

REVIEW

A scoping review describes methods used to identify, prioritize and display gaps in health research

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Abstract

Background and Objectives: Different methods to examine research gaps have been described, but there are still no standard methods for identifying, prioritizing, or reporting research gaps. This study aimed to describe the methods used to identify, prioritize, and display gaps in health research.

Methods: A scoping review using the Arksey and O'Malley methodological framework was carried out. We included all study types describing or reporting on methods to identify, prioritize, and display gaps or priorities in health research. Data synthesis is both quantitative and qualitative.

Results: Among 1,938 identified documents, 139 articles were selected for analysis; 90 (65%) aimed to identify gaps, 23 (17%) aimed to determine research priorities, and 26 (19%) had both aims. The most frequent methods in the review were aimed at gap identification and involved secondary research, which included knowledge synthesis (80/116 articles, 69%), specifically systematic reviews and scoping reviews (58/80, 73%). Among 49 studies aimed at research prioritization, the most frequent methods were both primary and secondary research, accounting for 24 (49%) reports. Finally, 52 (37%) articles described methods for displaying gaps and/or priorities in health research.

Conclusion: This study provides a mapping of different methods used to identify, prioritize, and display gaps or priorities in health research. © 2019 The Authors. Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Keywords: Evidence synthesis; Knowledge synthesis; Scoping review; Evidence mapping; Gaps in health research; Treatment uncertainties; Research gaps; Research priorities; Displaying gaps; Evidence gap maps

1. Introduction

The current body of research is growing, with more than 1 million clinical research papers published from clinical

trials alone [1]. Planning a study focusing on the wrong question is a frequent cause of waste in research [2]. Hence, completed and on-going research should be used to assess whether research gaps justify new research and can inform the design, conduct, and reporting of further research [3]. Initiatives such as the James Lind Alliance (JLA), UK Database of Uncertainties about the Effects of Treatments, Cochrane Agenda and Priority Setting Methods Group and Evidence-based Research Network are some examples of existing efforts to identify and prioritize research gaps in health.

The term “research gap” is not standardized, and its meaning can differ depending on the research context. In this study, we adopted the definition from the National

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What is new?

Key findings

- We identified 12 different definitions of the term research gaps. We found seven specific methods for identifying research gaps involving secondary and primary research: quantitative survey, academic crowd-sourcing, needs assessment, knowledge synthesis, bibliometric study, priority setting, and global evidence-mapping methods. We found five specific methods for determining research priorities involving secondary and primary research: Delphi survey, quantitative survey, knowledge synthesis, priority setting, and global evidence mapping method. We also identified 14 unique methods used to display research gaps and/or research priorities.

What this adds to what was known?

- This is the first study to describe methods used to identify research gaps, determine research priorities, and display research gaps or research priorities.

What is the implication and what should change now?

- The term “research gap” is not standardized, and its meaning can differ depending on the research context.
- The study findings can be adopted to inform the development of standardized methods to identify, prioritize, and display gaps in health research.
- We propose convening an international group of leaders in the field to clarify the methods for identifying, prioritizing, and displaying gaps in health research.

Collaborating Center for Methods and Tools in Canada, which describes a research gap as a research question for which missing or insufficient information limits the ability to reach a conclusion [4]. To further understand research gaps and their causes, we also referred to an article by Robinson et al. that developed a framework on identifying research gaps from systematic reviews by characterizing the gap with use of PICOS (population, intervention, comparison, outcomes, setting) elements and identifying reason(s) for why the gap exists, including insufficient or imprecise information, biased information, inconsistency or unknown consistency, and incorrect information [5].

On identifying research gaps, prioritizing research based on the gaps is essential to determine its importance and relevance, especially based on feedback from key

stakeholders such as patients, clinicians, researchers, advocates, and funders. Research priority setting is not commonly defined in a consistent way, although it has been described as any interpersonal activity that leads to the selection of topics or key questions to further investigate [6]. Research prioritization processes can help researchers and policy-makers effectively target research that has the greatest potential health benefit.

Consensus is lacking on what constitutes the best methodological approaches to identify research gaps [5,7], determine research priorities [6,8] and display research gaps or priorities. Therefore, we considered that a scoping review on this topic area was warranted. Our objectives were to (1) identify different definitions reported on the term “research gap”; (2) explore methods used to identify research gaps; (3) describe methods used to determine research priorities; and (4) map methods used to display research gaps or research priorities.

2. Materials and methods

The analytic framework for this scoping review involved the methodology outlined by Arksey and O'Malley [9] and further refined by the Joanna Briggs Institute [10]. It entails identifying the research question; expert consultation on conceptualizing the research topic, identifying the different key terms for the search strategy, developing the items for the data extraction form and reviewing the article; searching for relevant studies using key terms; selecting studies; charting the data; collating, summarizing, and reporting the results; and consulting with stakeholders to inform study findings. Experts played a major role in this study; their role was important because of the uncharted nature of this topic area. A detailed study protocol is included as supplementary material.

2.1. Search methods for identification of documents

The scoping review aimed to identify and include a wide range of article types, including original research, protocols, conference proceedings, and website content. The goal of the search strategy was to identify a diversity of methods used to identify, prioritize, and display gaps or priorities in health research. To build the search terms for the search strategy, because of the variability in terminology used, we began by contacting experts for the terms, descriptions, and definitions they use to refer to research gaps. On compiling different terms, we built our search terms with the assistance of a research librarian. The final search terms included “identifying gaps in research”, “research gaps,” “evidence gaps,” “research uncertainties,” “research gaps identification,” “research gaps prioritization,” and “methods” in health research including public health and clinical research. Two reviewers (LN and VN) conducted the searches by using the Peer Review of Electronic Search

Strategies (PRESS) guideline checklist, which aims to improve the quality of database searches [11].

The databases searched were MEDLINE, PubMed, EMBASE, Cochrane Library, Scopus, Web of Science, PROSPERO register, TRIP, Google Scholar, and Google. To focus on the most current research, database searches were limited to the past 10 years (2007–2017). Additional searches involved hand searches, web searches, expert suggestions, and checking reference lists of highly relevant articles. Only studies reported in English and involving humans were included to increase the feasibility of this scoping review. See [Appendix B](#) for complete search strategies.

2.2. Eligibility criteria

Studies were included if they aimed to describe a methodology and/or applied some methodology to identify gaps, determine research priorities, and/or display gaps or priorities in health research. All study designs were eligible, including those that used qualitative or quantitative methods, methodology, or guideline reports. We focused

our inclusion criteria to capture reports scoping within the domain of health, reporting on and/or describing methods for identifying, prioritizing and/or displaying research gaps. We excluded publications that did not explicitly describe how they aimed to identify, prioritize, and/or display research gaps. For additional information see [Appendix C](#).

2.3. Abstract and full-text screening and selection of articles

Abstract and full-text screening was performed by two authors. The first reviewer (LN) performed the entire screening of 1,938 abstracts, and a second reviewer (VN), screened 10% (194/1,938) of all abstracts. Agreement on selection of abstracts was 174/194 (90%). In total, 237 articles were selected for full-text screening. LN performed the entire screening and VN screened 10% (24/237) of articles. Among the 24 articles that were double screened, agreement was reached on 20 (85%). Title and abstract screening involved use of the software package Covidence for conducting systematic reviews. Full-text screening involved using EndNote to manage and retrieve full texts.

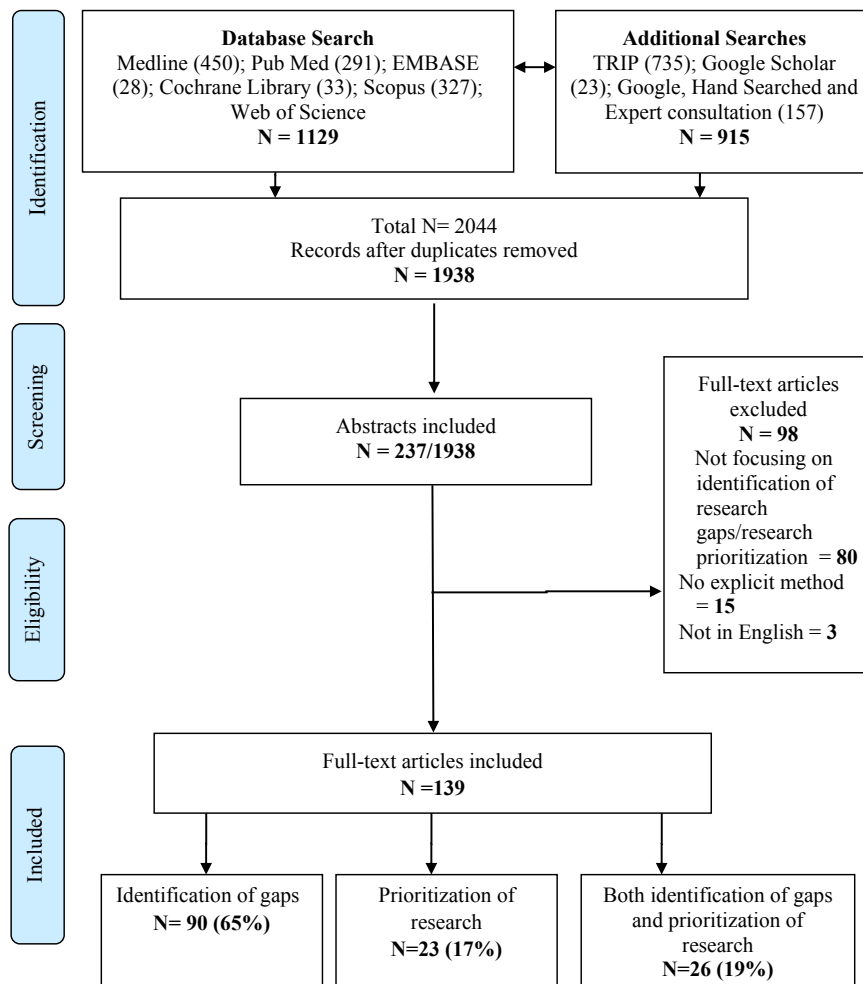


Fig. 1. Scoping review flow diagram.

Box 1 Definitions of research gaps as reported by the scoping review

Missing information

Research/evidence/knowledge gaps

- Evidence is missing from a body of research on a particular topic that could otherwise potentially answer the questions of decision-makers (clinicians, other practitioner groups, administrators, policy-makers) [14]

Synthesis/unidentified gaps

- Little or no evidence from systematic reviews is available and could be a valuable resource to inform the evidence base in a particular area [15,16]
- Lack of up-to-date and conclusive systematic reviews at low risk of bias mapped to a clinical question [17]

Treatment uncertainty

- Lack of up-to-date, reliable systematic reviews of research evidence addressing the uncertainty about the effects of treatment, and/or up-to-date systematic reviews of research evidence show that uncertainty exists [18]

Absolute evidence gaps

- Little or no evidence from primary studies is available [15]

Knowledge gap (knowledge void gap)

- Desired research findings do not exist [10,19,20]

Practical knowledge gap (action–knowledge conflict gap)

- Professional behavior or practices deviate from research findings or are not covered by research [10,19,20]

Inadequate information

Research/evidence/knowledge gaps

- The evidence base inadequately addresses a key question [21]

Empirical gap (evaluation void gap)

- Research findings or propositions need to be evaluated or empirically verified [10,19,20]

Population gap

- Research regarding a population that is not adequately represented or under-researched in the evidence base or prior research (e.g., sex, race/ethnicity, age) [5]

Insufficient information

Research/evidence/knowledge gaps

- Not much information is available and/or there is a lot of uncertainty about the accuracy of the existing estimates/evidence [7]
- Additional research is needed, from policy-makers perspectives, to address the evidence gap in the available primary research [14]

Methodological gap (method and research design gap)

- A variation in research methods is required to generate new insights or to avoid distorted findings [10,19,20]

Theoretical gap (theory-application void gap)

- Theory should be applied to certain research issues to generate new insights; theory is lacking, so a gap exists [10,19,20]

Discrepancies in both abstract and full-text screening were resolved in a meeting with senior researchers.

2.4. Data charting and synthesis

Data charting involved the use of Google Forms developed by LN with expert consultation, guidance from senior researchers and reviewing a previous methodological study [12]; the form was calibrated by LN and VN. See

Appendix D for the complete data extraction form. All data collection and analyses were conducted by LN, and VN extracted 10% (14/139 of all full-text articles). As an additional data cleaning step, two senior researchers then verified and discussed the 14 articles extracted by the second reviewer, to ensure data accuracy. A 95% agreement was achieved; disagreements were mainly on interpretation of methods used to identify gaps and/or determine research priorities. Disagreements were resolved in a meeting with

senior researchers. We extracted the following data from articles: type of article, main objective of the study, main study methodology, definition of research gaps, and specific methods to identify research gaps, determine research priorities and display research gaps or priorities [12]. The synthesis included quantitative analysis (i.e., frequency analysis) and qualitative analysis (i.e., thematic analysis) of the components of the methods to identify, prioritize, and/or display gaps in health research and conceptual definitions of gaps in health research [13].

3. Results

3.1. Results of the search

The literature search retrieved 2,044 citations, and after duplicates were removed, 1,938 remained. Overall, 247 references were considered potentially eligible. After full-text assessment, 98 articles were excluded, and 139 were included. Fig. 1 shows the flow chart of articles through the scoping review.

3.2. Summary of study designs

Among the 139 included articles, 90 (65%) aimed to identify gaps, 23 (17%) aimed to determine research

priorities, and 26 (19%) focused on both identifying gaps and determining research priorities.

3.3. Definitions of research gaps reported in articles

We explored the definitions as reported in the included studies. We identified a total of 12 different definitions, some of which overlapped, as presented in Box 1. Three cross-cutting themes were identified: definitions related to missing information, inadequate information, and insufficient information.

3.4. Specific methods for identifying research gaps

We then classified the methods used to identify research gaps. The most frequent methods in the review were aimed at gap identification (including both identification and prioritization) and involved secondary research, including knowledge synthesis (80/116 articles, 69%), specifically systematic reviews and scoping reviews (58/80, 73%) (Table 1). Overall, 24/116 (21%) articles described the use of both primary and secondary research and (12/116, 10%) only primary research. We found seven specific methods for identifying research gaps that we describe along with the purpose of the method (Table 2).

Table 1. Study designs used

Study design	All articles (N = 139)	Identification of research gaps (N = 90)	Research prioritization (N = 23)	Both identification and prioritization (N = 26)
Primary research	25 (18%)	8 (9%)	13 (56%)	4 (15%)
Qualitative study	3 (12%)	1 (13%)	2 (15%)	0
Quantitative survey	2 (8%)	1 (12%)	2 (15%)	1 (25%)
Both qualitative study and quantitative survey	20 (80%)	6 (75%)	9 (69%)	3 (75%)
Secondary research	85 (61%)	77 (86%)	5 (22%)	3 (12%)
Knowledge synthesis				
Systematic review ^a	36 (42%)	33 (43%)	1 (20%)	2 (67%)
Scoping review	25 (29%)	23 (30%)	2 (40%)	0
Evidence mapping	4 (4%)	3 (4%)	0	1 (33%)
Mapping study	2 (2%)	2 (3%)	0	0
Literature review	4 (4%)	4 (5%)	0	0
Umbrella review	4 (4%)	4 (5%)	0	0
Other (integrative review, critical interpretive synthesis)	8 (9%)	6 (8%)	2 (40%)	0
Bibliometric analysis	2 (1%)	2 (3%)	0	0
Both primary and secondary research	29 (21%)	5 (6%)	5 (22%)	19 (73%)
Review of evidence and quantitative study	6 (21%)	0	1 (20%)	5 (26%)
Review of evidence and qualitative study	3 (10%)	2 (40%)	0	1 (5%)
Review of evidence and both quantitative and qualitative study	20 (69%)	3 (20%)	4 (80%)	13 (68%)

^a Including methods used in Health Technology Assessments.

Table 2. Overview of specific methods to identify research gaps

Methods to identify research gaps	Definition	Purpose
Primary research methods		
Quantitative survey [17]	A scientific procedure for collecting information and making quantitative inferences about a predefined population	Determine evidence gaps by using a Likert-type response scale and scoring from 0 (not important at all) to 10 (highly important)
Academic crowd- sourcing [7]	An emerging paradigm that is based on harnessing the power of the crowd to solve problems [7]	Aims to reach a wider range of people, which may sometimes be required to solve a problem correctly and efficiently including identifying research gaps [7]
Needs assessment [22,23]	A systematic process for determining and addressing needs, or “gaps” between current conditions and desired conditions or “wants” by using various techniques including primary or secondary research methods (e.g., reviewing evidence, guidelines, and conducting interviews) [19]	Clarify problems and identify appropriate interventions or solutions [19]
Secondary research methods		
Knowledge synthesis		
Systematic review [14,24–27] ^a	Efficient scientific approach to identify and summarize evidence that allows for generalizability and consistency of the research findings to be assessed and data inconsistencies to be explored [28]	Summarize all pertinent studies on a specific question; improve the understanding of inconsistencies in diverse evidence and identify gaps in research evidence to define future research agendas [28]
Scoping review [12,29,30]		
Evidence mapping [15,31,32]		
Mapping study [33–35]		
Umbrella review [6]		
Integrative review [36]		
Critical interpretive synthesis [37]		
Bibliometric study [38,39]	The quantitative study of bibliographic material used to examine the knowledge structure and development of research fields based on analysis of related publications [40]	Provide a general picture of a research field that can be classified by papers, authors, and journals [40]
Both primary and secondary research methods		
Priority setting [17,18,41–51]		
James Lind Alliance priority setting partnership (JLA PSP), Cochrane Priority Setting (<i>consists of four steps: the first two aim at gap identification and the last two aim at research prioritization</i>)	JLA PSP methods were designed to allow clinicians, patients, and caregivers to work together to identify and prioritize uncertainties about the effects of treatments that could be answered by research by gathering research questions, checking existing research evidence, interim prioritization, and a final consensus meeting to reach agreement on the top 10 research priorities [41]	Raise awareness of research questions that are of direct relevance and potential benefit to patients and the clinicians who treat them, to lead to changes in how research funding is granted [41]
Global evidence-mapping methods [31,52]	Maps available research and provides an overview of a broad range of research questions and identifies evidence gaps [31]	Characterize the breadth, depth, methodology of relevant evidence and make this readily accessible [53]; identify research gaps

Italics represents an additional information on method.

^a Including methods used in Health Technology Assessments.

3.5. Specific methods for determining research priorities

Among the 49 studies aiming at research prioritization, the most frequent method involved both primary and secondary research, accounting for 24 (49%) studies, followed by primary research 17 (35%), and secondary research 8 (16%) (Table 1). We identified five

specific methods for determining research priorities (Table 3).

3.6. Specific methods for displaying research gaps and research priorities

We identified 14 unique methods used to display research gaps and/or research priorities and give some

Table 3. Overview of specific methods to determine research priorities

Methods to determine research priorities	Description	Summary of steps if specified
Primary research		
Delphi survey [51,54–56]	A group facilitation technique that seeks to obtain consensus on the opinions of relevant stakeholders by a series of structured questionnaires (commonly referred to as rounds). The questionnaires are completed anonymously by the experts (commonly referred to as panelists, participants, or respondents) [41]	Involves a series of questionnaires that are completed anonymously by experts. A process of group communication without the group ever meeting face to face. The responses from each set of questionnaires are analyzed, summarized, and then sent back to the participants until a large degree of consensus is reached in the area of interest.
Quantitative survey [17]	Adapted to determine participant research priorities by using forced ranking of research questions and Likert-type scale for responses	Developing and testing questionnaires to address research questions Forced ranking of research questions Likert-type scale
Secondary research		
Knowledge synthesis	Efficient scientific approach for identifying and summarizing evidence that allows for assessing the generalizability and consistency of research findings and exploring data inconsistencies [28]	Summarize all pertinent studies on a specific question; can improve the understanding of inconsistencies in diverse evidence, and identify gaps in research evidence to define future research agendas [28]
Systematic review [25] ^a		
Scoping review [29,30]		
Both primary and secondary research		
Priority setting [1,17,18,42–44, 46,47,49,50,54,57–65] <i>Example: JLA PSP methods</i>	Designed to enable clinicians, patients, and caregivers to work together to identify and prioritize uncertainties about the effects of treatments that could be answered by research [18]	Survey to identify treatment uncertainties Review of existing systematic reviews to explore existing evidence and address treatment uncertainties Interim prioritization to identify the priorities of relevant individuals and stakeholder groups Focus groups to discuss the research priorities based on missing or inadequate evidence A final consensus meeting to reach agreement on the top 10 research priorities [18]
Global evidence-mapping method [31,52]	Maps available research and provides an overview of a broad range of research questions and identifies evidence gaps [31]	Question development involving expert consultation, preliminary literature search, mapping workshop, online survey, and development of clinical question Question prioritization Evidence search and selections

Italics represents an example of method.

^a Including methods used in Health Technology Assessments.

examples of these methods (Table 4). We provide some illustrations of nontraditional methods. An illustration of all methods can also be found in Appendix E.

4. Discussion

Our findings demonstrate that the term “research gap” significantly differs across research contexts, and there is no common definition. It also reveals no clear methodological guidance on which methods should be used to identify research gaps or determine research priorities. This situation leads to a wide variety in methodology, for difficulties in comparing results across studies.

Also, many studies aimed at identifying gaps relied on secondary research, primarily systematic reviews. Systematic reviews are considered the gold standard in providing

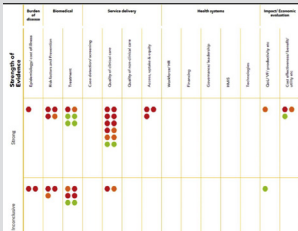
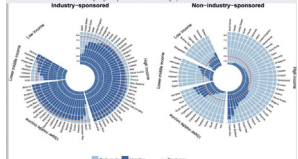
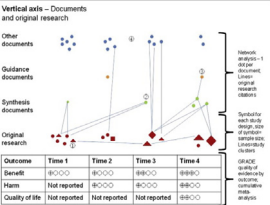
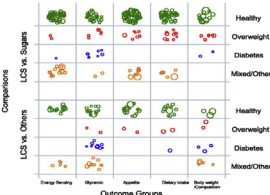
the highest level of evidence for the relative efficacy and safety of interventions [83] and summarizing the overall quality and results of research. A study on identifying and prioritizing research gaps corroborated that systematic reviews are the standard for evaluating the existing state of scientific knowledge regarding a specific clinical or policy question [79]. Robinson et al. [5] also developed a framework for using systematic reviews to identify research gaps. Although these two studies show that systematic reviews can identify research gaps, most systematic reviews address a highly focused question related to the existing evidence and thus present difficulties for explicitly identifying research gaps in a general area [5,79,84].

Other secondary research methods identified in this review were overviews of reviews, also known as umbrella reviews, scoping reviews, and evidence mapping.

Table 4. Overview of methods to display gaps and research priorities

Format	The information on research gaps and priorities displayed	Ways of displaying research
Table [1,14,17,18,23,30,31,41,45,47–49,52,58,66,67]	List of clinical questions, gaps, and research priorities Ranking quality of evidence Study designs to address research questions Scoring of each research gap List of research questions Prioritization of research questions Metric of ranking information	Table format ^a
Box plot [17]	List of research questions Ranking of research questions	Box plot format ^a
Bar graph/horizontal bar graph [17,33,61,68–74]	List of research priorities Frequency of questions prioritized Number of studies and categories studied Frequency of research questions Quality of evidence metric	Bar graph format ^a
Scatter plot [75]	Numeric values of desired research and current research	Scatter plot format ^a
Funnel plot [76]	Number of studies included in the review Effect sizes of studies on the x-axis	Funnel plot format ^a
Pie chart [70,77]	Proportional size of health problems being investigated by trials registered in a registry platform	Pie chart format ^a
Mind maps [78]	Diagram used to represent concepts, ideas, or tasks linked to and arranged radially around a central key word or idea Primary branches represent the major ideas or themes around the central topic, and secondary branches tend to include more concrete illustrative examples	Mind map format ^a
Tree map chart [33]	Number of clinical trials, population, and income group Comparison study of clinical registry data vs. global health research data from the Global Burden of Disease	 [33]
Word cloud [12]	Frequency of words Frequency of words between two groups	 [12]
Geographic map [24,79]	Studies mapped around the world using colors on a predefined health outcome. Different shapes and sizes also used for additional information on a map.	 [24]

(Continued)

Format	The information on research gaps and priorities displayed	Ways of displaying research
Dot plot [80]	Number of studies Quality of evidence Different colors to show different study designs	 [80]
Radial bar plot/polar histogram [33]	Proportion of trials in several countries using one color per country among two groups over a period of time Comparison of proportion of trials in several countries using one color per country among two groups over a period of time	 [33]
Schematic representation [38]	Horizontal axis represents time, and vertical axis represents different documents	 [38]
Bubble plot/chart [15,81,82]	Bubbles represent studies; size indicates the relative number of studies and color the study design Number of studies by intervention type and health status Compares three sets of values	 [82]

^a Examples available on [Appendix E](#).

A mix of primary and secondary research was most frequently used to determine research prioritization, namely, priority setting (e.g., JLA PSP methods). These

To display research gaps, half of the methods still used traditional ways to present findings (e.g., summary table and bar charts), and the other half used more advanced ways to display information (e.g., tree map charts, radial

bar plots, and bubble plots). The nontraditional methods used more colors and diagrams in presenting research gaps or priorities. For example, bubble plots use different shapes, sizes, and colors to display information and can be used to present up to three different variables in one diagram. These characteristics could be further explored to determine the appropriate method to be used along with specified methods to identify research gaps and/or determine research priorities.

Finally, our study confirmed that the various methods identified consist of both emerging and established approaches. Nonetheless, these methods can provide rich contextual details for establishing methodological guidance. We propose more work to improve the understanding of the methods and investigate ways to give the public, patients, clinicians, health researchers, decision-makers, and funders more opportunities to know what methodologies are available and can be used.

Our scoping review had some limitations. How the term “research gap” is used and defined varied widely among different authors and articles, and our exploration of methods for identifying research gaps, determining research priorities and displaying research gaps and priorities relied on definitions used by authors of included studies. Therefore, we may have missed some methods because of lack of clear definitions. Also, we included only documents written in English, relying on key articles to identify the steps involved in each method and as presented by the authors of the included articles. As such, we may have missed important methods that were published in other languages. In addition, the time restriction to the last 10 years provided a comprehensive list of recent methods used rather than an exhaustive list of all methods used.

Finally, we anticipate that our results will be of interest to knowledge users, including patients, public, clinicians, researchers, decision-makers, funders, key organizations such as JLA, the UK Database of Uncertainties about the Effects of Treatments, Joanna Briggs Institute, Campbell Collaboration, Africa Evidence Network, Cochrane Priority Setting Methods Group and Evidence-based Research Network, and finally methodologists focused on identifying and displaying gaps, and determining priorities in health research.

5. Conclusion

This study provides an overview of different methods used for and/or reporting on identifying gaps, determining research priorities and displaying both gaps and research priorities. The findings can be adopted to inform the development of standardized methods to identify, prioritize, and display gaps. They can inform further research and evidence-based decision-making by providing descriptions of different methods that can be adopted in identifying research gaps. These methods will also guide the

development of a qualitative study to explore key stakeholders’ perceived needs in identifying, communicating, and displaying gaps in research.

CRedit authorship contribution statement

Linda Nyanchoka: Conceptualization, Writing - review & editing, Formal analysis, Writing - original draft, Data curation. **Catrin Tudur-Smith:** Conceptualization, Writing - review & editing, Formal analysis. **Van Nguyen Thu:** Formal analysis, Writing - review & editing, Data curation. **Valentia Iversen:** Writing - review & editing. **Andrea C. Tricco:** Writing - review & editing. **Raphaël Porcher:** Conceptualization, Writing - review & editing, Formal analysis.

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Supplementary data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.jclinepi.2019.01.005>.

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