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Key performance indicators for pharmaceutical services: A systematic review☆

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ABSTRACT

Background: Key performance indicators (KPIs) are a set of indicators that improve the quality of services provided by pharmacists. They enable the monitoring and evaluation of result progress and optimize decision-making for stakeholders. Currently, there is no systematic review regarding KPIs for pharmaceutical services.
Objectives: To identify and assess the quality of KPIs developed for pharmaceutical services.
Methods: A systematic review was conducted in PubMed, Scopus, EMBASE, and LILACS from the inception of the database until February 5th, 2024. Studies that developed a set of KPIs for pharmaceutical services were included. The indicators were evaluated using the Appraisal of Indicators through Research and Evaluation (AIRE) instrument. Two independent reviewers performed the study selection, data extraction, and quality assessment.
Results: Fifteen studies were included. The studies were conducted in different regions, most of which were developed for clinical services in hospitals or ambulatory settings, and used similar domains for the development of KPIs such as medication review, patient safety, and patient counseling. Literature review combined with the Delphi technique was the method most used by the studies, with content validity by inter-rater agreement. Regarding methodological quality, most studies described information on the purpose, definition, and stakeholders' involvement in the set of KPIs. However, little information was observed on the strategy for risk adjustment, instructions for presenting and interpreting the indicator results, the detailed description of the numerator and denominator, evidence scientific, and the feasibility of the set of KPIs. Only one study achieved a high methodological quality in all domains of the AIRE tool.
Conclusion: Our findings showed the potential of KPIs to monitor and assess pharmacy practice quality. Future studies should expand KPIs for other settings, explore validity evidence of the existing KPIs, provide detailed descriptions of evidence, formulation, and usage, and test their feasibility in daily practice.

1. Introduction

Pharmaceutical services comprise a set of support and clinical activities provided by pharmacy professionals aimed at promoting the quality use of medicines and improving health outcomes for patients.[1,2] The support activities encompass the acquisition and stock management of medicines, pharmaceutical products handling (including storage and preparation), supply and/or administration of medicines, and distribution.[3,4] The clinical services involve activities such as patient education, medication review, medication reconciliation, therapeutic drug monitoring, disease management, medication management, and other activities related to pharmaceutical care.[1–3]

The expansion of pharmaceutical services worldwide is undeniable. Studies reported an improvement in the quality use of medicines with

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the involvement of pharmacists in patient treatment.[5–10] The implementation of pharmaceutical services is a complex process that needs to be monitored and evaluated to ensure that the service is provided with consistent quality.[11,12] In recent decades, assessing the quality of service, mainly involving clinical areas, has become increasingly important to providers, regulators, and purchasers of care.[13] In this context, quality indicators can be used in this assessment.[14] Quality indicators can be defined as measurement tools that are used to monitor, evaluate, and improve the quality of patient care, support services, management, and organizational functions that affect patient outcomes.[15]

Different types of quality indicators are found in the literature, such as those related to the structure, process, or outcome of health care.[13] Although outcome indicators are ideal for evaluating the quality of care, they are often difficult to measure compared to specific functions related to the care process, and the key performance indicators (KPIs) can be more useful.[16] KPIs are developed measures that assess the results of an organization or certain activities or services.[17] They measure specific functions within a care process or care outcomes associated with the process, helping to assess the progress toward strategic goals, identify areas that need improvement, and support decision-making.[16,18]

KPIs applied to pharmaceutical services have been developed to evaluate and improve the quality, efficiency, and safety of these services.[19,20] Some studies have reported pharmacists' perceptions of the role of KPIs in pharmacy practice, identifying barriers and facilitators for their implementation.[21,22] Moreover, a recent study showed that pharmacists' job satisfaction was positively associated with the use of KPIs in a hospital setting.[23]

A previous review aimed at investigating the use of KPIs from an Australian hospital pharmacy perspective was published,[24] but did not perform a systematic literature review and evaluate the methodological quality of the indicators developed. Therefore, this systematic review is aimed to identify and appraise the quality of the KPIs developed for pharmaceutical services.

2. Methods

The protocol of this systematic review was registered on the International Prospective Register of Systematic Reviews (PROSPERO; registration number CRD42023423276). This review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Statement (PRISMA) 2020 checklist and reporting guideline.[25]

2.1. Search strategy

A systematic literature search was conducted to identify relevant studies published from the inception of the database until February 5th, 2024, in the PubMed, Scopus, Embase, and LILACS (Latin American and Caribbean Health Sciences Literature) databases. The search strategy included combinations of terms relating to “performance indicator”, “KPI” and “pharmaceutical services”. In addition, a grey literature search in Google Scholar up to 60 registers was performed, excluding patents and citations, to identify non-indexed studies in the databases listed above. References found in the included studies were evaluated to include any potential studies not yet identified. The full search strategies search for all databases can be found in Supplementary Data S1.

2.2. Eligibility criteria and study selection

This step was performed using Rayyan QCRI,[26] a free web application designed to help researchers working on systematic reviews. The studies retrieved from databases were allocated in this application to exclude duplicate files and then for screening and selecting studies.

Studies were included if they: a) developed performance indicators, considered by the authors as a quantitative measure that can be used to track the progress of a service, enabling the measurement of specific functions within a process of care or outcomes of care known to be associated with the process of care[11,18]; b) created an original set of KPIs; c) focused on pharmaceutical services. Studies that did not clearly describe the indicator, KPIs developed in other scenarios, did not describe the type of pharmaceutical service, did not develop or did not present the KPIs were excluded. Reviews, letters to the editor, conference abstracts, guidelines, chapters and/or books, editorials, qualitative studies such as phenomenological and action research studies, and other non-peer-reviewed documents were also excluded.

Two authors (JFFS and BDF) independently screened the titles and abstracts of citations to identify potentially relevant studies. Full-text articles were obtained and reviewed according to the inclusion criteria. When the full texts of the articles could not be obtained in the databases, the corresponding authors were contacted by email or through ResearchGate (www.researchgate.net). A third author (TML) resolved any disagreements or doubts.

2.3. Data extraction

For each included study, characteristics of the study, such as author, year, country, proposal of the indicator, setting, classification of the indicator according to the authors, domains measured by the set of KPIs, number of the KPIs developed, description of goal/target of the indicator, the development process of KPIs, and psychometric properties were extracted. Two authors (JFFS and BDF) independently completed the data extraction, using a preformatted spreadsheet in Microsoft Excel. Disagreements were resolved by discussion with the third author (TML).

2.4. Quality assessment

The Assessment of Indicators through Research and Evaluation (AIRE) tool was used to critically appraise the indicators in eligible studies.[27] Prior systematic reviews of quality indicators use the same instrument.[28–31] The AIRE instrument consists of four domains (1. purpose, relevance, and organizational context, 2. stakeholder involvement, 3. scientific evidence, and 4. additional evidence, formulation, and usage) subdivided into 20 items which are listed in Supplementary Data S2. Each item is scored on a 4-point Likert scale (1 = strongly disagree or no information provided, 2 = disagree, 3 = agree, 4 = strongly agree). Two investigators (BDF and IR) independently conducted the evaluation of the studies and any disagreements were resolved by the third author (TML).

The scores for each item were averaged between both researchers, then summed and standardized to generate the domain score, ranging from 0% to 100%. It is important to note that domain scores are independent and should not be combined into a single quality score. The calculation of domain score followed the formula: (total obtained score – minimum possible score) / (maximum possible score - minimum possible score) x 100%.[27] An example of the calculation procedure has been demonstrated in a preview study.[31] A score of 50% or higher indicates the high methodological quality of the indicator.[27]

2.5. Data synthesis

Characteristics of the studies were descriptively summarized as a narrative synthesis, using structured tables. It was not possible to perform a quantitative synthesis due to methodological heterogeneities between studies. The original ideas and concepts presented in the included studies were recognized and maintained.

3. Results

3.1. Search results

A total of 1298 records were retrieved in the electronic search. After removing 402 duplicates and excluding 854 titles and abstracts, 38 reports were selected for full-text reading. Four reports were not retrieved.

Of these, 15 met the inclusion criteria and were included for review. No relevant studies were identified from searching the reference lists of the included studies. A flowchart of the literature search is shown in Fig. 1. A list of excluded studies and reasons for their exclusion are available in Supplementary Data S3.

3.2. Characteristics of the included studies

Studies were carried out in different regions, such as Australia (n = 3),[22,33,36] United States of America (n = 2),[34,37] Canada (n = 2),[19,32] Poland,[35] Brazil,[20] Portugal,[3] Iran,[38] New Zealand,[39] Indonesia,[40] Israel,[41] and Palestine[42] (n = 1 each). The purposes of the KPIs were to measure clinical services provided by pharmacists (n = 9)[19,20,22,33,34,37,39,41,42] or any services provided by pharmacists, including support activities and clinical services (n = 6).[3,33,34,36,38] Nine studies[3,19,22,32,33,35,36,38,39] developed KPIs for a hospital setting, with two specifically designed for neonatal intensive care units (NICU).[35,36] Six studies[20,34,37,40–42] created KPIs for an ambulatory setting; three of them specifically tailored to home care,[37] patients with epilepsy,[41] and integrative medicine.[42] Only one study[20] described the development of KPIs for community pharmacies.

Seven studies[3,32,34–36,38,39] classified the developed indicators; three of them designed indicators to assess structure, process, and outcomes following the Donabedian model (structure, process, and outcome).[34–36] One study[32] categorized the KPI as appropriateness, quality and safety, efficiency, innovation and continuous improvement, and organizational structure. Another study[40] classified indicators as management, clinical, and performance indicators. Additionally, a different study[38] grouped indicators as management, clinical, and financial indicators, while yet another study[3] classified them as clinical and support activity indicators. Most studies used similar domains such as medication review,[3,19,22,32–36,39–42] medication reconciliation,[3,19,22,32–34,39] patient safety,[3,22,35,36,38] costs,[35,36,38,40] patient satisfaction,[20,32,40–42] and patient counseling.[19,33,39–42] However, each study used different indicators to measure these domains. The number of KPIs ranged from 2 to 85, and seven studies[3,32–36,40] developed 15 or more indicators. Only three studies[20,34,37] described clearly the goal/target of the indicator.

Literature review combined with the Delphi technique was the most prevalent method used to develop the set of KPIs (n = 9).[19,20,33,35,36,39–42] Other studies used literature review with other techniques such as an expert panel,[3,20,34,41,42] focus group,[3,38] survey with pharmacists,[20] nominal group technique,[3] and interviews.[32,38] One study[35] did not provide information on the development process of KPIs. Nine studies[3,19,20,33,35,36,40–42] presented evidence of the validity of the indicators. Most of them (n = 8)[3,19,33,35,36,40–42] reported content validity through inter-rater agreement and only one[20] showed content validity (content validity index), construct validity (factor analysis), and reliability (Cronbach alpha coefficient). On the other hand, six studies[22,32,34,37–39] did not provide information on the evidence of validity of their KPIs. The characteristics of the studies included in this

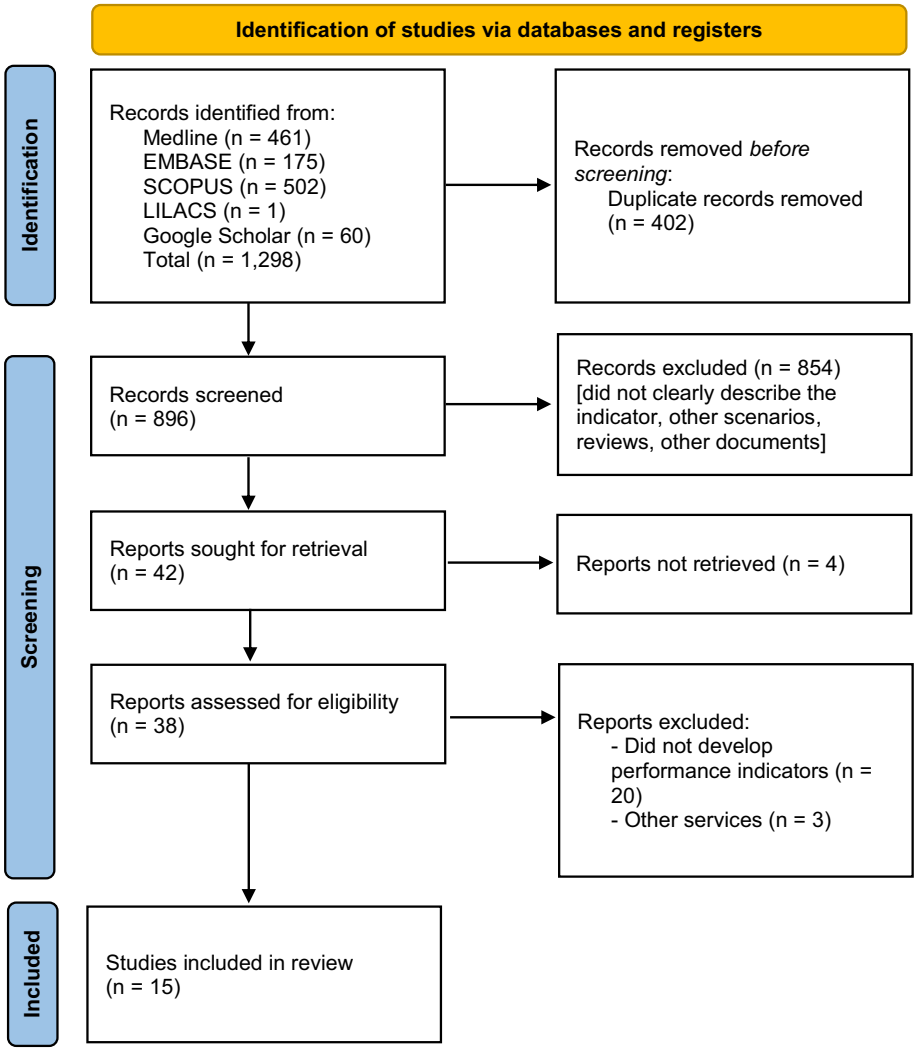

Fig. 1. Study selection flowchart through literature search.

review are summarized in Table 1.

3.3. Quality assessment

The methodological quality varied across the performance indicators presented in the included studies. Almost all studies scored higher in the domains "Purpose, relevance, and organizational context" (n = 14)[3,19,20,32–36,38–42] and "Stakeholder involvement" (n = 13).[3,19,20,32–34,36,38–42] Most of the sets of indicators in the included studies (n = 8)[19,20,33–36,41,42] obtained good scores in the domain of "Scientific evidence". On the other hand, fourteen sets of KPIs[3,19,32–42] scored less than 50% in the "Additional evidence, formulation, and usage" domain.

Only one study[20] achieved a high methodological quality of the set of indicators in all domains (76.7, 88.9, 88.9, and 63%, respectively). In contrast, another study[37] had the lowest scores for the set of indicators in all domains (46.7, 22.2, 16.7, and 42.6%, respectively). Eight sets of KPIs[3,22,32,34,37–40] obtained the lowest scores in at least two domains. The majority of items of the AIRE tool that scored poorly were "a strategy for risk adjustment has been considered and described", "specific instructions for presenting and interpreting the indicator results are provided", "the numerator and denominator are described in detail", "the indicator has been piloted in practice", "systematic methods were used to search for scientific evidence", and "the supporting evidence has been critically appraised". The scores for methodological quality of each set of KPIs assessed with the AIRE tool are shown in Table 2.

4. Discussion

4.1. Summary of evidence

Understanding available and effective KPIs can lead to improvements in the quality of pharmaceutical services and, consequently, better patient outcomes and overall healthcare delivery. Therefore, in this systematic review, we identified and evaluated the quality of the KPIs developed for pharmaceutical services. Fifteen studies that developed a set of KPIs to measure these services were found. Our findings revealed that most KPIs were developed for clinical services, with similar domains addressed during their development, including medication review, patient safety, and patient counseling. Therefore, it may not be necessary to develop a new set of KPIs; instead, adapting them for a specific local context may suffice. Furthermore, a literature review combined with the Delphi technique was the most commonly utilized method for endorsing the indicators, using content validity through inter-rater agreement. On the other hand, this review highlighted relevant gaps in the development of the KPIs for pharmaceutical services. Only one study proposed KPIs for community pharmacies. In addition, one study showcased a set of KPIs supported by robust evidence of validity and most of them did not achieve high methodological quality, primarily because they did not provide detailed formulas for KPI calculation, lacked instructions for interpreting results, and were not tested in practical scenarios, which can be a limiting factor for pharmaceutical services to fully monitor and assess whether or not quality has been achieved. Therefore, there is a need to robustly validate the KPIs for pharmaceutical services. This is essential to facilitate standardized monitoring and evaluating of quality of care and improvement in patient outcomes.

Previous reviews sought to identify and characterize quality indicators for community[43,44] and hospital pharmacy[45] services. However, none of them focused on KPIs and did not critically assess the set of indicators using a specific tool (AIRE) for this purpose. KPIs are crucial metrics in pharmacy practice because collecting KPI data over time allows monitoring, evaluation, and decision-making in an organization.[46] But that is not enough. The use of an instrument for assessing the quality of indicators, such as the AIRE tool, is important for individuals or institutions involved in developing indicators, promoting consistency in the procedures for development, and enhancing the overall quality of the indicators.[27]

The studies included in this review covered different scenarios and world regions, providing a broad perspective for the selection of indicators. Quality indicators must be adapted to the local context when developed and tested in a specific setting or country, as each region possesses unique healthcare systems and information infrastructure.[47] Most KPIs were developed for clinical services. For years, the pharmacy profession was focused simply on the supply of medicines rather than pharmaceutical care-related roles[48] and the findings highlight the increasing role of pharmacists in direct patient care. However, this finding reflects a gap in the availability of studies that developed indicators for other pharmaceutical services, such as the supply of medicines and drug dispensing. The number of different services provided by pharmacies represents a challenge in measuring pharmacists' productivity. Therefore, it is pertinent to establish KPIs to measure support activities.[3,49] Moreover, pharmacists need to keep in mind the importance of support activities to improve the patient's health status, as it ensures the safe and quality management and distribution of medicines.

The number of set of indicators found in this review ranged from 2 to 85. Tanaka et al.[50] suggested selecting a few indicators to be feasible in daily practice based on their significance, synthesis capability, and ease of data collection. Some studies developed a large set of indicators, which may result in operational difficulties, increased pharmacist workload, and disbelief regarding the advantages of KPIs.[21,50]

Only three studies reported the goals/targets for a set of KPIs. Bicalho et al.[31] had already observed that no study reported this important requirement for the indicator. The assumption of evaluation is to reach the value judgment and, for this, it is essential to compare with defined parameters. Moreover, the goals/targets contribute to measuring progress and assist decision-making, promoting performance enhancement and sustainability of services.[50] In addition, although the goals/targets may be distinct in different contexts, these parameters reported in the studies can assist stakeholders in implementing an initial system for measuring the quality of pharmaceutical services.[20]

A set of KPIs can be developed using either non-systematic or systematic evidence methods, whether combined with expert opinion or not.[51] In this review, almost all studies reported the use of literature review with expert opinion by consensus method, although they did not clearly describe how it was conducted. Consensus techniques involve group facilitation to assess experts' opinions and achieve a collective judgment, considered more reliable than individual judgments susceptible to personal bias.[51] Among these methods, the majority of studies used the Delphi technique. Jaam et al.[52] observed that this technique is increasingly being used in pharmacy practice research. One reason is that the tool allows respondents anonymity and potentially rapid feedback, and it can also be implemented through electronic technologies.[52,53] Regarding the psychometric properties of the set of KPIs, five studies did not report any information on evidence of validity. Reliability and validity are crucial characteristics for the development or adaptation of quality indicators to ensure quality measurement.[44,54] Seven studies related the use of content validity through inter-rater agreement indices such as concordance rates. Content validity is an important criterion for validating a set of indicators.[55] However, the indices used in almost all studies were designed to evaluate the general agreement among different raters regardless of the judgment (agree or disagree) rather than specifically quantifying the content validity and, thus, should be interpreted carefully.[56] Finally, only one study presented a set of KPIs with evidence of validity and reliability, reinforcing that further research should be designed with robust methodologies.

4.2. Quality assessment of KPIs

This study highlights methodological limitations in the development of KPIs for pharmaceutical services. Among the studies investigated, only one[20] achieved high assessment quality scores across all four

Table 1
Characteristics of the included studies.

Authors, Year	Country	Proposal of indicator	Setting	Classification of the indicator[a]	Main domains measured	Number of items	Description of goal/ target	Development	Psychometric properties
Boucher et al., 2023[32]	Canada	Support activities and clinical services	Hospital	Appropriateness, quality and safety, efficiency, innovation and continuous improvement, and organizational structure	Infrastructure (equipment and human resources), drug distribution, medication review, medication reconciliation, patient satisfaction, and research	24 (13 with high priority)	No	Literature review, interviews, and consensus technique with 3-rounds	NR
Canning et al., 2024[33]	Australia	Clinical services	Hospital	NR	Medication review, medication reconciliation, patient education, and patient counseling	26	No	Literature review and Delphi technique with 2-rounds	Content validity (inter-rater agreement)
Clements et al., 2021[34]	United States	Clinical services	Ambulatory (primary care)	Structure, process and outcome	Medication review, medication reconciliation, patient engagement, disease monitoring, and treatment adherence	17 (2 of structure, 7 of process, and 8 of outcome)	Yes (short and long-term)	Literature review and expert panel	NR
Fernandes et al., 2015[19]	Canada	Clinical services	Hospital	NR	Medication reconciliation, participation in interprofessional rounds, patient education, and patient counseling	8	No	Literature review and Delphi technique with 3-rounds	Content validity (inter-rater agreement)
Krzyżaniak, Pawłowska, Bajorek, 2019[35]	Poland	Support activities and clinical services	Hospital (NICU)	Structure, process and outcome	Infrastructure (equipment and human resources), pharmacist consultation, medication review, patient safety, and costs.	23 (9 of structure, 9 of process, and 5 of outcome)	No	Literature review and Delphi technique with 2-rounds	Content validity (inter-rater agreement)
Krzyżaniak, Pawłowska, Bajorek, 2019[36]	Australia	Support activities and clinical services	Hospital (NICU)	Structure, process and outcome	Infrastructure (equipment and human resources), pharmacist consultation, medication review, patient safety, and costs.	31 (12 of structure, 13 of process, and 6 of outcome)	No	Literature review and Delphi technique with 2-rounds	Content validity (inter-rater agreement)
Kulischak, 1996[37]	United States of America	Clinical services	Ambulatory (home care)	NR	Therapeutic drug monitoring and nutritional monitoring	2	Yes	NR	NR
Lima, Aguiar, Storpirtis, 2019[20]	Brazil	Clinical services	Ambulatory or community pharmacy	NR	Pharmacist consultation, medication review, clinical status, quality of life, and patient satisfaction	6	Yes	Literature review, expert panel, Delphi technique with 2-rounds, and survey with community pharmacists	Content validity (CVI), Construct validity (Factory analysis), and Reliability (Cronbach alpha coefficient)
Lloyd et al., 2017[22]	Australia	Clinical services	Hospital	NR	Medication review, medication reconciliation, and patient safety	7	No	Literature review and interviews with experts	NR
Lopes et al., 2021[3]	Portugal	Support activities and clinical services	Hospital	Clinical and support activity	Supply of medicines, production of pharmaceutical products, medication review, medication	85 (40 of support, 39 of clinical, and 6 each)	No	Literature review, expert panel, nominal group technique, and focal	Content validity (inter-rater agreement)

(*continued on next page*)

Table 1 (*continued*)

Authors, Year	Country	Proposal of indicator	Setting	Classification of the indicator[a]	Main domains measured	Number of items	Description of goal/ target	Development	Psychometric properties
					reconciliation, patient safety, and quality assurance			group with 5-rounds	
Mahmodabadi et al., 2019[38]	Iran	Support activities and clinical services	Hospital	Management, clinical, and financial	Professional satisfaction, infrastructure (equipment and human resources), patient safety, and costs	8 (4 of management, 1 of clinical, and 3 of financial)	No	Literature review, interviews, and focal group	NR
Ng and Harrison, 2010[39]	New Zealand	Clinical services	Hospital	NR	Medication review, medication reconciliation, and patient counseling	10	No	Literature review and Delphi technique	NR
Satibi, Rokhman, Aditama, 2019[40]	Indonesia	Support activities and clinical services	Ambulatory (primary care)	Management, clinical, and performance	Management of medicines, documentation, medication review, drug information, patient counseling, patient satisfaction, and costs	47 (26 of management, 19 of clinical, and 2 of performance)	No	Literature review and Delphi technique with 3-rounds	Content validity (inter-rater agreement)
Shawahna, 2019[41]	Israel	Clinical services	Ambulatory (patients with epilepsy)	NR	Medication review, medication reconciliation, patient education, patient counseling, interprofessional care, and patient satisfaction	8	No	Literature review, expert panel, and Delphi technique with 3-rounds	Content validity (inter-rater agreement)
Shawahna, 2020[42]	Palestine	Clinical services	Ambulatory (integrative medicine)	NR	Medication review, medication reconciliation, patient education, patient counseling, interprofessional care, and patient satisfaction	8	No	Literature review, expert panel, and Delphi technique with 3-rounds	Content validity (inter-rater agreement)

Abbreviation: CVI (Content Validity Index), NICU (Neonatal Intensive Care Unit), NR (Not reported).
[a] According to the authors.

domains of the AIRE instrument. This specific study presented a comprehensive account of the methodology employed in developing indicators. This is consistent with findings from other systematic reviews that employed the AIRE tool, wherein either none[31] or only a minimal 6.6%[28] of the included studies reached a cumulative score of 50% on the tool across the four domains. Other reviews also revealed poor reporting of the methods used for developing quality indicators that complicated the assessment of the methodological rigor and quality of the studies.[57–59] It is important to highlight that there was no disparity in quality assessment between studies that developed a set of KPIs solely for clinical services compared to those that incorporated support activities.

In general, a majority of the studies did not describe satisfactorily the domains of 'Scientific evidence' and 'Additional evidence, formulation, and usage', and then, achieved low scores. Notably, few studies described the use of systematic methods to search for scientific evidence (e.g., performed a comprehensive literature review) and related that the supporting evidence has been critically appraised. The transparency and limitation of the development process of KPIs are essential for the user to consider their assessment.[55] Only one study[20] encompassed a complete definition of both the numerator and denominator and none provided specific instructions for presenting and interpreting the results of the indicators. Each quality indicator should have a clear numerator and denominator to ensure correct interpretation and comparability of the results.[13] Moreover, the lack of operational definitions for KPIs found in the majority of studies could hinder the replicability of these indicators within healthcare systems.[13] Just one study[37] conducted a pilot of the KPIs in clinical practice, reflecting the scarcity of studies that discussed the feasibility of indicators. An explanation for this could be the publication of findings on the feasibility of KPIs in other documents. Additionally, none of the studies took into account or described a strategy for risk adjustment. The absence of risk adjustment means that KPIs cannot be standardized, preventing benchmarking of healthcare professionals,[60] although the use of this method is controversial for indicators developed for local-level services.

The set of KPIs with high AIRE scores may be suitable for daily use, while the other sets may require further enhancement before consideration, particularly in domains related to scientific and additional evidence. However, these sets should not be disregarded. KPI selection should follow the needs of the pharmaceutical service to help drive continuous improvements in care delivery.

Finally, the AIRE tool can assist in the development of the KPIs, although it was not specifically designed for this purpose. Other desirable criteria, such as costs of measurement and prioritization of 'essential' indicators, are described in the literature and can be used.[55]

4.3. Limitations

This systematic review has some limitations. Although a comprehensive search of the literature was conducted, some studies may have been missed because they were not indexed in the databases searched or were published on the websites of institutions or scientific societies. However, manual searches were conducted by checking the reference

Table 2
Methodological quality of the performance indicator sets using the AIRE tool.

Studies	Domains (%)			
	Purpose, relevance and organizational context	Stakeholder involvement	Scientific evidence	Additional evidence, formulation, usage
Boucher et al., 2023[32]	73.3	77.8	33.3	37.0
Canning et al., 2024[33]	80.0	77.8	55.6	44.4
Clements et al., 2021[34]	63.3	38.9	55.6	37.0
Fernandes et al., 2015[19]	73.3	88.9	77.8	38.9
Krzyżaniak, Pawłowska, Bajorek, 2019[35]	86.7	94.4	61.1	33.3
Krzyżaniak, Pawłowska, Bajorek, 2019[36]	80.0	94.4	61.1	25.9
Kulischak, 1996[37]	46.7	22.2	16.7	42.6
Lima, Aguiar, Storpirtis, 2019[20]	76.7	88.9	88.9	63.0
Lloyd et al., 2017[22]	66.7	77.8	16.7	42.6
Lopes et al., 2021[3]	76.7	77.8	27.8	33.3
Mahmodabadi et al., 2019[38]	53.3	61.1	27.8	24.1
Ng and Harrison, 2010[39]	73.3	100.0	33.3	40.7
Satibi, Rokhman, Aditama, 2019[40]	70.0	88.9	33.3	29.6
Shawahna, 2019[41]	80.0	100.0	88.9	48.1
Shawahna, 2020[42]	73.3	100.0	55.6	40.7

Abbreviation: AIRE (Appraisal of Indicators through Research and Evaluation).

lists during full-text screening and utilizing Google Scholar engine search to mitigate this issue.

In addition, studies that classified performance indicators differently may not have been retrieved. Moreover, the assessment of the quality of the set of KPIs through the AIRE tool might have been underestimated in some items. The lowest ratings were given to an item when the study did not provide any information.

5. Conclusion

The sets of KPIs reviewed in these studies showed the potential of indicators to monitor and assess the quality of care in the pharmacy practice. The list of identified indicators can be used as a database for monitoring and evaluating pharmaceutical services and the stakeholders can select KPIs for their own purposes. Our findings showed that most KPIs described in the included studies were developed to measure hospital and ambulatory services using a literature review combined with a general agreement estimate. However, most of the KPIs failed to provide robust evidence of validity and did not achieve high methodological quality in all domains of the AIRE tool.

Further research is encouraged to develop KPIs for other settings and services, including community pharmacies and drug management. Moreover, additional studies must investigate validity evidence of the existing sets of KPIs, provide more comprehensive descriptions of their evidence, formulation, and usage, and test their feasibility in daily practice.

CRediT authorship contribution statement

Julie Faria Ferreira de Souza: Methodology, Investigation, Data curation. **Brígida Dias Fernandes:** Methodology, Investigation, Formal analysis, Data curation. **Inajara Rotta:** Writing – review & editing, Writing – original draft, Visualization, Methodology, Investigation, Formal analysis. **Marília Berlofa Visacri:** Writing – review & editing, Writing – original draft, Validation, Supervision. **Tácio de Mendonça Lima:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Methodology, Investigation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.rcsop.2024.100441.

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