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

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1 **Title:** Recommendations for the extraction, analysis and presentation of results in scoping

2 reviews

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7 **Abstract**

8 Scoping reviewers often face challenges in the extraction, analysis and presentation of

9 scoping review results. Using best-practice examples and drawing on the expertise of the

10 JBI Scoping Review Methodology group, and an editor of a journal that publishes scoping

11 reviews, this paper expands on existing JBI Scoping Review guidance. The aim of this article

12 is to clarify the process of extracting data from different sources of evidence, discuss what

13 data can be extracted (and what should not), how to analyse extracted data including an

14 explanation of basic qualitative content analysis, and to offer suggestions for the

15 presentation of results in scoping reviews.

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Introduction

Scoping reviews have been defined as a *"type of **evidence synthesis** that aim to systematically identify and map the breadth of evidence available on a particular topic, field, concept, or issue, often irrespective of source (i.e. primary research, reviews, non-empirical evidence) within or across particular contexts."*[1] (pg 1) 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 of 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 comparison to the more precise, targeted questions of feasibility, appropriateness, meaningfulness, or the 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 (i.e. how is hearing measured?) for children who have grommet insertion due to chronic ear infections; while 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 has been a recurrent issue.[5] In part, this may be due to scoping review guidance being unclear and not describing a practical approach to how to extract, analyse 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]

51 Seminal scoping review guidance referred to the process of extraction, analysis, and

52 presentation as 'data charting',[7,8] and this terminology is used in the Preferred Reporting

53 Items for Systematic Reviews and Meta-analysis extension for Scoping Reviews (PRISMA-

54 ScR).[9] The term charting is seen as a higher level of extraction, which is theoretically

55 appropriate for scoping reviews, and was used to differentiate from the term 'extraction'.

56 'Extraction' may suggest that review authors always extract the study outcome results.

57 However, guidance from JBI has recommended that to be consistent with other evidence

58 synthesis approaches, the term 'extraction' was most appropriate, and will be used

59 throughout this guidance. Arksey and O'Malley [7] suggested that for scoping reviews, an

60 analytical framework, which was 'basic numerical analysis' be used, along with the use of

61 'thematic constructions.' However, Arksey and O'Malley [7] were clear that scoping reviews do

62 not synthesize evidence or 'aggregate findings'. Levac, Colquhoun [8] and colleagues agreed

63 with Arksey and O'Malley [7] on the importance of a descriptive numerical summary analysis,

64 however, argued that there was a need for more guidance on the methodological approach

65 to thematic presentation of data. Levac, Colquhoun [8] proposed the use of qualitative content

66 analysis. JBI guidance recommends the use of frequency counts, tabular/graphical

67 presentation and where appropriate 'basic' qualitative content analysis; however, to date, the

68 methodological approach has not been thoroughly described for scoping reviews. Therefore,

69 the JBI Scoping Review Methodology group have developed guidance using best-practice

70 examples of scoping reviews to provide clarity on the following:

71 1. Data extraction process: what type of data should be extracted from the included

72   evidence sources and the level of detail required during extraction.

73 2. Data analysis: how to analyse the data collected from evidence sources, including a

74   detailed approach of how to conduct basic qualitative content analysis.

75 3. Data presentation: suggestions for the presentation of results in scoping reviews.

76 **A team approach**

As with many other rigorous evidence syntheses, best-practice recommends that scoping reviews require 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 extraction and analysis phases are particularly important to discuss this 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 that 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 (e.g. patients, clients, consumers, public), other researchers, healthcare 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 sub-categories 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 question/s. The PCC framework (population, concept, and context) is recommended as a guide to construct a clear and meaningful objective 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, it could include definitions, statements, or arguments surrounding a concept. It could be 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

104   within a scoping review to ensure its conduct is transparent and rigorous. These principles

105   are as follows:

106   • Create a standardized data extraction form and guidance for the form, which

107   describes each point that will be extracted (see Table 1 for an example extraction

108   form). The development of the initial data extraction form is guided by the review

109   question and usually includes population, concept and context. It is recommended

110   that an extraction guidance form (see image one for an example) is developed and

111   accompanies the extraction form detailing each item to be extracted and shared with

112   each scoping reviewer.

113   • Describe the planned data extraction approach within an *a-priori* protocol and include

114   a draft data extraction form. This draft extraction form is usually formatted as a table

115   and should be; developed specifically for the review topic at hand, detailed, and

116   include more than a basic plan (i.e. more than just the population, concept and

117   context) for the items that will be extracted.

118   • Best-practice is to have at least two scoping review authors extracting data

119   independently per evidence source. However, if this is not possible, one scoping

120   reviewer per evidence source with another person reviewing either all or a proportion

121   of the extraction to ensure it is accurate and complete can be considered.[13]

122   • Pilot-test the data extraction form on each type of evidence source, such as primary

123   research articles, evidence syntheses, guidelines, policy statements, or blog posts,

124   included in the review. Aim for each scoping reviewer to independently complete at

125   least 2-3 items per evidence source type, however, this will depend on the complexity

126   of the topic and the variety of evidence sources. During pilot-testing, scoping review

127   authors should reflect on the following questions:

128   o Was there anything missing from the extraction form?

129   o Was there anything redundant included in the extraction form?

130   o   Was there anything on the extraction form that you did not understand or that

131   could be further clarified?

132   o   Was there any unclear information in the accompanying guidance form?

133   o   How long did it take you to extract the necessary information? This

134   information will help guide further time allocation.

135   •   Have a review group discussion with all scoping review authors after piloting to agree

136   on all aspects of the tool, data to be extracted, and reach agreement on queries or

137   conflicts.

138   •   Only extract data that is relevant to addressing the stated review questions of the

139   scoping review.

140   •   If scoping review authors need any additional information or to clarify doubts about

141   some of the study's information, the authors of the evidence sources should be

142   contacted as soon as possible. Further follow-up of these authors may be necessary.

143   •   Ensure and plan for regular team meetings and/or communication during the

144   extraction process to discuss progress and assess if the data extraction form is

145   capturing the necessary information to answer the review question/s.

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147   _____

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149   INSERT TABLE 1

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154   INSERT Image one- Example of data extraction guidance

155   _____

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Data extraction can be an iterative process

158	Given the breadth of scoping review questions and the varied sources of evidence that can

159	be included, additional relevant data items may be identified by scoping review authors

160	during the process of extraction from included sources. This means that data extraction can

161	evolve to capture new and different data items requiring an iterative approach, for example if

162	collecting data on education courses, details on assessment methods used may not have

163	been considered initially, but then deemed important throughout the process. It is not

164	uncommon to add additional item(s) to the data extraction form that require extraction during

165	the process. If additional items are extracted which were not pre-specified, it should be made

166	clear in the final report that there was a deviation from the protocol and provide a rationale

167	as to why it occurred.

168

169	**Identifying the relevant information in the evidence source**

170	In systematic reviews, which analyse primary research articles, data is typically extracted

171	from the methods, and results of included sources. This may not be strictly the case for

172	scoping reviews. This is due to the varied types of data of evidence sources included within

173	scoping reviews. Scoping reviews do not typically pose analytical questions where extracting

174	the results of primary research (such as effect sizes or qualitative results) is necessary.[2]

175	Hence, it may be required to examine other sections of a source including the introduction,

176	discussion, conclusions, and even supplementary information. For example, a scoping

177	review might be conducted to identify and report on the methodological approaches that

178	have been used to investigate a particular topic, and in this case, the methods section would

179	be the primary place where extraction will occur. In the review published by Khalil and

180	Huang [14], the authors extracted both the methodology and methods associated with each

181	study in their data extraction table as part of their review to map the work that has already

182	been undertaken in the area of medication adverse events in primary care. In another

183	scoping review Hoppe, Karimi [15]et al. (2022) mapped the research addressing prescription

184 drug monitoring programs and extracted from the discussion section of primary research

185 articles to determine what they perceived their results to practice were, and the gaps and

186 areas in need of further research.

187 Depending on the purpose and review question/s posed, scoping review authors may or may

188 not aim to extract the results of primary studies. For example, in a scoping review

189 addressing medication safety programs, the authors extracted information about the types of

190 programs used, the personnel involved in the programs and the outcome measures used to

191 measure the efficacy of the programs. Despite extracting some result information, the

192 authors did not gather information about the effectiveness of the programs.[16]

193 Scoping reviews that serve to be precursors to systematic reviews could, with clear rationale

194 and justification, focus on the extraction of results, as seen in a scoping review performed to

195 inform the feasibility and appropriateness of a health technology assessment.[17] In scoping

196 reviews exploring barriers and facilitators, reviewers may extract from the results of

197 qualitative primary studies, and then subsequently categorize these in their respective

198 categories.[18,19] However, in each of these cases, we suggest scoping review authors be

199 explicit regarding the inability to draw conclusions regarding the effectiveness (or prevalence

200 or meaningfulness or accuracy or costs) of a practice or phenomenon due the absence of

201 risk of bias assessment or advanced data synthesis techniques such as meta-analysis or

202 meta-synthesis. Scoping review authors can however recommend subsequent specific

203 systematic reviews to be undertaken based on the results of their scoping review.

204 **We advocate for extreme caution in cases where a scoping reviewer would want to**

205 **extract the results of evidence sources.** In most instances, a systematic review approach

206 will be the more suitable methodology for dealing with review questions that require the

207 extraction of the results (e.g., effect measures and variance, meaning of phenomena) of

208 included sources. Systematic reviews typically include methodological quality assessment

209 and utilize (where appropriate) formal methods of data synthesis or aggregation.

210 Extracting and presenting results (for example, a relative risk with associated confidence

211 intervals and p-values or themes from a qualitative thematic analysis) may lead to misplaced

212 conclusions regarding the effectiveness (or not) of an intervention, the prevalence of a

213 condition, the accuracy of a test or the experience of a condition/phenomenon. This is due to

214 the included sources of evidence not having undergone a process of critical appraisal (or risk

215 of bias appraisal) and secondly, not having undergone a process of pooling or aggregation

216 that considers the combination of all study results. Without this assessment of

217 methodological quality and pooling or aggregation, authors and readers may be susceptible

218 to making false assumptions based on a naïve or incomplete reading of the results and be

219 more inclined to apply vote counting of results. In this instance, a systematic review is likely

220 the more suitable methodology for dealing with review questions that require the extraction

221 of the results (e.g., effect measures and variance) of included sources.

222

223 **Analysis in scoping reviews**

224 Scoping review authors should present the intended analytical approach that will be used

225 within their scoping review in the protocol. Scoping review authors should clearly articulate

226 how they intend to analyse and present each review question as this may vary. The detail

227 provided by authors should be more than a general statement that they will undertake

228 descriptive statistics, tables and a narrative summary. Rather, there should be a

229 comprehensive description of the analyses undertaken in order to address each individual

230 review question/objective.

231 Scoping review authors may be tempted to perform more advanced statistical or qualitative

232 analysis within a scoping review.[6] The intention of synthesis methods such as meta-analysis,

233 meta-ethnography, thematic analysis, realist synthesis or meta-aggregation, among others,

234 is to answer questions or inform understandings regarding the feasibility, appropriateness,

235 meaningfulness and effectiveness of a particular intervention or phenomenon.[6] Therefore,

236 for these questions, the most appropriate review type is a systematic review where the

237 findings/results have undergone critical appraisal, and approaches to establish certainty of

238 those results have been applied to generate conclusions that can inform practice and policy

239 recommendations.

240 Scoping reviews do not address questions of feasibility, appropriateness, meaningfulness

241 and effectiveness, and as such, will not and should not, apply advanced analysis methods. If

242 scoping review authors feel that they are unable to answer their review question without the

243 use of a meta-analysis for example, then the question they are asking is possibly best suited

244 for a quantitative systematic review.[2]

245 Most scoping reviews will analyse data items by quantifying text and doing frequency counts

246 of data extraction items. These are relatively easy to manage, and should only require the

247 use of descriptive statistics, such as percentages/proportions. For example, common

248 frequencies seen in scoping reviews are the number of evidence sources, which used a

249 particular method (i.e., numbers of RCTs, surveys, evidence syntheses) or the

250 location/country/context where the evidence source was conducted. Furthermore, scoping

251 review authors can extract relevant information aligning to a framework with single-word

252 responses such as 'yes', 'no', 'unsure', or even through the use of a Likert scale. For

253 example, in a recent scoping review, the scoping review authors mapped exercise

254 interventions to the template for intervention description and replication (TIDieR) checklist.[20]

255 For the nine items on the checklist, reviewers classified each as either fully reported, partially

256 reported or not reported for each included evidence source. [21]

257 **Using basic qualitative content analysis**

258 In scoping reviews that include qualitative evidence, it is not uncommon for scoping review

259 authors to use qualitative synthesis approaches that go beyond the scope of a scoping

260 review, such as thematic synthesis, or a meta-aggregative approach. These approaches are

261 not appropriate within a scoping review as they are better suited to examining questions of

262 experiences and meaningfulness, and require a level of interpretation, which would align

263   more appropriately with a systematic review. Synthesis approaches that aim to re-interpret

264   evidence are not consistent with the purposes of a scoping review. Scoping reviews are

265   descriptive in nature, or to map the available evidence or identify characteristics or factors.

266   For the most part, there will be no need for scoping review authors to go beyond basic

267   descriptive analysis. However, there may be times when it would be appropriate to use a

268   basic qualitative content analysis, such as if the scoping review is identifying key

269   characteristics or factors related to a concept. In these cases, a more complex qualitative

270   data analysis beyond simple frequency counts may be required. This may be necessary

271   when a scoping review has the objective of informing the development of a conceptual

272   framework or theory.

273   When performing basic qualitative content analysis, categorization is required to map the

274   results in a way to aid their simplification to address the scoping review question. For

275   example, in a scoping review by Hoppe, Ristevski [22] the authors mapped the evidence

276   associated with community pharmacists' views towards drug misuse management. The

277   authors mapped the results into pharmacists' knowledge, training and education, attitudes,

278   and practice strategies. [22]

279   JBI scoping review guidance recommends using basic qualitative content analysis,[6] which is

280   a descriptive approach to analysis and involves a process of open coding to code concepts

281   or characteristics into overall categories. This can be applied to any evidence source or

282   study design in any scoping review, it is not limited to primary qualitative studies only. In

283   previous guidance, including JBI, there has been no definitive process described as to what

284   basic qualitative content analysis involves, and it is acknowledged that there are many

285   different analytical approaches that could be undertaken. However, the present paper

286   describes one approach that could be undertaken by scoping review authors.

287   *A basic qualitative content analysis approach for scoping reviews*

288 Elo and Kyngäs [23] describe three phases of qualitative content analysis for the results of

289 primary qualitative research including *preparation, organizing,* and *reporting*. These phases

290 could also be used to describe a basic process of qualitative analysis within scoping reviews.

291 A fourth '*abstraction*' phase is also described by Elo and Kyngäs [23] however this technique

292 would be beyond the realm of scoping reviews in which we do not seek to synthesize or re-

293 interpret evidence. Flowchart 1 shows the process of how to conduct the analyses of

294 qualitative data within a scoping review.

295 *Preparation Phase*

296 Scoping review authors should first determine if there is the need to conduct a basic

297 qualitative content analysis during the protocol stage of their scoping review. If the aim of the

298 review were to explore experiences, or the meaningfulness of an issue, then a qualitative

299 systematic review would be more appropriate.[2] If a basic qualitative content analysis

300 approach is deemed necessary (e.g., as the characteristics of a particular issue, definitions

301 for a concept, or concept are being mapped) then it would be appropriate to use this method

302 within scoping reviews.

303 Depending on the research question, and the field of research, an inductive or deductive

304 approach will need to be decided upon by the scoping review team during the protocol

305 development stage and subsequently reported within the protocol. These terms will be

306 familiar to qualitative researchers. An inductive approach may be useful where there is a

307 dearth of evidence on the topic, or the goal is to develop or inform a conceptual framework

308 or theory.[23] The deductive approach is typically used to map the data to an established

309 framework or theory within the literature.[23] There may be times however, when a deductive

310 approach is chosen without using a pre-existing framework – (for example, when no suitable

311 framework or theory can be found). In such situations, the review team needs to decide upon

312 a framework during the protocol stage and, ideally, will have consulted on the suitability of

313 the framework.

314   __

315   INSERT Flowchart 1: The process of how to conduct the analyses of qualitative data within a

316   scoping review.

317   __

318

319   *Organizing phase*

320   The organizing phase during qualitative data analysis within scoping reviews will differ

321   depending whether the scoping review is following an inductive or deductive approach.[23]

322   The first step in the organization stage is for the review authors to familiarize themselves

323   with the data. This includes reading and comprehending all the included evidence sources

324   and understanding how it is relevant to the objective and questions of the scoping review.[23]

325   *Inductive approach*

326   When the authors have become familiar with the sources of evidence and relevant data,

327   review authors can then carry out open coding of the data. A code can be described as a

328   label and can be an initial descriptor that is a few words long. The process of open coding

329   involves reviewing the evidence sources again and listing initial thoughts, possible

330   categories or notes which help describe what is occurring within the data which explains the

331   objective and review question. During this stage, there are no limitations as to how many

332   high-level categories can be listed. This is an initial process that will be refined. Once the

333   open coding process has occurred, the coding framework can be developed. This will

334   involve gathering all the information in the prior stage to develop a coding framework to help

335   describe and answer the review question(s) and allow the organization of extracted data.

336   At this stage, the coding framework may include higher order categories, or sub-categories.

337   It is also beneficial to provide a definition of these categories and sub-categories to help

338   extractors, but also to show transparency in the decision-making that has occurred

339   throughout this process. The coding framework should be reviewed by all members of the

340   review team. Once the coding framework has been reviewed, extractors are now able to go

341   through the included evidence sources, extract the relevant information, and organize it

342   within the coding framework. Categorization involves exploring the organized extractions and

343   assessing if the initial coding framework adequately answers the review question. It is

344   common for the categories and sub-categories within the initial coding framework to be

345   changed during this stage to accommodate new understanding of what was stated within the

346   evidence sources. These categories can form a conceptual framework or theory.

347

348   **Case study of inductive qualitative data extraction and analysis**

349   A scoping review was undertaken with the objective to assess the available literature that

350   documents or utilizes patient journey mapping methodologies and examine their reporting

351   processes.[24] After an extensive searching and selection process, there were 81 included

352   evidence sources within this scoping review. The scoping review authors chose to extract

353   information about why primary authors would use patient journey mapping. The scoping

354   review authors extracted 76 justifications. During the analysis stage, the scoping review

355   team met several times to review each of these justifications. The process of analysis

356   included listing initial thoughts, possible categories or notes (which help describe what is

357   occurring within the data) with the eventual goal to make a smaller list of common

358   justifications why researchers choose patient journey mapping. After meeting several times

359   as a group, 10 categories were identified, such as comprehensiveness of care, how people

360   were navigating the system, patient satisfaction with services and comparing patient

361   experiences with standards of practice. An example of this process of developing categories

362   can be seen in flowchart 2, however, to note, this is not a linear process, and it may be

363   necessary to re-examine the categories and establish whether they could be further refined.

364   __

365   INSERT Flow chart 2: Example of the process of developing categories

366   __

367   Once the framework had been developed, two scoping review authors individually went

368   through the extracted data and assigned it to a category. These review authors then came

369   together and assessed if there were any discrepancies. All discrepancies were discussed

370   and consensus was achieved, however, a third reviewer had agreed to manage any

371   discrepancies that could not be resolved through discussion.

372   *Deductive approach*

373   As described above, in the deductive approach, the framework has already been developed

374   during the protocol stage. Therefore, the review authors can extract data according to that

375   framework, by extracting the verbatim text, which maps to the decided framework and

376   answers the proposed question(s). Once this is completed, the extractions should then be

377   reviewed by the members of the review team to ensure that they reflect the understanding of

378   the framework. There may be a scenario, when scoping review authors initially utilize a

379   deductive framework, and then recognize that this would not be the best fit for the extracted

380   data and its ability to provide a descriptive map of the available evidence. Therefore, the

381   scoping review authors can switch to an inductive approach during the extraction and

382   analytical steps of a scoping review and document this deviation from the protocol in the final

383   review.

384   **Case study of deductive qualitative data extraction and analysis**

385   A scoping review was conducted to identify barriers and facilitators in the prevention of type

386   two diabetes mellitus and gestational diabetes in vulnerable groups.[25] After searching

387   several databases, 125 evidence sources were included. A pre-existing framework had been

388   developed prior to the extraction of the data, which included eight categories: language;

389   economic factors; family and friends; work; social support; religion; culture and knowledge.

390   During extraction, scoping review authors extracted barriers and facilitators and then sorted

391 into pre-arranged categories. Other barriers which did not fit into these pre-arranged

392 categories were found, and they included insufficient time, problems with travelling and

393 insufficient motivation, however these were minimal and the framework did not change.[25]

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

395 An issue seen within systematic reviews is ensuring that the same data set is not counted

396 across multiple studies. Double counting issues can arise in scoping reviews for numerous

397 reasons such as when you include evidence synthesis and primary articles (i.e. there is the

398 potential for overlap). There may also be a scenario where multiple evidence synthesis

399 sources are included in the scoping review and the primary article is included within them all;

400 or there are several reports of one, and, the same primary study. This may become

401 problematic if, for example, the review question is attempting to determine the type and

402 frequency of outcomes being used within a particular field of work, as scoping review

403 authors may count the same outcome from both the original study and any evidence

404 synthesis source that also included the original study, thus skewing the prominence. While

405 there is no formal guidance on how to manage this issue, scoping review authors should be

406 aware of the risk and make efforts to avoid counting the same data items multiple times from

407 different sources. Authors may decide to still include the evidence synthesis within the

408 scoping review to be able to map the available evidence and to report the number of

409 evidence syntheses mapped. Guidance for systematic reviews and overviews (reviews of

410 reviews/umbrella reviews)[26] might also apply. However, scoping review authors should

411 clearly report which other included sources of primary evidence were included within that

412 evidence synthesis. The final scoping review report should clearly state how other types of

413 evidence synthesis were handled in the review and what data were extracted from them and

414 from the primary studies (if appropriate).

415

416 **Presentation of data**

417   There are a multitude of ways that scoping reviews can present data and answer the

418   proposed review question(s). Scoping reviews commonly include tables that present the

419   available data. Although useful as they can summarize a large amount of information, and

420   show how extraction has occurred, there also needs to be consideration in communicating

421   results from the scoping reviews to the wider community. Further, scoping review results

422   with many included sources may result in tables that are too large to easily present in the

423   standard fashion of a journal article. There are many creative approaches that scoping

424   reviews can include to convey results to the reader in an understandable way. For example,

425   in Tricco, Lillie [5] they visualized the different terminology of scoping reviews through a word

426   cloud. Kynoch, Ramis [27] used a honeycomb to visualize the outcomes in the included

427   evidence sources and the number of relevant studies. The author team using Power BI

428   developed four further examples of how scoping review results can be visualized. In

429   example 1, the authors have created a world heat map with the size of the circle indicating

430   how many evidence sources were conducted in that country. Example 2; is a tree graph

431   indicating the illness categories seen within the included evidence. Example 3 is using

432   iconography to represent the different types of populations (and how many of each) were

433   included within the evidence sources. Example 4 are waffle charts of the type of

434   methodology used by the evidence sources included within a scoping review.

435   Alongside any visual presentation, a supporting narrative must be provided about the result.

436   Further consideration for the presentation of scoping review results is the use of interactive

437   resources. While many scoping reviews map the breadth of the evidence in an area, this can

438   be useful to inform future research and as such, a searchable interactive resource would be

439   helpful. An example of this is the searchable interactive map of outcome tools and

440   International Scientific Tendinopathy Symposium Consensus (ICON) health domains relative

441   to tendinopathy types presented as supplementary files in a scoping review of exercise for

442   tendinopathy. [28]

443   _____

444   INSERT Examples 1,2,3 and 4

445   __

446   **Reporting scoping reviews**

447   The PRISMA-ScR provides a checklist for reporting a scoping review. It has clear guidance

448   on how to report the extraction (called 'data charting' within PRISMA-ScR), analysis (called

449   'data synthesis'), and presentation of data. Items 10, 11, 14, 17, 18, 20 and 21 are

450   applicable for these sections and should be referred to whilst writing the scoping review

451   report to ensure a transparent and rigorous process. A completed PRISMA-ScR checklist

452   which documents page numbers where each of these actions have been addressed should

453   also be included as a supplementary file to your scoping review report. Because the

454   checklist requires authors to indicate the page that items are checked off against, ensure

455   that these page numbers are accurate in the final proofs of your scoping review if it is to be

456   published otherwise, they will not match up.

457   The PRISMA-ScR also provides an appendix (titled: PRISMA extension for Scoping Reviews

458   Explanation and Elaboration) that describes each section, which needs to be reported within

459   a scoping review, and a written example of how this can be achieved within a report.

460   **Software**

461   There are many software programs, which can be used to assist in the extraction, analysis

462   and presentation of scoping review data. These include Google Sheets as this allows for

463   real-time editing and can manage version control issues. However, Microsoft Excel is also

464   appropriate for data extraction, and can facilitate basic descriptive analyses. NVIVO

465   (released in March 2020)[29] is also often used in the extraction, analysis and presentation of

466   qualitative information. Further, data visualization programs can include Microsoft Power BI,

467   or Tableau. For mapping, EPPI-Mapper[30] and even EndNote[31] are useful tools, amongst

468   others. Having scoping review authors familiar with software use and its application helps

469   facilitate the data extraction, analysis, and presentation of results.

470   **Conclusion**

471   Scoping reviews aim to systematically identify and map the breadth of evidence available on

472   a particular topic, field, concept, or issue within or across particular contexts, and this

473   requires a different analytical approach to systematic reviews. The extraction, analysis, and

474   presentation of results within a scoping review can be challenging due to the variety of

475   evidence sources that scoping reviews can include and the absence of specific guidance for

476   reviewers. This article has partially addressed this gap by providing guidance regarding how

477   to extract, analyse, and present data within scoping reviews. It is hoped that scoping review

478   authors will be able to use this guidance to improve the quality and clarity of published

479   scoping reviews and to make conducting and reporting scoping reviews easier.

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References

1. Munn Z, Pollock D, Khalil H, Alexander L, McInerney P, Godfrey CM, et al. What are scoping reviews? Providing a formal definition of scoping reviews as a type of evidence synthesis. JBI Evidence Synthesis. 9000.

2. Munn Z, Peters MDJ, Stern C, Tufanaru C, McArthur A, Aromataris E. Systematic review or scoping review? Guidance for authors when choosing between a systematic or scoping review approach. BMC Medical Research Methodology. 2018; 18(1):143.

3. Peters MDJ, Godfrey C, McInerney P, Khalil H, Larsen P, Marnie C, et al. Best practice guidance and reporting items for the development of scoping review protocols. JBI Evidence Synthesis. 9000.

4. Khalil H, Peters MDJ, Tricco AC, Pollock D, Alexander L, McInerney P, et al. Conducting high quality scoping reviews-challenges and solutions. Journal of Clinical Epidemiology. 2021; 130:156-60.

5. Tricco AC, Lillie E, Zarin W, O'Brien K, Colquhoun H, Kastner M, et al. A scoping review on the conduct and reporting of scoping reviews. BMC Medical Research Methodology. 2016; 16(1):15.

6. Peters MDJ, Marnie C, Tricco AC, Pollock D, Munn Z, Alexander L, et al. Updated methodological guidance for the conduct of scoping reviews. JBI Evidence Implementation. 2021; 19(1):3-10.

7. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. International Journal of Social Research Methodology. 2005; 8(1):19-32.

8. Levac D, Colquhoun H, O'Brien KK. Scoping studies: advancing the methodology. Implementation Science. 2010; 5(1):69.

9. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. Annals of Internal Medicine. 2018; 169(7):467-73.

10. Tricco AC, Tetzlaff J, Moher D. The art and science of knowledge synthesis. Journal of Clinical Epidemiology. 2011; 64(1):11-20.

11. Jull JE, Davidson L, Dungan R, Nguyen T, Woodward KP, Graham ID. A review and synthesis of frameworks for engagement in health research to identify concepts of knowledge user engagement. BMC medical research methodology. 2019; 19(1):211-.

12. Pollock D, Alexander L, Munn Z, Peters MDJ, Khalil H, Godfrey CM, et al. Moving from consultation to co-creation with knowledge users in scoping reviews: guidance from the JBI Scoping Review Methodology Group. JBI Evidence Synthesis. 2022; 20(4).

13. Robson RC, Pham B, Hwee J, Thomas SM, Rios P, Page MJ, et al. Few studies exist examining methods for selecting studies, abstracting data, and appraising quality in a systematic review. Journal of Clinical Epidemiology. 2019; 106:121-35.

14. Khalil H, Huang C. Adverse drug reactions in primary care: a scoping review. BMC Health Serv Res. 2020; 20(1):5.

15. Hoppe D, Karimi L, Khalil H. Mapping the research addressing prescription drug monitoring programs: A scoping review. Drug and Alcohol Review. 2022; 41(4):803-17.

16. Khalil H, Shahid M, Roughead L. Medication safety programs in primary care: a scoping review. JBI Database System Rev Implement Rep. 2017; 15(10):2512-26.

17. Prediger B, Mathes T, Probst C, Pieper D. Elective removal vs. retaining of hardware after osteosynthesis in asymptomatic patients—a scoping review. Systematic Reviews. 2020; 9(1):225.

18. Tricco AC, Cardoso R, Thomas SM, Motiwala S, Sullivan S, Kealey MR, et al. Barriers and facilitators to uptake of systematic reviews by policy makers and health care managers: a scoping review. Implement Sci. 2016; 11:4.

19. Tricco AC, Zarin W, Rios P, Nincic V, Khan PA, Ghassemi M, et al. Engaging policy-makers, health system managers, and policy analysts in the knowledge synthesis process: a scoping review. Implement Sci. 2018; 13(1):31.

20. Hoffmann TC, Glasziou PP, Boutron I, Milne R, Perera R, Moher D, et al. Better reporting of interventions: template for intervention description and replication (TIDieR) checklist and guide. Bmj. 2014; 348:g1687.

21. Cooper K, Pavlova A, Alexander L, Swinton P, Brown V, Maclean C, et al. Exercise therapy for the treatment of tendinopathies: A mixed methods evidence synthesis. 2021.

549   22. Hoppe D, Ristevski E, Khalil H. The attitudes and practice strategies of community pharmacists
550   towards drug misuse management: A scoping review. Journal of Clinical Pharmacy and Therapeutics.
551   2020; 45(3):430-52.
552   23. Elo S, Kyngäs H. The qualitative content analysis process. Journal of Advanced Nursing. 2008;
553   62(1):107-15.
554   24. Davies EL, Pollock D, Graham A, Laing RE, Langton V, Bulto L, et al. Reporting of patient journey
555   mapping in current literature: a scoping review protocol. JBI Evid Synth. 2021.
556   25. Breuing J, Pieper D, Neuhaus AL, Heß S, Lütkemeier L, Haas F, et al. Barriers and facilitating
557   factors in the prevention of diabetes type 2 and gestational diabetes in vulnerable groups: A scoping
558   review. PLOS ONE. 2020; 15(5):e0232250.
559   26. Lunny C, Pieper D, Thabet P, Kanji S. Managing overlap of primary study results across systematic
560   reviews: practical considerations for authors of overviews of reviews. BMC Medical Research
561   Methodology. 2021; 21(1):140.
562   27. Kynoch K, Ramis M-A, Crowe L, Cabilan CJ, McArdle A. Information needs and information
563   seeking behaviors of patients and families in acute healthcare settings: a scoping review. JBI
564   Evidence Synthesis. 2019; 17(6):1130-53.
565   28. Alexander L, Shim J, Harrison I, Moss R, Greig L, Pavlova A, et al. Exercise therapy for
566   tendinopathy: A scoping review mapping interventions and outcomes

567   2021.
568   29. Ltd QIP. NVIVO (released in March 2020). 2020.
569   30. EPPI-Centre DSFa. EPPI-Mapper, Version 2.1.0. In: EPPI-Centre USRI, University College London
570   editor.: https://eppi.ioe.ac.uk/cms/Default.aspx?tabid=2967; 2022.
571   31. Team TE. EndNote. Philadelphia, PA: Clarivate; 2013.

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582   Table 1: Example of a data extraction table

Author, year	Country	Aim	Study type/Source	Population	Sample size	Age (yrs)	Gender	Other demographics	Setting	Concept – Ex type	Ex Adherence	Outcomes (Health Domain)	Results
Crawshaw 2010[12]	UK	To compare the effectiveness of subacromial corticosteroid injection combined with timely exercise and manual	RCT – 2arm	Aged 40 and older, have unilateral shoulder pain, subjectively rate their pain as moderate or severe on a 3 point scale (mild/ moderate/sev ere), and have a non-capsular	Total (n = 232), Injection + exercise (n=115), Exercise only (n = 117)	Injection + exercise = M (57.2), SD (10.3), Exercise only = M (54.9), SD (10)	Injection + exercise = 57% F, Exercise only = 52% F	Median weeks of shoulder pain, started after injury, employed, diabetic	Clinic	Flexibility - Stretching, Flexibility - PNF, Strength - Isometric, Other - Scapular stabilisation or motor control,	Treatment logs	SPADI (Disability); GROC (Participant/pat ient rating overall condition)	Disability &GROC: Short term benefit from injection, but no difference at 12 or 24 weeks

		therapy (injection plus exercise) or exercise and manual therapy alone (exercise only) in patients with subacromial impingement syndrome		pattern of restriction.						Strength - Progressi ve Resistan ce Exercise			

| Levy et a; 2009[13] | UK | To investigate recreational participants' experiences of adhering to a sport injury rehabilitation program | Qualitative | Recreational sport participants, tendonitis related overuse injury | 6 | Range 24-38 | 4 M, 2 F | Reason for injury | Mixed | Group exercise class and social dancing class | Lack of motivation and confidence had –ve effect on home ex; ineffective coping strategies, over support and pain affected clinic adherence | NA | 5 themes: motivation, confidence, coping, social support, and pain |

Ex – Exercise

NA – Not applicable
PNF – Proprioceptive Neuromuscular Facilitation
GROC – Global rating of change
SPADI – Shoulder Pain and Disability Index

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584   Image one- Example of data extraction guidance

- **Author**
    - o Smith
    - o Smith & Hunt
    - o More than three authors-> Smith et al
- **Title of source**
  What is the title of this article, guideline, etc.? Write the full title
  For example the experience of mothers and fathers in cases of stillbirth in
  Spain. A qualitative study

- **Publication**
  Where was this article published? I.e. Midwifery; Birth; Women and Birth. If it
  is an organisation guideline-, write the organisation, i.e. American College of
  Obstetrics and Gynaecology.
  There is the occasion where there may be multiple dates on an article i.e. pre-
  prints, or an article that would be put online before it then is published. Just
  stick to the date on the article that you have.
- **Year**
  The year the article was published.
  Date the data was collected
  The article may have collected data at another time point prior to publication.
  In this section write the time period, i.e. (1990-2000) data was collected. If this
  data was not stated, or no data was collected (i.e. discussion paper) then
  write NA.
- **Type of Evidence Source (Primary Research/ Evidence
  Synthesis/Conference abstract/ Discussion article)**
    - o Primary research: Peer-reviewed research articles
    - o Epidemiology: Articles that have used population-level datasets
    - o Evidence synthesis: Narrative reviews, systematic reviews, scoping
        reviews, rapid reviews etc.
    - o Conference abstracts: Abstracts presented within conferences.
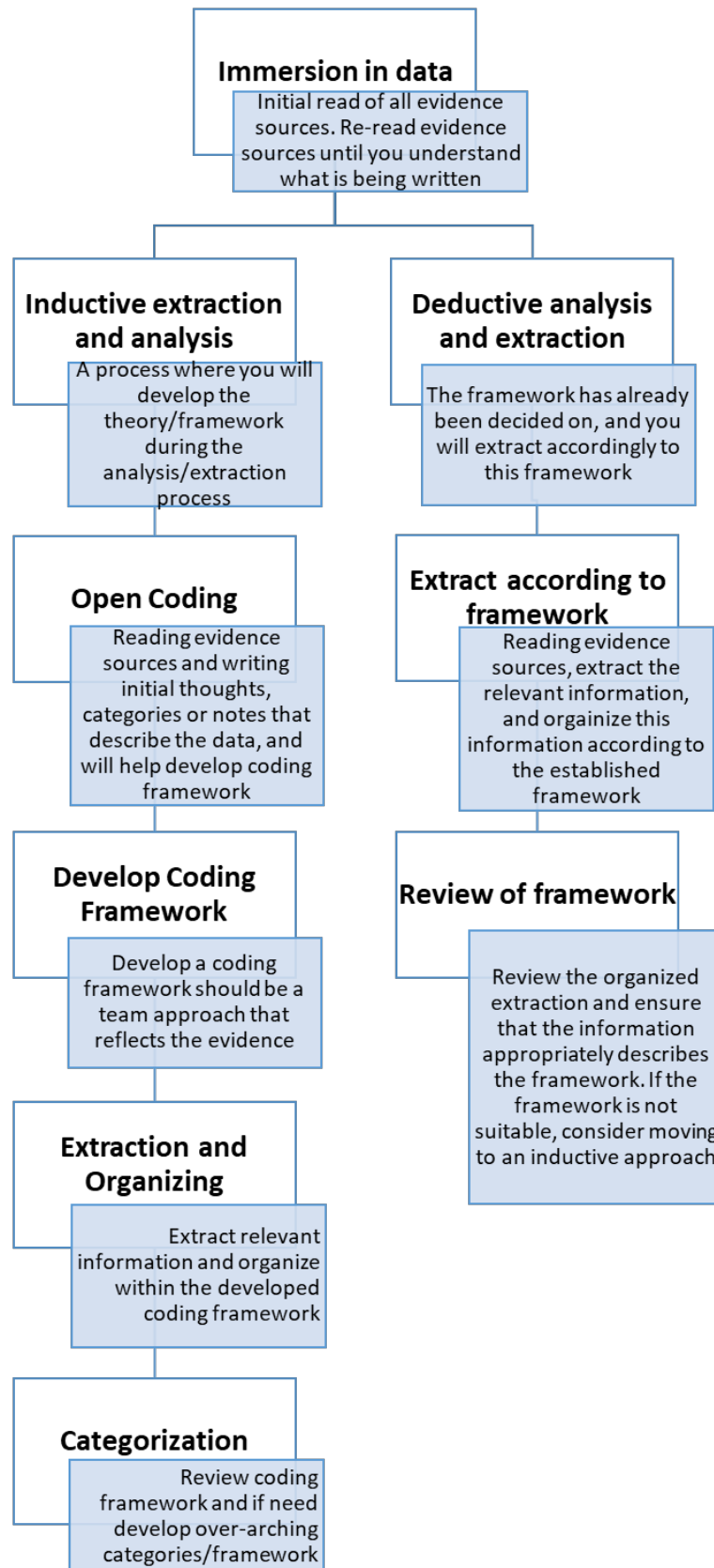
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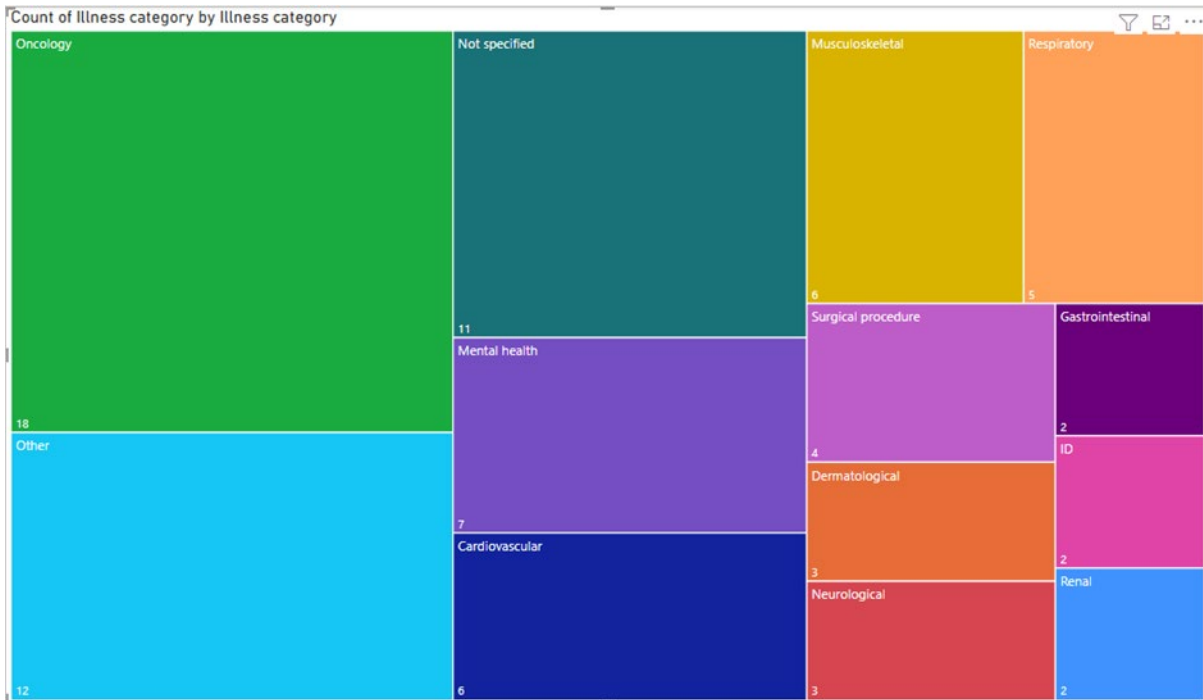588

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Immersion in data

Initial read of all evidence sources. Re-read evidence sources until you understand what is being written

Inductive extraction and analysis

A process where you will develop the theory/framework during the analysis/extraction process

Deductive analysis and extraction

The framework has already been decided on, and you will extract accordingly to this framework

Open Coding

Reading evidence sources and writing initial thoughts, categories or notes that describe the data, and will help develop coding framework

Extract according to framework

Reading evidence sources, extract the relevant information, and organize this information according to the established framework

Develop Coding Framework

Develop a coding framework should be a team approach that reflects the evidence

Review of framework

Review the organized extraction and ensure that the information appropriately describes the framework. If the framework is not suitable, consider moving to an inductive approach

Extraction and Organizing

Extract relevant information and organize within the developed coding framework

Categorization

Review coding framework and if need develop over-arching categories/framework

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597   Flowchart 1: The process of how to conduct the analyses of qualitative data within a scoping

598   review

599   Flowchart 2: Example of the process of inductive analysis

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| EXTRACTED DATA | *'To compare the experiences of patient with established standards of care.'* | INITIAL THOUGHTS AND OPEN CODING | Comparison practices patient experiences | CATEGORY DEVELOPMENT | Comparing the patient experiences with standards of practice |

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602   Example 1: A world map with the number of studies conducted in each country.

Number of studies by Country and Number of studies
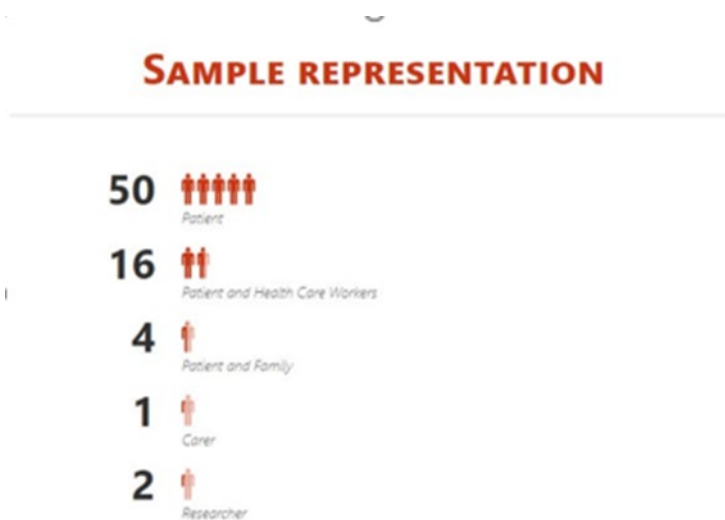
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610 Example 2: A tree graph of illness categories seen within the included evidence

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613 Example 3: A visual representation of the different types of populations included within the
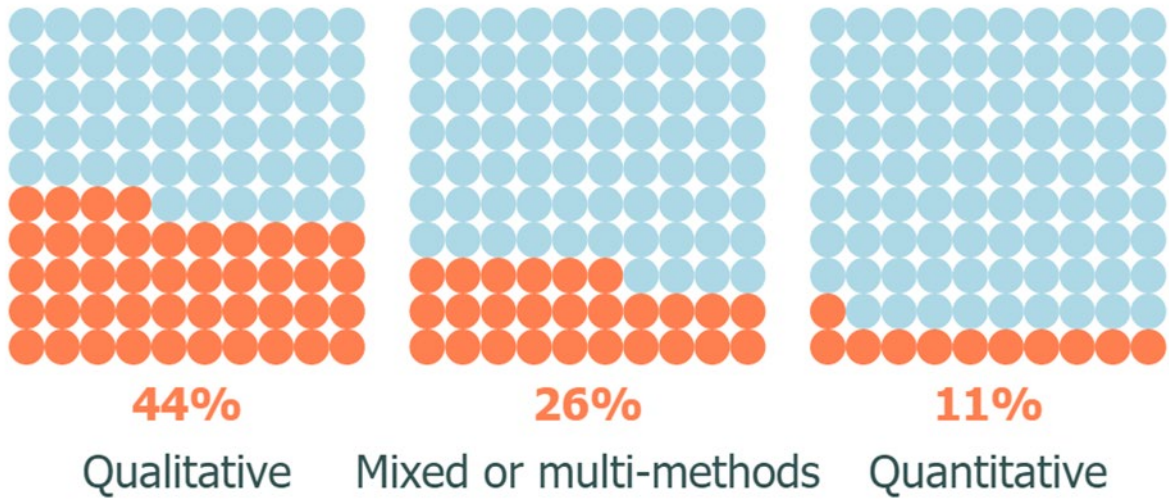
614 evidence sources

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618   Example 4: A waffle chart of the methodology used within the included evidence sources

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Count of Methodology by Methodology

44%
Qualitative

26%
Mixed or multi-methods

11%
Quantitative

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