

REVIEW ARTICLE

The barriers and facilitators for the implementation of clinical practice guidelines in healthcare: an umbrella review of qualitative and quantitative literature

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Abstract

Objectives: To identify barriers and facilitators of clinical practice guidelines (CPGs) implementation, and map those factors to the theoretical domains framework (TDF) and behavior change wheel (BCW).

Methods: We conducted an umbrella review of systematic reviews. PubMed, Embase, and the Cochrane Library were searched. Two investigators independently screened the studies, extracted the data, and assessed the methodological quality. The identified barriers and facilitators of CPG implementation were categorized and mapped to the TDF domains and BCW components.

Results: Thirty-seven studies were included, and 193 barriers and 140 facilitators were identified. Intrinsic aspects (35 barriers and 28 facilitators) mainly included the CPGs' impracticality, complexity, and inaccessibility. Extrinsic aspects (158 barriers and 113 facilitators) mainly included lack of resources, training, funding, or awareness of CPG content in barriers; audits and feedback; strong leadership and management support; and educating and training about CPGs in facilitators. Environmental context and resources ($n = 97, 19.48\%$) were the most reported barriers in TDF domains. Physical opportunity and social opportunity were the most frequently mentioned models in BCW.

Conclusion: Multiple barriers and facilitators for healthcare CPG implementation are identified, with further links to TDF and BCW. Future knowledge translation strategies should be developed accordingly in specified health care settings. © 2023 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: Clinical practice guidelines; Implementation; Barriers; Facilitators; Theoretical domains framework; Behavior change wheel

Data availability: The original contributions presented in this study are included in the article or Supplementary Materials. Further inquiries can be directed to the corresponding authors.

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1. Introduction

Clinical practice guidelines (CPGs) are systematically developed statements for the optimization of patient care based on the current best available evidence, professional expertise, and the patient's values and preferences [1,2]. As a significant part of the research evidence ecosystem [3], CPGs are recognized as irreplaceable tools to narrow the gap between evidence and practice and reduce clinical practice variation.

Despite trustworthy CPGs being increasingly developed according to the AGREE (appraisal of guidelines, research,

What is new?**Key findings**

- Implementation of clinical practice guidelines (CPGs) yields a complex process that is impacted by multiple-level barriers and facilitators; nevertheless, there has not been an overview of the latest literature that map the framework and behavioral change.
- This umbrella review comprehensively summarizes knowledge on 193 barriers and 140 facilitators in health care CPG implementation, along with further links to the 14 theoretical domains framework domains and the behavior change wheel components.

What this adds to what was known?

- Our findings contribute to the development of theory-based knowledge translation strategies in specific clinical settings to hopefully improve adherence to CPGs.

What is the implication and what should change now?

- Implementation strategies for CPGs should be formulated based on identified factors and further adjusted according to target clinical practice settings.

wide variety of guidelines-, individual-, organizational-, and system-level barriers and facilitators [6,10].

Prior overviews have originally explored various factors of CPG implementation in different clinical settings [11,12]. However, their included studies did not rigorously focus on CPG implementation. They failed to categorize the preidentified determinants into theory-based frameworks, thus being unable to further link them to potential behavior change interventions, which were believed to optimize CPG dissemination and implementation [13]. Factors that are not likely to translate into behavior change may not achieve implementation objectives. The theoretical domains framework (TDF), one of the most frequently used theoretical basis frameworks [14], is regarded as an efficacy approach to identifying the determinants of behavior [15]. While the behavior change wheel (BCW), a method for characterizing and designing behavior change interventions, has been well linked to TDF and intervention functions and policy categories [16].

The published body of knowledge on this area continues to grow since CPG implementation has been increasingly recognized as a process crucial to improving healthcare quality. Therefore, there is a need for an updated, comprehensive, and theory-based review to summarize the currently identified determinants of CPG implementation. A umbrella review systematically collects and evaluates information from multiple systematic reviews and has the potential to provide the highest quality of evidence [17]. In light of the above, this umbrella review aims to (1) identify barriers and facilitators for CPG implementation; (2) map them to the TDF; and (3) map them to the BCW.

and evaluation) II [4] instrument and RIGHT (reporting items for practice guidelines in healthcare) statement [5], which assess the process of CPGs development and reporting, not all CPGs are readily and directly translatable into practice and/or policy. Therefore, efforts are urgently needed to promote active dissemination and innovative implementation. A systematic review indicated that the median proportion of respondents who reported adhering to CPGs is only 36% [6], with a large variation between different physicians and between different CPGs. Therefore, well-designed, well-prepared, and pilot-tested implementation strategies should be considered to successfully enhance the adaptability of CPGs to local contexts or circumstances [7].

Implementation science is defined as the scientific study of methods to promote the systematic uptake of research findings and other evidence-based practice into routine practices to improve the quality and effectiveness of health services and care [8]. Hence, identifying determinants that affect its uptake into routine use plays crucial roles according to implementation models [9]. However, CPG implementation yields a complicated process affected by a

2. Methods

We conducted an umbrella review of relevant systematic reviews and reported the results according to the Preferred Reporting Items for Overviews of Reviews reporting guidelines [18] ([Supplementary Material 1](#)). The protocol was registered (PROSPERO, CRD42022337120), and there were no amendments of principle in this review to the information provided in the protocol.

2.1. Eligibility criteria

Sample, Phenomenon of Interest, Design, Evaluation, Research type (SPIDER) model was applied to identify eligible studies [19] ([Supplementary Material 2](#)). Systematic reviews or meta-analyses of qualitative, quantitative, or mixed-methods studies that examined the barriers and facilitators for the implementation of health care CPGs. Narrative reviews, methodology articles, and the application of implementation tools studies was excluded. Additionally, unpublished data, conference abstracts, editorials, or letters were not included.

2.2. Search strategy

The prior umbrella reviews conducted by Francke et al. [11] and Correa et al. [12] included studies that were published from inception to November 2006 and from December 2006 to January 2018, respectively; therefore, we updated the search from January 2018 to June 2023. Searches were performed using the SPIDER framework in electronic databases (PubMed, Embase, and the Cochrane Library) according to a predesigned search strategy, including “guideline”, “barrier”, “facilitator”, “implementation”, “systematic review”, and “meta-analysis”, using MeSH terms, titles, and abstracts (Supplementary Material 3). A gray literature search in Google Scholar was performed, and a manual search of references in key background documents was also conducted to further include eligible records.

2.3. Study selection

Pairs of investigators (P.Z. and L.C.) independently screened the titles, abstracts, and full texts that appeared relevant to the topic after eliminating the duplicates, with any discrepancies resolved through discussion or consultation by a third investigator (S.Z.). A blind review of a sample of 5% of records was carried out to ensure interrater reliability until a consensus ($\geq 90\%$) was reached in the study selection. Studies included in pre-existing reviews before 2018 were also selected based on the inclusion criteria in this review. The overlap among the included systematic reviews on the same health topic was carefully considered. A Preferred Reporting Items for Systematic reviews and Meta-Analyses flow diagram was generated to show the research results and the process of screening and selecting studies for inclusion.

2.4. Data extraction

Data were extracted from the included studies using a template, including the following baseline information: the first author, the publication year, countries or regions, the research topic, data synthesis methods, the number and type of included studies, methodological quality assessment tools, confidence assessment tools, and the detailed determinants of CPG implementation. The data extraction was carried out independently by two investigators (P.Z. and L.C.), with any disagreement discussed or consulted by a third investigator (S.Z.).

2.5. Methodological quality assessment

Two investigators (P.Z. and Z.W.) independently appraised the methodological quality of included studies using the “Checklist for Systematic Reviews and Research Syntheses” developed by the Joanna Briggs Institute, which was designed to evaluate the quality of quantitative and qualitative systematic reviews or meta-analyses [20]. The

checklist consists of 11 questions (detailed in Supplementary Material 4), each of which could be scored as being ‘met’, ‘not met’, ‘unclear’, or ‘not applicable’. Scores range from 0 to 10 points, and higher scores indicate higher levels of methodological quality. The preassessment of a sample of 10% of the included studies was independently performed to ensure consistency in understanding individual questions. Any disagreement was resolved through discussions or consultation with a third investigator (K.Y.).

2.6. Data synthesis and analysis

The determinants of CPG implementation were first categorized according to the Tailored Implementation for Chronic Diseases (TICD) checklist, an integrated checklist of determinants of practice, as this framework was specifically developed for health care improvement, comprising guideline factors (one intrinsic aspect), individual health professionals’ factors, patient factors, professional interactions, incentives and resources, capacity for organizational change, and social, political, and legal factors (six extrinsic aspects) [10]. The determinants were not considered if they were neutrally described (i.e., training), so it was difficult to determine whether they belonged to barriers (i.e., lack of training) or facilitators (i.e., provide training). This assessment was independently performed by two investigators (P.Z. and E.W.), with disagreement resolved by discussion or consultation with the third investigator (Y.Y.).

In order to transfer these determinants to behavior change, they were then mapped to TDF, which contained 14 domains highlighting individual, social, and environmental factors that may influence behavior [15,21]. Furthermore, TDF determinants were further linked to the BCW model (six sources of behavior, nine intervention functions, and seven policy categories) [16,22]. The data analysis process is shown in Supplementary Material 5. Furthermore, the detailed determinants were descriptively analyzed in tables. The categorized domains of TICD, TDF, and BCW were graphically synthesized.

3. Results

3.1. Search process

A total of 3,874 records were identified through updated searches. After duplicates were removed, 2,275 records were obtained through a multistep screening process (title, abstract, and full-text review), leaving 19 records that met the inclusion criteria. Together with 18 studies selected from prior overviews [11,12], 37 studies were finally eligible for quality evaluation and data synthesis (Fig. 1).

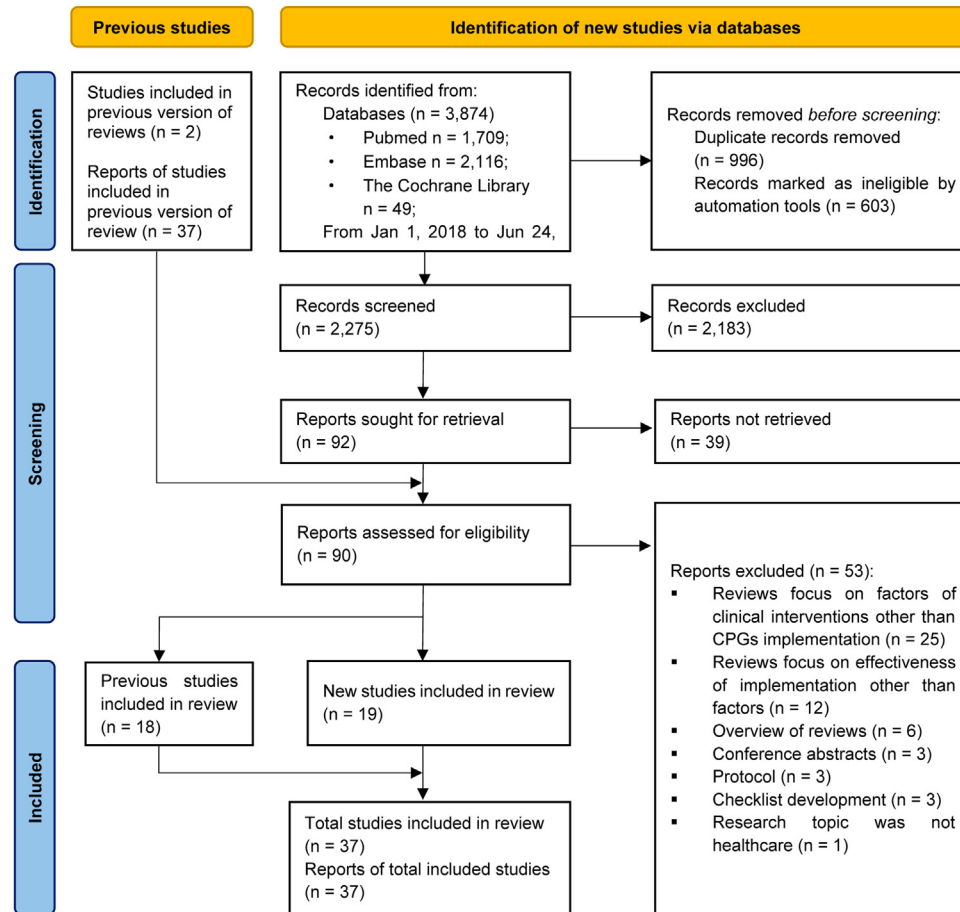


Fig. 1. Study flow from literature search. (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

3.2. Study characteristics

The main characteristics of individual studies are available in [Table 1](#) and [Supplementary Material 6](#). Most reviews included quantitative, qualitative, and mixed-methods studies from a variety of countries or regions. All studies focused on barriers and facilitators of CPG implementation with a wide range of health themes, mainly including nursing, infectious diseases, cancer treatment, musculoskeletal disorders, pulmonary diseases, pediatrics, psychological interventions, evidence-based medicine, etc. More than half of the reviews (21, 63.6%) assessed the methodological quality of the included studies, and only three reviews [23–25] (9.1%) used assessment tools to evaluate the confidence of the evidence. The overlap across research was not taken into consideration because only a very tiny proportion of the included studies had comparable health themes.

3.3. Methodological quality assessment

The overall methodological quality assessment of the included reviews is presented in [Table 1](#), and detailed

reasons can be found in [Supplementary Material 4](#). A total of 37.83% (14/37) met all criteria, and 70.27% (26/37) had a quality score of no less than 7 out of 10 criteria. The reasons for low methodological quality mainly included the absence or inappropriate method of data extraction, criteria for study appraisal, and specific directives for new research.

3.4. Barriers and facilitators for CPGs implementation

Initially, a total of 307 barrier factors and 190 facilitator factors were identified from the included studies. After splitting and merging the pertinent determinants, 193 barrier factors and 140 facilitator factors were eventually confirmed.

As shown in [Fig. 2](#), the most frequently identified barrier factors in TICD included individual health professional factors, guideline factors, and incentives and resource factors. While the most frequently highlighted facilitator factors in TICD were incentives and resources factors, capacity for organizational change factors, and guideline factors. Similarly, patient factors, professional interactions, and social, political, and legal factors were relatively less addressed.

Table 1. Baseline characteristics of included studies

First author, yr	Countries or regions	Research topic ^a	Data synthesis methods	The number and study types of included studies	Methodological quality assessment tools	Confidence assessment tools	Methodological quality assessment by JBI
Gittus 2023	USA, Canada, Europe, Japan, Saudi Arabia, Netherlands, Portugal, Australia, International	Rare diseases	Mixed	44 studies (29 quantitative; six qualitative; eight mixed-methods; one unknown)	JBI-TO, JBI-PS, QI-MQCS, CASP checklist, MMAT, ROBICSSAP, ROBIS	NR	10/10
Cormican 2023	Australia, Canada, Ireland, Netherlands, New Zealand, UK, Iceland	Stroke rehabilitation	Qualitative	22 studies (10 qualitative, six quantitative; six mixed-methods)	MMAT	NR	8/10
Gallione 2022	Jordan, USA, Europe, Sweden, Rwanda, Canada, Ghana, Lebanon, India, Australia, Spain, China, The Netherlands, Finland, Korea, Brazil, Sri Lanka, Germany, Poland, UK, Switzerland, Cyprus, Singapore, South Africa	Nurses' implementation of clinical practice	Mixed	60 studies (34 quantitative; 16 qualitative; 10 mixed-methods)	MMAT	NR	8/10
Hassan 2021	USA, Australia, Brazil, Canada, France, Italy, Jordan, UK, Belgium, China, Greece, Ireland, Korea, New Zealand, Nigeria, Qatar, South Africa, Spain, Turkey	Adherence to surgical antimicrobial prophylaxis	Qualitative	48 studies (36 non-randomized studies; five qualitative studies; four quantitative studies; two randomized control trials; one mixed methods study)	MMAT	NR	8/10
Islam 2021	South Africa, Nigeria, India, China, Pakistan, Indonesia, Bangladesh	Tuberculosis infection prevention and control	Qualitative	29 studies (21 quantitative studies; four qualitative studies; four mixed method studies)	NR	NR	5/10
Mcarthur 2021	Canada and Australia, Netherlands, the USA, England, Sweden, Germany, South Korea, Belgium	Long-term care	Qualitative	33 studies (10 qualitative studies; six mixed method studies; six process evaluations; three multiple case studies; six other types or not reported)	CASP checklist; the critical appraisal tools developed by Salmi	NR	10/10
Paksaitė 2021	Australia, Canada, UK, New Zealand, the Netherlands, Ireland, Lao People's Democratic Republic	Adoption of prescribing CPGs	Qualitative	15 studies (six mixed method studies; six interviews; two focus groups; one survey study)	NR	NR	6/10
Sorondo 2021	Europe, and North America, New Zealand or Australia, Israel and Africa	Musculoskeletal disorders	Qualitative	44 studies (27 epidemiological designs; 13 qualitative studies; three mixed method studies)	COREQ	NR	10/10

(Continued)

Table 1. Continued

First author, yr	Countries or regions	Research topic ^a	Data synthesis methods	The number and study types of included studies	Methodological quality assessment tools	Confidence assessment tools	Methodological quality assessment by JBI
Almazrou 2020	Middle East, North Africa region	Adherence to CPGs	Qualitative	15 studies (four qualitative studies; nine quantitative studies; two mixed method studies)	CASP checklist	NR	10/10
Bierbaum 2020	Australia, Canada, others	Cancer treatment	Qualitative	15 studies (11 quantitative studies; four qualitative studies)	MMAT	NR	9/10
Finch 2020	USA, Canada, Africa, international samples and Scandinavia	Post-traumatic stress	Qualitative	34 studies (24 quantitative studies; eight qualitative studies; two mixed method studies)	modified McMaster Critical Appraisal tool	NR	10/10
Houghton 2020	Australia, Canada, Hong Kong (China), Singapore, South Korea, Taiwan (China), and USA, China, the Dominican Republic, India, Russia and South Africa, Uganda	Infection prevention and control CPGs for respiratory infectious diseases	Qualitative	20 quantitative studies	CASP checklist	GRADE-CERQual	10/10
Spoon 2020	USA, Netherlands, Australia, China, UK, Italy, Iran, Germany, Sweden, Canada, Angola, Belgium, Finland, Iceland	Nursing CPGs in daily practice	Mixed	54 studies (15 studies had controlled before-after, randomized controlled trial or cluster randomized controlled trial design; 38 studies had before-after design)	Cochrane risk of bias tool and Newcastle-Ottawa Quality Assessment	NR	10/10
Tan 2020	South Africa, Ethiopia, the Dominican Republic	Tuberculosis infection prevention and control	Qualitative	24 studies (16 quantitative studies; eight qualitative studies)	COREQ; The Quality Assessment Tool for Quantitative Studies designed by the Effective Public Health Practice Project	NR	8/10
Tatar 2020	Europe, North America, Africa, Asia, Oceania	Human papillomavirus test	Qualitative	32 studies (28 quantitative studies; four qualitative studies)	NR	NR	7/10
Govere 2020	Sub-Saharan Africa	Antiretroviral therapy initiation	Qualitative	16 studies (four cross-sectional surveys; three observational studies; four cost-effectiveness studies; five retrospective studies)	NR	NR	6/10
Hall 2019	USA, UK, Germany, New Zealand, Israel, Norwegian, Australia, Republic of Ireland, Canada, Netherlands	Low back pain	Qualitative	14 studies (eight interviews; six focus group studies)	CASP checklist; CORED	CERQual	10/10
Fishe 2018	USA, Canada, the Netherlands, Australia, Sweden, Denmark, Finland	Prehospital evidence-based CPGs	Qualitative	41 studies (12 statement documents; 12 retrospective cohort studies; nine cross-sectional studies; eight NR)	NR	GRADE	6/10

(Continued)

Table 1. Continued

First author, yr	Countries or regions	Research topic ^a	Data synthesis methods	The number and study types of included studies	Methodological quality assessment tools	Confidence assessment tools	Methodological quality assessment by JBI
Sehl 2018	USA, UK, Switzerland, Italy, Sweden, Spain, Australia	Chronic obstructive pulmonary disease	Qualitative	11 studies (one quantitative studies; 10 qualitative studies)	NR	NR	5/10
Baatiema 2017	Australia, USA, Switzerland, Denmark, Netherlands, Norway	Evidence-based practice for acute stroke care	Qualitative	10 studies (three qualitative studies; seven quantitative studies)	The checklist by the JBI; The guidelines suggested by the Center for Evidence-Based Management	NR	10/10
De Clercq 2017	USA, UK, Canada, Australia, Italy, Germany, Switzerland, Israel, Poland	Pediatric palliative care	Mixed	25 studies (10 quantitative methods, 10 qualitative methods, five mixed methods)	NR	NR	6/10
Egerton 2017	Australia, France, UK, Germany, Mexico	The management of osteoarthritis	Qualitative	Eight qualitative studies	CASP checklist	CERQual	10/10
Wood 2017	USA, UK, Germany, Canada	Collaborative care for depression	Qualitative	18 studies (12 qualitative studies; two service evaluations; one mixed method study; one grounded theory analysis; one researcher narratives; 1 three component model)	The Cochrane assessment of bias and CASP checklist	NR	10/10
Craig 2016	USA, France, Australia, Sweden, The Netherlands	Acute stroke patients in the emergency department	Qualitative	Nine studies (five qualitative studies; four survey studies)	CASP checklist; the Center for Evidence-Based Management “Appraisal of a Survey” tool	NR	10/10
Ince 2016	UK	Psychological interventions for schizophrenia	Mixed	26 studies (12 quantitative observational cross-section studies; five national audits; seven local service audits; four qualitative studies using a mixture of methods; seven mixtures of qualitative and quantitative cross-section studies; two randomized control trials; one non-experimental cases study)	Three NICE quality appraisal checklists	NR	8/10
Jun 2016	USA, Australia, Canada, Finland, Singapore, Sweden, the Netherlands	Nurses’ use of CPGs	Mixed	16 studies (nine qualitative studies; seven qualitative descriptive studies; one grounded theory analysis; one phenomenology)	CASP checklist	NR	8/10

(Continued)

Table 1. Continued

First author, yr	Countries or regions	Research topic ^a	Data synthesis methods	The number and study types of included studies	Methodological quality assessment tools	Confidence assessment tools	Methodological quality assessment by JBI
Stokes 2016	Sub-Saharan Africa, Somalia, Tanzania, Burkina Faso, Benin, Senegal, South Africa	Obstetric care practice improvement	Qualitative	9 studies (eight qualitative studies; one mixed method studies)	CASP checklist	NR	10/10
Sadeghi-Bazargani 2014	UK, USA, India, Canada, Pittsburgh, Estonia, Australia, Poland, the Netherlands, Finland, Iowa City, Jordan, Sweden, Cameroon, Belgium, South Africa, Argentina, China, Japan, Qatar, Malaysia, Saudi Arabia, Iran, South Korea	Evidence-based medicine	Mixed	106 studies (Descriptive and qualitative studies)	STROBE checklist; CASP checklist; PRISMA	NR	10/10
Christl 2011	NR	Preventing vascular disease	Mixed	NR	NR	NR	5/10
Gaston 2012	USA, Australia, Saudi Arabia, UK, Iran, Ireland, Canada	Venous thromboembolism risk assessment and prophylaxis	Mixed	20 studies (16 quasi-experimental (pre-test post-test) studies; one cohort study; one case series; one ethnographic study; one study using grounded theory)	JBI-MAStARI; JBI-QARI	NR	9/10
Cochrane 2007	NR	General health care	Mixed	256 studies (34 qualitative studies, 178 surveys, 44 mixed-model studies)	The analysis technique outlined by Bickman and Miles and Huberman	NR	9/10
Grimshaw 2006	USA, and 13 other different countries	CPGs	Mixed	235 studies (110 cluster randomized trials; 29 patient randomized trials; seven cluster allocated controlled clinical trials; 10 patient allocated controlled clinical trials; 40 controlled before and after studies; 39 interrupted time series designs)	Cochrane EPOC group criteria	NR	9/10
Simpson 2005	NR	The management of community-acquired pneumonia	Qualitative	Eight studies (five surveys; one review; two others)	NR	NR	4/10
Toohar 2003	NR	Implementation of pressure ulcer CPGs	Mixed	20 pre- and post-intervention studies	NR	NR	6/10
Gross 2001	NR	Antimicrobial usage	Qualitative	40 studies	NR	NR	4/10

(Continued)

Table 1. Continued

First author, yr	Countries or regions	Research topic ^a	Data synthesis methods	The number and study types of included studies	Methodological quality assessment tools	Confidence assessment tools	Methodological quality assessment by JBI
Cabana 1999	NR	CPGs, practice parameters, clinical policies, national recommendations or consensus statements	Qualitative	76 studies (five qualitative studies, 120 surveys ^b)	NR	NR	7/10
Davis 1997	NR	CPGs	Qualitative	NR	NR	NR	5/10

Abbreviations: NR, not reported; CPGs, clinical practice guidelines; JBI, Joanna Briggs Institute; JBI-TO, Joanna Briggs Institute-Text & Opinion; JBI-PS, Joanna Briggs Institute-checklist for prevalence studies; QI-MQCS, Quality Improvement-Minimum Quality Criteria Set; CASP, Critical Appraisal Skills Program; MMAT, The Mixed Methods Appraisal Tool; ROBICSSAP, Risk of Bias instrument for cross-sectional surveys of attitudes and practices; ROBIS, Risk of Bias in Systematic Reviews; COREQ, Consolidated criteria for Reporting Qualitative research Checklist; STROBE, Strengthening the Reporting of Observational studies in Epidemiology for observational studies; PRISMA, Preferred Reporting Items for Systematic reviews and Meta-Analyses; JBI-MAStARI, Standardized critical appraisal instruments from the JBI Meta Analysis of Statistics Assessment and Review Instrument; JBI-QARI, standardized critical appraisal instruments from the JBI Qualitative Assessment and Review Instrument.

^a All included studies focused on CPG implementation.

^b A survey was defined as at least one question.

Supplementary materials 7 and 8 summarized the detailed information on all identified factors of CPG implementation. The most frequently identified barriers included lack of resources ($n = 16$), lack of awareness of CPG content ($n = 15$), lack of training ($n = 15$), lack of knowledge ($n = 14$), lack of funding ($n = 13$), lack of familiarity with CPGs ($n = 11$), and emotional burden and physician reluctance ($n = 10$). While the most often highlighted facilitators contained audits and feedback ($n = 12$), education and training about CPGs ($n = 11$), strong leadership and management support ($n = 11$), and collaboration between clinical disciplines ($n = 9$).

3.4.1. Guideline factors

A total of 35 barriers and 28 facilitators in CPG factors were identified. Considering their applicability, guideline factors are unlikely to be mapped to the TDF. CPGs may not be followed if they are considered impractical, complex, inaccessible, inapplicable, heterogeneous in published CPGs, lack of clarity, or considered to challenge clinician authority or autonomy. Conversely, CPGs are more likely to be utilized if they are accessible, concise, or clearly developed, simple or user-friendly described, flexible, evidence-based, peer-endorsed, or a part of routine clinical practice (Supplementary Materials 7 and 8).

3.4.2. TDF domains

A total of 158 barriers and 113 facilitators in TDF domains for CPG implementation were reported, and the information was summarized in Supplementary Materials 7 and 8. Overall, environmental context and resources (33 barriers reported 109 times, expressed as 33/109), social influences (34/63), knowledge (9/55), and skills (11/50) were the most reported barriers in TDF. Social influences (20/45), environmental context and resources (21/32), skills (11/31), reinforcement (17/30), and social or professional

role and identity (6/26) were the most frequently identified facilitators in TDF (Supplementary Materials 9).

3.5. BCW components

BCW interventions and policies for CPG implementation determinants were produced in accordance with the BCW mapping principles to the TDF domains (Supplementary Materials 9 and 10) [16,26]. For CPG implementation, physical and social opportunities were the components that the identified factors mapped onto most frequently, and restriction, environmental restructuring, and enablement are suggested interventions to change behavior. Psychological and physical capabilities were the components of increasing the skills of CPG implementation through education, training, and enablement. Automatic motivation was also a component linked to the reinforcement domain, which is likely changed by persuasion, incentivization, coercion, environmental restructuring, modeling, or enablement. Furthermore, policies linked to intervention functions can be found in previously published methodological articles [16], which may help policymakers and researchers to develop strategies in to successfully improve the CPG implementation.

4. Discussions

4.1. Summary of the main findings

In this umbrella review, we systematically identified 185 barriers and 138 facilitators to CPG implementation in a variety of healthcare themes. Intrinsic and extrinsic aspects can both have an impact on CPG implementation [27,28]. Our analysis provides a comprehensive summary of guideline factors, which may serve as a significant source of information for the optimization of CPG implementability for

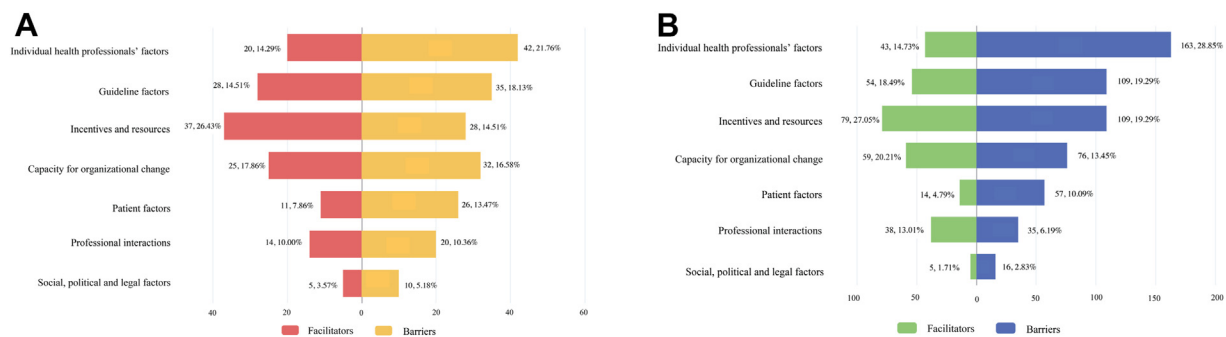


Fig. 2. A), TICD distribution based on factors. (B), TICD distribution based on reported frequency. (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

CPG development organizations, methodologists, and policymakers. Additionally, the extrinsic barriers and facilitators were comprehensively synthesized and linked to the TDF domains and BCW components, which can contribute to the design of implementation strategies in clinical settings.

CPGs increasingly play vital roles in the optimization of patient care, but adherence to CPGs is unsatisfied [29,30]. The methodological and reporting quality of CPGs remains variable [31] and needs to be continuously improved. As shown in our study, CPG recommendations will be more easily implemented if they are based on trustworthy evidence, peer-endorsed, and updated regularly. Large efforts are required for the dissemination of CPG development checklists [4,5], training of CPGs makers, and the continuous quality evaluation of published CPGs. More importantly, poor CPG implementability is more commonly addressed in our study. CPG developers, users, and researchers can recognize the gap between existing CPGs and clinical practice requirements.

Apart from CPG factors, our study also identified a substantial number of extrinsic factors in CPG implementation. Education of clinicians or patients through materials, meetings or outreach visits, training, auditing, feedback, opinion leadership, management support, multi-disciplinary team (MDT), and reminders were frequently reported factors that were also proven to be effective in promoting CPG adherence [32–34]. However, some social or environmental barriers may be challenging to overcome owing to their objective attributes, and their implementation effectiveness in different clinical conditions remains uncertain.

Interestingly, several factors may be reversed under certain circumstances. For instance, the collaboration between clinical disciplines in MDT was found to be a facilitator, but unclear accountability in MDT care can lead to confusion in CPG utilization. As for the experience, more experienced the staff are, the more inclined they are to rely on their personal judgment rather than CPG recommendations. Conversely, younger clinicians with less experience are more likely to obey the CPGs. Therefore, implementation interventions must be tailored to barriers and the local context [35].

4.2. Theory-based knowledge translation

While the significance of translating knowledge into behavior change is widely acknowledged in CPG implementation, it still presents a challenge to most CPG developers and users. An increasing number of studies used processes to select and tailor interventions for CPG implementation, but only 21.2% of those studies referred to frameworks or theories [14]. A total of 55.9% of the included studies pre-identified barriers through the literature, and TDF (28%) and BCW (20%) were discovered to be the frameworks that were adopted the most frequently [14].

Interventions and policies to practice behavior change can be theoretically designed and implemented in accordance with identifying factors of CPG implementation using TDF and then mapping them onto BCW [36–38]. Considering that TDF was initially intended to identify influences on health professional behavior linked to the adoption of evidence-based recommendations, CPG factors appear to be unable to map onto any of the TDF domains. A wide range of BCW components were reported in our study, and potential intervention functions and policies might be considered to improve CPG adoption behavior. However, the effectiveness of specific CPG implementation strategies was not further discussed in our research since they should be established according to clinical settings and targeted populations [39].

A worldwide survey demonstrated that implementation scientists utilized numerous criteria to choose frameworks and theories, but there was little consensus on which was most crucial [40]. TDF can also be related to other relevant frameworks or theories, such as the Consolidated Framework for Implementation Research 2.0 [41], Reach, Effectiveness, Adoption, Implementation, Maintenance (RE-AIM) framework [42], etc. Furthermore, the combination of multiple frameworks was used to address multiple study purposes, such as using CFIR + TDF [43] or CFIR + RE-AIM [44].

4.3. Strengths and limitations

Our study featured several strengths. This review updates the literature and takes into account the latest

situation regarding barriers and facilitators to CPG implementation. Further, the identified factors have been linked to TDF and BCW, which can benefit the establishment of theory-based knowledge translation interventions.

Some limitations need to be considered. First, given that we included systematic reviews, it's possible that duplicate factors were obtained from reviews with similar healthcare themes. Second, while categorizing the factors within the TDF domain, a little part of the factors may cross over due to the various study granularities, but the general trend and composition may not be impacted. Third, the factors that were not originally based on theory were categorized into TDF domains according to definitions and examples, so they might be influenced by subjectivity. Fourth, the strength and heterogeneity of the explored factors of CPG implementation were not evaluated.

4.4. Implications for practice and research

We suggest that health care organizations should select trustworthy and high-quality CPGs to guide clinical practice and be aware of the facilitators and barriers to CPG implementation. National organizations should further disseminate, organize training, and develop assessment systems to promote the improvement of the methodological and reporting quality of CPGs. Furthermore, the CPG development institutions can develop a set of implementation strategies (e.g., the Expert Recommendations for Implementing Change, [45]) in combination with surveys, group discussions, or Delphi expert consensus. Implementation strategies for specific and target clinical practice settings can be developed and validated by conducting controlled implementation studies on key intervention strategies [46,47].

Future studies should further explore the differences in implementation strategies across CPGs of different types, healthcare conditions, and target populations. The discrepancy between multi-factorial and single-factorial interventions' effects on CPG implementation should also be addressed [48]. CPG implementation needs complex interventions (interventions with multiple interconnecting components [49]), and we need to determine the interaction and priority of multiple identified factors when developing the strategies. Furthermore, more effort is required to utilize and improve computerized decision support systems to assist and facilitate CPG implementation [50].

5. Conclusion

Multiple barriers and facilitators for healthcare CPG implementation are identified, with a further link to TDF and BCW. Knowledge translation strategies for CPG implementation should be developed according to these factors in

specified health care settings and populations. Considering the complexity and heterogeneity of the clinical application of CPGs, future studies are needed to explore the combined effects and interactions of multiple complex intervention strategies.

CRedit authorship contribution statement

Pengxiang Zhou: Data curation, Formal analysis, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. **Lu Chen:** Data curation, Formal analysis, Resources, Validation, Visualization, Writing – review & editing. **Ziyang Wu:** Data curation, Formal analysis, Resources, Validation, Visualization, Writing – review & editing. **Ente Wang:** Formal analysis, Validation, Visualization, Writing – review & editing. **Yinying Yan:** Formal analysis, Supervision, Validation. **Xiaodong Guan:** Methodology, Supervision, Writing – review & editing. **Suodi Zhai:** Conceptualization, Methodology, Project administration, Writing – original draft, Writing – review & editing. **Kehu Yang:** Conceptualization, Methodology, Project administration, Writing – original draft, Writing – review & editing.

Declaration of competing interest

The authors have no competing interests.

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Supplementary data

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