included sources,
309 items 12 (risk of bias in individual studies) and 19 (risk of bias within studies results)
310 from the original PRISMA are treated as optional in the PRISMA-ScR.

311

312 **3.8 PRISMA-ScR Explanation and Elaboration**

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

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

317 **4. DISCUSSION**

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

328
329 The PRISMA-ScR will be housed on the websites of the EQUATOR Network's library of
330 reporting guidelines and the Knowledge Translation Program of St. Michael's Hospital
331 (27). To promote its uptake, we will create 1-minute YouTube videos to outline how to
332 operationalize each of the items; offer webinars for organizations that conduct scoping
333 reviews, and create 1-page tip sheets for each item. In the future, we will consider
334 creating an automated email PRISMA-ScR dissemination tool, as well as an online tool
335 similar to Penelope, which verifies manuscripts for completeness and provides feedback
336 to authors as they prepare to submit their work to the BMJ Open journal (28). We will
337 share the PRISMA-ScR widely within our networks, including the Alliance for Health

338 Policy and Systems Research, the World Health Organization (WHO) (29) and the
339 Global Evidence Synthesis Initiative (30). We will also collect and review readers'
340 suggestions to improve uptake of the PRISMA-ScR via an online feedback form on the
341 Knowledge Translation Program of St. Michael's Hospital's website (27).
342
343 Study Protocol: Available at EQUATOR and PRISMA websites.
344 Data Set: Available from corresponding author.

345 **CONTRIBUTIONS**

346 ACT developed the original idea, oversaw all stages of the project, facilitated the in-
347 person meeting, wrote the manuscript draft, and is the guarantor for this manuscript. EL
348 wrote sections of the manuscript and coordinated and operationalized all stages of the
349 project with WZ. KOB, HC, DL, DM, MDJP, TH, LW, SH, EAA, CC, JM, LS, LH, AA,
350 MGW, CG, SL, CMG, MTM, EVL, KS, JM, TC, and OT completed round 1 of scoring.
351 KOB, HC, DL, MDJP, TH, LW, SH, EAA, CC, JM, LS, LH, AA, and MGW attended the
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355 EAA, CC, JM, LS, LH, AA, CG, SL, MTM, and KS participated in the working group
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357 CG, SL, CMG, MTM, EVL, KS, JM, TC, and OT completed the final round of scoring.
358 SES developed the original idea, oversaw all stages of the project and facilitated the in-
359 person meeting. All authors critically reviewed the manuscript and approved the final
360 version.

361 **ACKNOWLEDGEMENTS**

362 We would like to thank the following individuals:
363 Susan Le for supporting the coordination of the project and formatting the manuscript.
364 Anna Lambrinos for participating in round 1 of scoring and attending the in-person
365 meeting.
366 Mai Pham for participating in round 1 of scoring and attending the in-person meeting.

367 Lisa O'Malley for participating in round 1 of scoring and in the E-Delphi round 2 of
368 scoring.
369 Peter Griffiths for participating in round 1 of scoring and providing feedback on
370 Conceptboard.
371 Charles Shey Wiysonge for participating in round 1 of scoring and providing feedback
372 on Conceptboard.
373 Jill Manthorpe for participating in round 1 of scoring.
374 Mary Ann McColl for participating in round 1 of scoring.
375 Assem M Khamis for assisting with the identification of examples for the Explanation
376 and Elaboration document.
377 Melissa Chen for providing administrative support for the in-person meeting.
378 Jessica Comilang for providing administrative support for the in-person meeting.
379 Meghan Storey for providing administrative support for the in-person meeting.

380 **FUNDING**

381 This work was supported by a Knowledge Synthesis grant from the Canadian Institutes
382 of Health Research (CIHR) [grant # KRS 144046]. This funding body had no role in
383 designing the study, in collecting, analyzing and interpreting the data, in writing this
384 manuscript, and in deciding to submit it for publication. ACT is funded by a Tier 2
385 Canada Research Chair in Knowledge Synthesis. KOB was supported by a Canadian
386 Institutes of Health Research (CIHR) New Investigator Award. SES is funded by a Tier 1
387 Canada Research Chair in Knowledge Translation.

388 **COMPETING INTERESTS**

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

399 **ETHICAL APPROVAL**

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

402 **DATA SHARING**

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

405 **TRANSPARENCY STATEMENT**

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

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

410 **SUPPLEMENTARY FILES**

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

412 Supplement 2: The PRISMA Extension for Scoping Reviews (PRISMA-ScR):

413 Explanation and Elaboration

414 Supplement 3: Letters of Permission

415 **FIGURES**

416 Figure 1: Methods flow

417 **TABLES**

418 Table 1: PRISMA-ScR checklist

419 **Table 1: PRISMA-ScR Checklist**

420

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	<i>If done</i> , 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	<i>Not applicable for scoping reviews.</i>	
Synthesis of results	14	Describe the methods of handling and summarizing the data that were charted.	
Risk of bias across studies	15	<i>Not applicable for scoping reviews.</i>	
Additional analyses	16	<i>Not applicable for scoping reviews.</i>	
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	<i>If done</i> , 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	<i>Not applicable for scoping reviews.</i>	
Additional analyses	23	<i>Not applicable for scoping reviews.</i>	
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
<p>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).</p> <p>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).</p> <p>Information sources - This is where <i>sources of evidence</i> (see definition) are compiled from such as, bibliographic databases, social media platforms, websites, etc.</p> <p>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 <i>information sources</i> (see definition).</p>

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