

Evaluation of quality indicators for management of the National School Feeding Program in Brazil: a systematic review

Avaliação de indicadores de qualidade da gestão do Programa Nacional de Alimentação Escolar no Brasil: uma revisão sistemática

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Abstract *This article aims to identify studies that developed quality indicator for the management of the National School Feeding Program (PNAE, in Brazilian context) and to critically appraise the properties of their instruments. Systematic review using Scopus, Lilacs, Pubmed and Web of Science for data collection. The search was limited to studies between 2009 and 2019. The search strategy included search terms related to school feeding, program evaluation, and indicator. The indicators were evaluated using the Appraisal of Indicators through Research and Evaluation instrument. The search identified 1,355 studies, of which 14 were potentially relevant records and 10 met the inclusion criteria. Most studies used a literature review with consensus techniques in the development of the instrument and a frame work format to evaluate the PNAE. None of them presented evidence of validity of the instrument. The highest level was achieved on the domain ‘Purpose, relevance and organizational context’, followed by ‘Stakeholder involvement’, ‘Additional evidence, formulation and usage’, and ‘Scientific evidence’. This review found gaps in the methodology of studies that had developed quality indicators for the management of PNAE. Future development of these instruments should include validity evidence.*

Key words *School feeding, Program evaluation, Indicator*

Resumo *O objetivo deste artigo é identificar estudos que desenvolveram indicador de qualidade para gestão do Programa Nacional de Alimentação Escolar (PNAE), e avaliar criticamente as propriedades de seus instrumentos. Revisão sistemática utilizando Scopus, Lilacs, Pubmed e Web of Science para coleta de dados. A busca foi limitada aos estudos realizados entre 2009 e 2019. A estratégia de pesquisa incluiu termos relacionados à alimentação escolar, avaliação de programas e indicador. Os indicadores foram avaliados pelo instrumento Avaliação de Indicadores por Pesquisa e Avaliação. A pesquisa identificou 1.355 estudos, dos quais 14 eram registros potencialmente relevantes e dez preencheram os critérios de inclusão. A maioria dos estudos utilizou uma revisão de literatura com técnicas de consenso no desenvolvimento do instrumento e um formato de matriz para avaliar o PNAE. Nenhum estudo apresentou evidência de validade do instrumento. As melhores pontuações foram obtidas nos domínios “Finalidade, relevância e contexto organizacional”, seguido de “Envolvimento das partes interessadas”, “Evidência, formulação e uso adicionais” e “Evidência científica”. Esta revisão encontrou lacunas na metodologia de estudos que desenvolveram indicadores de qualidade da gestão do PNAE. O desenvolvimento futuro desses instrumentos deve incluir evidências de validade.*

Palavras-chave *Alimentação escolar, Avaliação de programas, Indicador*

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Introduction

The Brazilian Constitution of 1988 recognized the right of students to a diet provided by the public network and ensured this universal service for students with a national feeding program¹. The Brazilian public intervention to provide meals to students through the school system started in 1954 when the National School Feeding Program (*Programa Nacional de Alimentação Escolar* - PNAE - in Brazilian Portuguese) were first implemented. This is a public policy of greater longevity in Brazil in the area of food and nutritional security and is considered one of the few programs in the world to be universal and free².

PNAE is set up by Federal Law n° 11.947³ which regulates the provision of school meals. Since 2009, it has been required that 30.0% of the food budget of the PNAE be used to purchase foods directly from family farms³. This measure was implemented with the aim of 'meeting the nutritional needs of students while at school, contributing to the growth, development, learning and academic achievement of students, and promoting the formation of healthy eating habits'³.

The PNAE is a model from which other countries can draw important lessons. Multisectoral food and nutrition security strategy developed in Brazil prioritized the expansion of school feeding and brought significant changes in the design and implementation of this Program⁴. Moreover, Brazil has requested to cooperate internationally, in partnership with the Food and Agriculture Organization of the United Nations and World Food Program, for development of others School Feeding Programs. In this sense, Brazil shared experiences and knowledge to other regions around the world, such as Latin America, Caribbean, and Africa. These opportunities provided changes in dietary habits through food and nutrition education actions and the incorporation of fresh and healthy food into schools⁵. The Brazilian program is also exemplary for its reach, for instance, in 2018, it served 40.5 million public school students with a budget of 4 billion Brazilian real (\$US 1 billion)⁶.

The existence of a strong legal framework with operational regulations supports consistent, high-quality service delivery⁷. Successful management of the PNAE depends on a network of relationships involving professionals from different disciplines, such as education, the economic sector, family farming, civil society, and all levels of government (municipal, state, and federal). Decisions should be made through intersectoral collaboration and all actors must offer a local support network to allow efficient PNAE management⁸.

Evaluating this program is the key to ensuring and improving the quality of its managers' decision-making to optimize public health care resources⁹. Quality in health services must permeate organizational policies and goals, based on the assumptions of safety and the satisfaction of users and professionals. In this sense, quality indicators can be used to assess quality improvement¹⁰.

The term indicator is defined as 'a quantitative measure that can be used to monitor and evaluate the quality of care provided to the user and the activities of the services'¹¹. The indicator is not a direct measure of quality, but rather a flag that identifies or directs attention to specific issues and needs periodic review¹². Indicators can be associated with the structure, process, and outcomes of healthcare. 'Structure' refers to the attributes of settings in which care occurs; 'process' expresses what is actually done in giving and receiving health care; and 'outcome' assesses the effects of care on the health status of the population¹³.

Some authors have developed methodologies to evaluate the PNAE, but with specific proposals in few cities^{9,14-16}. Although the PNAE has previously been assessed for certain aspects in some Brazilian municipalities, no publications were found in the literature on the evaluation of the national management of this Program.

However, as the 2009 framework does not include guidance and indicators for results measurement, indicators for all existing processes and indicators of effectiveness additional researchers needed to be developed. Therefore, this systematic review aimed to identify quality indicator instruments to evaluate the management of PNAE and critically appraise their properties.

Methods

The protocol for this systematic review has been published in PROSPERO (the International Prospective Register of Systematic Reviews), and is available at: <http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42019111796>. The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines for reporting systematic reviews were used to undertake the present review.

Search strategy

A comprehensive literature search was performed in the Web of Science, PubMed/Medline, Scopus, and Lilacs databases to identify relevant

studies published between January 2009 and December 2019. The starting year 2009 was chosen because PNAE's Law 11,947, which is on the food supply given to the students of public schools, was enacted that year. The search strategy included the use of the Health Sciences Descriptors (DeCS) and Medical Subject Headings (MeSH) for school feeding and quality indicator studies. The descriptors used were "school feeding" AND "program evaluation" OR "indicator". The search strategy included other keywords about school feeding subjects: "school meal" OR "school food". The full search strategy for all databases can be found in Chart 1. A grey literature search was conducted in Google Scholar (Google, Inc., Mountain View, CA, USA), using the search term "School feeding" AND "program evaluation". Duplicate studies were eliminated.

Study selection

The present review was restricted to studies that (a) had been published in English, Portuguese, or Spanish; (b) developed an original instrument; (c) described a literature search to develop the quality indicator instrument ;(d) were on instruments target the Brazilian National School Feeding Program, defined in Law no. 11,947 of 2009(any food offered in the school environment, regardless of its origin, during the school term); (e) described only students of Brazilian public schools; and (f) described at least one type of quality indicator according to Donabedian's¹² conceptual framework of structure, process, and outcome.

Studies were excluded if they studied instruments targeted for school feeding programs from other countries or private school feeding services, did not define the type of services provided, or did not report the instrument.

All titles and abstracts were independently screened and selected by two authors (D.B. and T.S.S.S.). The full-text version of each article was obtained and reviewed to determine whether the article met the eligibility criteria. Disagreements were resolved by a third reviewer (T.M.L.). In addition, all the references cited in the included articles were reviewed to identify any studies that might have been missed.

Data extraction and analysis

For each included study, extracted information consisted of the year of publication, state, proposal of indicator, type of indicator according to Donabedian¹³, format of the instrument, target public, the instrument domains, number of items of the instrument, instrument development, application of the instrument, and the instrument validation properties. Two reviewers (D.B. and T.S.S.S.) independently completed the data extraction, using a preformatted spreadsheet in Microsoft Excel version 2013. Disagreements were resolved by a third reviewer (T.M.L.).

Quality assessment

The quality assessment of the indicators was determined using the AIRE (Appraisal of Indicators through Research and Evaluation)

Chart 1. Search Strategy in all data bases.

Scopus	TITLE-ABS-KEY("school feeding" OR "school meal" OR "school food") AND ("program evaluation" OR indicator*) AND PUBYEAR > 2009 AND (LIMIT-TO (LANGUAGE, "English") OR LIMIT-TO (LANGUAGE, "Portuguese") OR LIMIT-TO (LANGUAGE, "Spanish"))
Lilacs	(tw:("school feeding")) OR (tw:("school meal")) OR (tw:("school food")) AND (tw:("program evaluation")) OR (tw:(indicator*)) Filters: Publication date from 2009/01/01; Portuguese; Spanish; English
Pubmed	#1 ("school feeding"[tiab] OR "school meal"[tiab] OR "school food"[tiab]) #2 ("program evaluation"[MeSH] OR indicator*[tiab] OR index [MeSH]) #1 AND #2 Filters: Publication date from 2009/01/01; Portuguese; Spanish; English
Web of Science	#1 TS=("school feeding" OR "school meal" OR "school food") #2 TS=("program evaluation" OR indicator*) #1 AND #2 Filters: Publication date from 2009/01/01; Portuguese; Spanish; English
Google Scholar	("school feeding") AND ("program evaluation") Filter: published after 2009 and English or Portuguese or Spanish

Source: Author's elaboration.

instrument¹⁷. The AIRE instrument is a valid and reliable instrument specifically designed to appraise the quality of indicators¹⁸. The instrument was derived from the AGREE (Appraisal of Guidelines Through Research and Evaluation) instrument¹⁹, a widely used standard for assessing the methodological quality of practice guidelines. The AIRE instrument has been used previously in several systematic reviews on the quality of indicators²⁰⁻²³, and in studies developing quality indicators^{24,25} in other fields of knowledge.

The AIRE instrument consists of 20 items addressing four domains: 'Purpose, relevance, and organizational context'; 'Stakeholder involvement'; 'Scientific evidence'; and 'Additional evidence, formulation, and usage' (Chart 2). These four domains reflecting the methodological quality were used to address the research objectives. Each item presents a statement on the quality of indicators and is scored on a 4-point scale (1 'totally disagree or no information provided' to 4 'strongly agree'). Two reviewers (D.B. and T.S.S.S.) independently evaluated each study applying this scale for all items of the AIRE instrument. At this time, disagreements in the evaluation are accepted and a third revision is not demanded.

The scores for each of the four categories were calculated by summing the individual authors' scores for the items in a category and standardizing this total as a percentage of the maximum possible score for that category. The maximum possible score for a category was calculated by multiplying the maximum score per item (score of 4) by the number of items in that category and the number of evaluators (two). The minimum possible score was calculated at the same time by using the minimum score per item (score of 1). A standardized domain score was calculated according to the instrument's guidelines following the formula: (total obtained score - minimum possible score) / (maximum possible score - minimum possible score) x 100%¹⁷. This standardized score may range from 0% to 100%. An example of the calculation procedure is shown in Figure 1. A higher standardized score indicates a higher level of quality. Quality indicator sets were considered to have a high assessment quality on a domain if they scored 50% or higher, which correlates with an overall 'agree' or 'strongly agree'. Domain scores are independent and should not be combined into a single quality score¹⁷.

Chart 2. The Appraisal of Indicators through Research and Evaluation tool¹⁸.

Domain	Item
I. Purpose, relevance and organizational entity	Purpose, relevance and organizational context
	The criteria for selecting the topic of the indicator are described in detail
	The organizational context of the indicator is described in detail
	The quality domain the indicator addresses is described in detail
	The health care process covered by the indicator is described and defined in detail
II. Stakeholder involvement	The group developing the indicator includes individuals from all relevant professional groups
	Considering the purpose of the indicator, all relevant stakeholders have been involved at some stage of the development process
	The indicator has been formally endorsed
III. Scientific evidence	Systematic methods were used to search for scientific evidence
	The indicator is based on recommendations from an evidence-based guideline or studies published in peer-reviewed scientific journals
	The supporting evidence has been critically appraised
IV. Additional evidence, formulation, usage	The numerator and denominator are described in detail
	The target patient population of the indicator is defined clearly
	A strategy for risk adjustment has been considered and described
	The indicator measures what it is intended to measure (validity)
	The indicator measures accurately and consistently (reliability)
	The indicator has sufficient discriminative power
	The indicator has been piloted in practice
	The efforts needed for data collection have been considered
	Specific instructions for presenting and interpreting results

Source: Based on Koning et al.¹⁷.

Example:

If 2 researchers give the following scores for Domain 1:

Researcher	Item 1	Item 2	Item 3	Item 4	Item 5	Total
1	3	4	4	4	4	19
2	3	4	3	3	3	16
Total	6	8	7	7	7	35

Maximum possible score = 4 (strongly agree) x 5 (items) x 2 (researchers) = 40

Minimum possible score = 1 (strongly disagree) x 5 (items) x 2 (researchers) = 10

The scaled domain score will be:

Total obtained score - Minimum possible score x 100%

Maximum possible score - Minimum possible score

$$\frac{35 - 10}{40 - 10} \times 100 = \frac{25}{30} \times 100 = 0,8333 \times 100 = 83,33\%$$

Figure 1. Example of the calculation procedure for Domain 1 of the Appraisal of Indicators through Research and Evaluation(AIRE) instrument.

Source: Author's elaboration.

Results

Search results

A total of 1,355 unique records were identified from the databases. After reviewing the titles and abstracts, 14 articles were selected for full-text examination. Of these, eight studies^{16,26-32} met the inclusion criteria and were included in the present review. Reference tracking of the articles identified two additional eligible studies^{33,34}. As a result, a total of ten studies were included in the present review. A flowchart of the selection process of the literature search and reasons for exclusion is shown in Figure 2. A list of excluded studies is shown in Chart 3.

Characteristics of the studies

The characteristics of the ten included studies are shown in Chart 4. The studies were carried out in different Brazilian states: Bahia (four studies)^{27-29,34}, Santa Catarina (three studies)^{26,31,32}, São Paulo (two studies)^{16,30}, and Rio de Janeiro (one study)³³. All studies were published in Portuguese. The purposes of the indicators were to evaluate the effects of Brazil's school feeding law on the quality of the menus (two studies)^{16,30} and to evaluate management of the PNAE (8 studies)^{26-29,31-34}.

Most studies assessed only two types of indicators: structure and process (three studies)^{26,31,32} and process and outcome (three studies)²⁷⁻²⁹. The

remaining four studies assessed all indicators proposed by Donabedian¹³: structure, process, and outcome^{16,30,33,34}. Most of the studies used frameworks for the indicators (seven studies)^{16,27-32}, and three studies used the questionnaire format^{26,33,34}.

The studies included actors from different segments: manager, nutritionist, school manager, school cook, student, and members of the Municipal School Nutrition Councils^{27-29,34}. Nevertheless, four studies included only the nutritionist^{16,30-32}, and another study included only the PNAE's manager²⁶. One study did not describe the target population²⁸.

The number of instrument items ranged from 8 to 88. The number of domains ranged from 2 to 6. Most studies used similar domains such as: management^{27-29,33,34}, participation and social control^{127-31,32}; operationalization^{16,26,30-32,34}, promotion of healthy food²⁷⁻³³, and material and human resources^{16,26,30-32}; however, each study used different items to measure their domains. Five studies^{26,27,31-33} used literature review combined with other techniques, such as an expert's panel, workshops, and qualitative interviews with field visits to develop the instrument. However, five studies^{16,28-30,34} used only the literature review method. Almost all studies applied the instrument^{26,27,29-34}. Nevertheless, none of the studies presented evidence for the validity of the instrument. Although five studies discussed consensus techniques^{26,27,31-33}, the authors did not calculate any index of content validity.

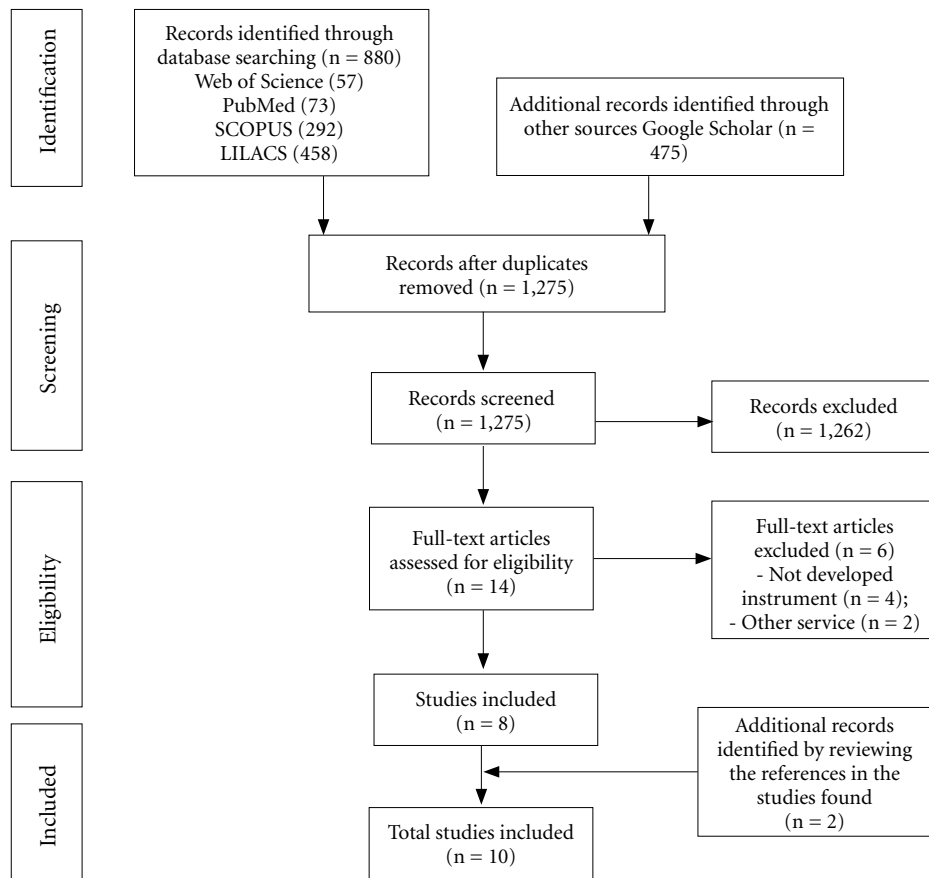


Figure 2. Study selection flowchart through literature search.

Abbreviation: LILACS – Latin American and Caribbean Literature in Health Sciences

Source: Author's elaboration.

Chart 3. List of excluded studies.

Reason for exclusion	Author, Year	Title	Reference
Not developed instrument	Gabriel et al., 2014	Evaluation of municipal management of the Brazilian National School Nutrition Program in the largest cities of Santa Catarina State, Brazil	<i>Cad Saúde Pública</i> 2014; 30(9):2017-2023.
	Gabriel et al., 2015	Municipal management of the National School Meal Program in the capitals of Southern Brazil	<i>Rev. Nutr.</i> 2015; 28(6):667-680.
	Figueroa et al., 2017	The National School Feeding Program in public schools	<i>Rev. Brasileira em Promoção da Saúde</i> 2017; 30(2):161-169.
Other service	Da Silva et al., 2017	Territorial development and national school feeding program in rural territories of Litoral and Campos de Cima da Serra rural territories, in RIO Grande do SUL	<i>Rev. Brasileira de Gestão e Desenvolvimento Regional</i> 2017; 14(1):61-65.
	Constanty et al., 2016	National School Feeding Programme (PNAE) and Sustainability: The Case of Marechal Candido Rondon County	<i>Desenvolv. Meio Ambiente</i> 2016; 36: 371-392.
Not School Feeding Program	Sobral et al., 2010	Proposal of a methodology for evaluating training in healthy eating	<i>Rev. Nutr.</i> 2010; 23(3):399-415.

Source: Author's elaboration.

Chart 4. Descriptive data and characteristics of the included studies.

Author, Year,	Country, State	Proposal of indicator	Type of indicator ^a	Format; Target public	Domains evaluated	Number of items	Development	Application	Validation properties
Silva, 2009 ²⁷	Brazil, Bahia	Evaluate management of the PNAE	Process and Outcome	Framework; PNAE's manager, nutritionist, School manager, students, school cook, members of CAE	Management; Participation and social control, Promotion of healthy food	29	Literature review; Qualitative interview with field visit; Workshop; experts' panel consensus techniques	5 schools	Content validity: expert panel, without reported content validity index
Carvalho, 2012 ³³	Brazil, Rio de Janeiro.	Evaluate management of the PNAE	Structure, Process, and Outcome	Questionnaire; PNAE's manager, nutritionist, School manager, students, school cook, members of CAE	Management; Participation and social control; Promotion of healthy food	88	Literature review; Conceptual map; Workshop; Consensus techniques	14 schools	Content validity: workshop, without reported content validity index
Soares, 2012 ³⁴	Brazil, Bahia	Evaluate management of the PNAE	Structure, Process, and Outcome	Questionnaire; PNAE's manager, nutritionist, School manager, students, school cook, members of CAE	Management; Operationalization	20	Literature review	1 school	Not reported
Calasans, 2013 ³⁸	Brazil, Bahia	Evaluate management of the PNAE	Process and Outcome	Framework; Notreported	Management; Participation and social control, Promotion of healthy food	35	Literature review	Not reported	Not reported
Gabriel, 2013 ³¹ ; 2014 ³²	Brazil, Santa Catarina	Evaluate management of the PNAE	Structure and Process	Framework; PNAE's Nutricionist	Participation and social control; Operationalization; Promotion of healthy food; Material and human resources	22 (45 sub items)	Literature review; Logical theoretical model; 2-round Delphi consensus techniques	1 county's Pilot test and counties	Content validity: expert panel, without reported content validity index and field test
Calasans, 2014 ²⁹	Brazil, Bahia	Evaluate management of the PNAE	Process and Outcome	Framework; PNAE's manager, nutritionist, School manager, students, school cook, members of CAE	Management; Participation and social control, Promotion of healthy food	35	Literature review	3 schools	Not reported
Goulart, 2015 ³⁶	Brazil, Santa Catarina	Evaluate management of the PNAE in elementary school	Structure and Process	Questionnaire; PNAE's manager	Operationalization, Promotion of healthy food; Material and human resources	20 (59 sub items)	Literature review; 2-rounds experts' panel consensus techniques	1 School's pilot test and 11 elementary schools	Content validity: expert panel, without reported content validity index and field test
Bicalho, 2017 ³⁰ ; 2019 ¹⁶	Brazil, São Paulo	Evaluate the effect of the PNAE's law on the quality of the menus	Structure, Process, and Outcome	Framework; PNAE's Nutricionist	Operationalization; Promotion of healthy food; Material and human resources	8	Literature review	38 schools	Not reported

Abbreviation: PNAE (National School Feeding Program); CAE (Municipal School Nutrition Councils). ^aAccording to Donabedian conceptual framework;

Source: Author's elaboration.

Quality assessment results

The results of the assessment quality of the indicators using the AIRE instrument are shown in Table 1. The methodological quality of indicators presented in these studies varied considerably.

Most of sets of indicators presented in these studies obtained the highest scores for the items 'Purpose, relevance and organizational context' (range 73% - 93%) and the lowest scores for the item 'Stakeholder involvement' (range 0% - 72%), followed by 'Additional evidence, formulation, and usage' (range 22% - 46%), and 'Scientific evidence' (range 22% - 44%). No study achieved high assessment quality scores in all four categories. Carvalho³³ presented a set of indicators with high scores on domains 'Purpose, relevance and organizational context' (93%) and 'Stakeholder involvement' (72%). The study of Soares³⁴ had the lowest scores for the set of indicators on domains 'Scientific evidence' (22%) and 'Additional evidence, formulation, usage' (22%). The majority items that scored poorly were 'the supporting evidence has been critically appraised,' 'a strategy for risk adjustment has been considered and described,' 'the indicator measures what it is intended to measure (validity),' 'the indicator measures accurately and consistently (reliability),' and 'the indicator has sufficient discriminative power'.

Discussion

Summary of evidence

To our knowledge, this is the first review to identify and assess studies that have developed quality indicators for the management of the PNAE. Ten studies were found that developed instruments to measure and evaluate the PNAE. The present review has provided a comprehensive critical analysis of the study characteristics and the measurement properties of the studies.

We systematically searched the literature in five electronic reference databases and thoroughly reviewed and evaluated a vast number of articles. The selection of articles, data extraction, and quality assessment were independently conducted by two reviewers, which increases the reliability of the results. Therefore, we can be confident that the present review provides a comprehensive overview of the available indicators.

The present review highlighted relevant gaps in the quality of the instruments. No study achieved high assessment quality scores in all four domains of the AIRE instrument. Moreover, none of them developed an instrument with evidence of validity, and this limited the psychometric quality of the instruments. Likewise, no study included goals and frequency for the indicators to support decision-making of the stakeholders. Consistent with Donabedian's framework¹³, further research should include the development and validation of the indicators underlying the

Table 1. Methodological characteristics of the quality indicator sets assessed with the Appraisal of Indicators through Research and Evaluation (AIRE) instrument.

Studies	Domains (%)				Range
	Purpose, relevance and organizational context	Stakeholder involvement	Scientific evidence	Additional evidence, formulation, usage	
Silva, 2009 ²⁷	87	61	44	44	44-87
Carvalho, 2012 ³³	93	72	39	46	39-93
Soares, 2012 ³⁴	77	22	22	22	22-77
Calasans, 2013 ²⁸	73	0	33	33	0-73
Gabriel, 2013 ³¹ ; 2014 ³²	87	67	33	35	33-87
Calasans, 2014 ²⁹	73	0	33	46	0-73
Goulart, 2015 ²⁶	90	56	44	37	37-90
Bicalho, 2017 ³⁰ ; 2019 ¹⁶	77	22	28	39	22-77
Range	73-93	0-72	22-44	22-46	0-93

Source: Author's elaboration.

structures, processes, and outcomes. This approach may provide a comprehensive evaluation of the quality of the management of the PNAE.

General view of the studies

All studies developed the instrument in Portuguese and were carried out in Brazil, but only to states in the northeast, south, and southeast of the country. Considering that PNAE is a national program, it was not necessary to have a specific instrument for each state. But would be important to test characteristics of reliability and validity or adapt the instrument in other regions. Adapting existing instruments for each setting is necessary to guarantee the instruments' linguistic and cultural appropriateness³⁵.

Quality indicators can be categorized according to structure, process, and outcome¹³. However, most studies assessed two types of indicators: structure and process or process and outcome. There is a consensus that the three types of indicators complement each other and can assist in obtaining service with better quality^{36,37}. An indicator that evaluates structure can assist, under favourable or unfavourable conditions, in the achievement of the objectives of the PNAE in the other dimensions. Likewise, the process indicator assesses what the provider did for the PNAE and how well it was done³⁸. However, structure is not a necessary condition for the processes to occur. The structure of the program will fulfil its purposes if the applied processes are appropriate. In addition, both types of indicators (structure and process) will only reach their ultimate goals with the achievement of good outcomes³⁹.

The number of indicators in the instruments ranged from 8 to 88. Three studies divided indicators in subitem's sets^{26,31,32}. For example, the indicator 'Adequacy of school cooks team' is considered to assess the subitems 'number of school meals/school cooks ratio' and 'Extra tasks for school cooks'³². However, these subitems should not be considered indicators. According to Tanaka et al.³⁹, the indicator is a numeric variable that can be an absolute number, a two-events ratio, or a quality event. One study²⁶ classified some items of the instrument, such as 'Has the school kitchen a Standard Operating Procedures?' and 'Were the school cooks trained to use the Standard Operating Procedures?', as process indicators. Nevertheless, according to Santos et al.⁹ based on Donabedian's conceptual framework¹³, these items are considered structure indicators as they refer to the actual PNAE law and the human resources training. Another important finding of the pres-

ent review is that only two studies^{16,30} developed a short set including eight indicators. The literature recommends the choice of three to five indicators for their importance, synthesis capability, and ease of data collection because too many indicators may cause operational difficulty³⁹.

One important aspect of the development of quality indicators is the enrolment of stakeholders with different perspectives on quality management. The combination of PNAE's legal and institutional mechanisms for the participation of civil society and the partnership of different government sectors set the conditions for the promotion of intersectorality⁴⁰. It is recommended to include the perspectives of all potential end users including the service recipient, their families, health professionals, and managers⁴¹. However, the included studies^{16,26,30-32} mainly considered the points of view of the manager and nutritionists of the PNAE. Some studies^{27-29,34} included the perspectives of the students, school managers, school cooks, or members of Municipal School Nutrition Councils in the development of the quality indicators. Therefore, specific challenges in measuring results are related to one of the major strengths of the programme: its integrated and multisectoral approach⁷. The management of the PNAE depends on a network of relationships involving different areas: education, the economic sector, family farming, civil society, and all levels of government⁸.

Quality indicators can be developed using non-systematic or systematic evidence, combined or not with expert opinion methods⁸. Five studies^{26,27,31-33} used the literature review method combined with consensus techniques. Consensus techniques are group facilitation techniques that explore the level of consensus among a group of experts while synthesizing opinions. Group judgements are preferable to individual judgements, which are prone to personal bias⁸.

Five studies^{16,28-30,34} used only the literature review method to develop the instrument. Many areas of healthcare that have a limited or methodologically weak evidence base, especially within the evaluation of public policy, require other evidence, including expert opinion⁸. Systematic research methods that also involve consensus are the best methods for developing quality indicators in many areas of health care where the scientific evidence base is limited⁴². In the development of indicators, the use of expert opinion is necessary in order to obtain more validity evidence⁴³. Therefore, the instruments from the five studies^{16,28-30,34} that did not perform a literature review are not suitable for further application.

Finally, three studies^{16,29-31} in the present review were from dissertations. We included these studies because they report important additional information regarding the development process of indicators.

Assessment of quality indicators

The set of indicators presented in the studies varied in the methodological quality and the information available about development process. Some studies described set of indicators in detail, with a clear definition of numerators, denominators, and/or performance standards as well as the development process, whereas other studies presented set of indicators without more detailed information about methodology process.

The sets of indicators presented by Carvalho³³ study had the highest methodological scores according the AIRE instrument. The development process for these sets was described more precisely and elaborately. Moreover, no study obtained high assessment quality scores in all four categories.

Overall, in terms of assessment quality, most of the studies^{26,27,31-33} reached a high-quality level on the domains and 'Purpose, relevance, and organizational context' and 'Stakeholder involvement'. However, the studies did not describe satisfactorily the domains 'Scientific evidence' and 'Additional evidence, formulation, and usage'. Information about formal endorsement of the indicators was barely available in the studies. They may have put less emphasis on this type of information, resulting in lower quality scores on these aspects. We have tried to resolve this by incorporating as much information as possible about the indicator sets when evaluating their quality.

The characteristics of the quality indicators of the studies in the present review varied widely. The addressed content, the organizational context, and the criteria for interpretation were described in detail in all studies. On the other hand, no information was available about reliability and validity in the studies. Two studies^{31,32} discussed some aspect of validity (e.g. the cut-off of the experts consensus) but did not describe a process of validating the instrument. In addition, no studies considered a sufficient discriminative power; no strategy for risk adjustment was considered and described. Characteristics of reliability and validity are very important to develop or adapt research-measuring instruments⁴⁴⁻⁴⁶.

Indicator sets without a robust development process (i.e. those sets scoring poorly in a methodological assessment) can still be considered as potential quality indicators. They can be used in

other quality assessment initiatives, on the condition that they will be further studied²⁰. In the literature concerning quality indicators, there are some disagreements on the types of indicators that are most suitable for the assessment of quality. Therefore, publication of the methodological characteristics of quality indicator sets, including an extensive description of the development process, is recommended⁴⁷.

Limitations

Although this systematic review makes a significant contribution to the quality of public-school feeding policies literature, some limitations must be acknowledged. As demonstrated in this comprehensive review, few studies developed an instrument to assess the quality of local management of the PNAE. It is possible that some studies were missed because they were not indexed in the databases searched or were published by institutions, foundations, or societies. This setting was minimized to track down relevant grey literature by manually checking the reference lists during the full-text screening and using Google's internet search.

Finally, the assessment quality of the indicator sets of the studies included in the present review might have been underestimated in some aspects. Following the instructions from the AIRE instrument, the lowest score was assigned to an item when no information was provided in the article or dissertation.

Conclusions

The PNAE monitoring and evaluation mechanisms in the studies presented in this review focused on implementation. Few studies were identified proposing quality indicator instruments to evaluate the management of the PNAE. The literature review combined with consensus techniques was used for instrument development in some studies although the authors did not perform the reliability and validity of the indicators. The highest level of the quality assessment according AIRE instrument was achieved on the domains 'Purpose, relevance and organizational context' and 'Stakeholder involvement', however the studies did not describe satisfactorily the domains and 'Additional evidence, formulation, and usage' and 'Scientific evidence'.

This study was carried out by understanding that an evaluation is considered positive when it is possible to contribute for identifying problems

and proposing solutions. The quality indicators could contribute to reducing the gap in the area of evaluation and improvement of the implementation of this Program. However, one challenge identified in this study is inadequate research to support the school feeding policy. Therefore, the flaws observed in this study showed that further research concerning the development of quality indicators with rigorous methods of evidence of validity are necessary to evaluate the management of the PNAE.

Collaborations

D Bicalho, TM Lima and B Slater contributed to the planning and design of the research. Bicalho, TM Lima and TSS Santos conducted the search in the database and the screening procedure. TM Lima resolved the disagreements. Bicalho wrote the manuscript. All authors commented the drafts and read and approved the version of the final manuscript forwarded.

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