Int J Clin Pharm (2015) 37:799–807
DOI 10.1007/s11096-015-0123-2

RESEARCH ARTICLE

Critical appraisal of clinical practice guidelines in pediatric infectious diseases

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Received: 24 February 2015 / Accepted: 14 April 2015 / Published online: 25 April 2015

Abstract *Background* There is a need to critically appraise clinical practice guidelines in order to ensure safe and effective practices are being implemented to optimize patient care. Appraising guidelines within one therapeutic area enable recommendations for improvement during guideline creation and dissemination. *Objectives* Study objectives were to systematically appraise selected published guidelines used in the treatment of pediatric infectious diseases and to make recommendations for improvement throughout the development and dissemination processes. *Setting* The study occurred between collaborative academic and practice-based institutions located in Canada and Qatar. *Methods* A literature search identified guidelines for management of pediatric infectious diseases from 1997 to 2013. Each guideline was appraised by four independent assessors, according to the appraisal of guidelines for research and evaluation II (AGREE II) instrument. Standardized domain scores were calculated for each guideline and pooled. Final endorsements for use in clinical practice were also determined. Inter-rater reliability was assessed using intraclass correlation coefficients. *Main outcome measure* Standardized domain scores according to the AGREE II instrument. *Results* Twenty guidelines met inclusion criteria and were appraised. Pooled domain scores were: scope and purpose (69.9), stakeholder involvement (40.1), rigour of development (47.1), clarity of presentation (73.4), applicability (23.7), editorial independence (46.7), and overall assessment (55.8). Two (10 %) guidelines were recommended for use without revision, 13 (65 %) guidelines were recommended with modifications, and 5 (25 %) guidelines were not recommended for implementation into practice. Inter-rater reliability was moderate to good with intra-class correlations of 0.65–0.93 per guideline. *Conclusion* The majority of appraised guidelines were moderately rated, with a 25 % of guidelines not recommended for use. Strategies for improvement require the involvement of all key stakeholders (caregivers, patients, and allied health professionals), and consideration of facilitators, barriers and resource implications during implementation. Additionally, critical appraisal of guidelines should become standard practice prior to adoption into clinical settings.

Keywords Children · Clinical practice guidelines · Decision making · Evidence-based medicine

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Impact of findings on practice

- Clinical practice guidelines for pediatric infectious diseases require revision prior to publication and widespread use

- Guideline developers should attempt to engage all stakeholders (including patients and caregivers) during guideline development process
- A universal lack of reporting costs, barriers, and tools for implementation decreased applicability scores and hinders potential for international acceptance of guidelines
- The 'Appraisal of guidelines for research and evaluation II' (AGREE II) instrument demonstrates high interrater reliability for guideline appraisal

Introduction

Clinical practice guidelines (CPGs) are statsements that summarize disease management recommendations to standardize and optimize patient care through a systematic review of evidence and assessment of the benefits and harms of alternative care options [1]. They are often targeted to specific audiences, such as physicians, pharmacists, nurses, allied health care practitioners and/or patients to assist them in making clinical decisions for specific clinical scenarios [1]. Guidelines have greatly influenced modern medicine by becoming standard resources in routine care for health care professionals [2].

From guideline inception to implementation, multiple processes are required and quality measures should be in place to ensure that the document is comprehensive, accurate, effective and safe for application. Recommendations are generally developed based on strength of evidence in the literature, typically with meta-analyses, systematic reviews, and randomized controlled trials being considered highly [3]. In addition, the recommendations are typically ranked on a scale ranging from 'strong' to 'weak,' based on the importance of the results to achieve the outcomes of interest. The grading of recommendations assessment, development, and evaluation (GRADE) working group rating is commonly cited throughout guidelines as the gold standard model for rating the quality of evidence and strength of recommendations [4]. GRADE uses a well-defined and systematic approach that standardizes the assessment in a clear and concise manner.

Although CPGs aim to provide statements to standardize clinical care and practices, limitations have been identified in the development process of many guidelines, which subsequently affects their content [2]. More specifically, guidelines have not traditionally been subjected to the high-level of critical evaluation that published clinical trials receive [5]. This is an unexpected finding, as CPGs have great potential to directly influence patient management. Without measures to ensure that CPGs are produced and applied according to established methodologies, guidelines are at risk of both error and bias. External review, peer review, and critical appraisal should be a part of the guideline development and implementation process [6].

Standardized critical appraisal instruments are available to evaluate CPGs. The appraisal of guidelines for research and evaluation II (AGREE II) instrument has been validated and extensively studied in comparison to other methods, and remains the current gold standard for guideline appraisal [7, 8]. The purpose of AGREE II is to evaluate the strengths and limitations of guidelines; to provide a methodological strategy for development of guidelines; and to present guidance for the reporting of content and recommendations. It is a generic instrument that can be readily applied to guidelines for any disease state or patient population. The intended stakeholder groups include healthcare providers, guideline developers, policy makers, researchers, and educators. Numerous studies have utilized the AGREE II instrument as an evaluation tool for guideline appraisals in the medical literature [9, 10].

Aim of the study

The objectives of this study were to systematically assess the strengths and limitations of CPGs used in the treatment of pediatric infectious diseases and to formulate recommendations to be used during the development process that will enhance the quality and applicability of new guidelines.

Ethical approval

Ethical approval was not necessary for this study.

Methods

Identification of clinical practice guidelines

A literature search was conducted to identify published CPGs for the treatment of common pediatric bacterial infectious diseases. The electronic databases of MEDLINE (1948-May 2013), EMBASE (1980-May 2013), *International Pharmaceutical Abstracts* (1970-May 2013), National Guideline Clearing House and Google Scholar were searched, as well as manual screening of the references from cited articles to capture those not found in the electronic search. Keywords were pediatrics; paediatrics; child; children; guideline; CPG; statement; infectious diseases; otitis media; pneumonia; sepsis; bacteremia; sinusitis; pharyngitis; urinary tract infection; cellulitis; endocarditis; and gastroenteritis. In addition, pediatric infectious diseases and related professional society websites were reviewed for relevant publications [11, 12]. Technical reports

and other supporting documents were sought along with the primary guideline document.

Eligibility criteria

All CPGs identified through the search that were published in English and addressed pediatric bacterial infectious diseases topics were eligible for inclusion. Bacterial infectious diseases were targeted due to treatment recommendations that typically include pharmacotherapy. Pediatric patients were defined as those aged between 1 month and 18 years. Only the most recent version of a CPG was included (i.e. full updates to previously published guidelines). Guidelines that did not report recommendations in pediatrics, and those specific to neonatal or pediatric oncology populations were excluded. Additional exclusion criteria were guidelines for immunizations and tropical diseases, since these specialty areas typically had locally derived treatments based on susceptibility patterns. CPGs reporting recommendations in both pediatrics and adults were included (if identified through the search), but only the pediatric sections of the guidelines were assessed. Unless identified by the search strategy, non-peer reviewed CPGs were not sought in order to avoid contamination of the sample from lower quality guidelines.

Critical appraisal instrument

The appraisal of guidelines, research and evaluation II instrument (AGREE II) was used as the appraisal tool [7]. AGREE II outlines a standardized methodology that guides the user to systematically appraise 23 items under 6 subject domains. It is recommended that at least 2 (but preferably 4) independent appraiser evaluations be combined for a more robust assessment. Each of the 23 statements is ranked on a 7-point scale with 7 being 'strongly agree' and 1 being 'strongly disagree' [7].

Study Procedures

Two investigators conducted the literature search and reviewed each CPG to determine its suitability for inclusion. Once all eligible guidelines were identified, they were distributed to study team members for independent appraisals. Four additional evaluators aside from study investigators were hired to assist with the assessment. All appraisers had at minimum a post-graduate Doctor of Pharmacy degree and were familiar with the AGREE II instrument. The project leader had received extensive training on the AGREE II instrument and teaches its application within a post-graduate setting. The project leader offered additional training (interpretation of domains, clarification of item descriptors, general questions), when needed to all appraisers. All appraisers received the AGREE II User Manual for review and the PI (KW) met face-to-face with all hired evaluators to provide an additional orientation.

CPGs were evaluated using the AGREE II instrument, as described above. Once completed, each appraiser forwarded their appraisal results to the project leader for inclusion in a master spreadsheet. When four appraisals were received for each CPG, the project leader merged the results and reviewed them for consistency between appraisals. Results were deemed inconsistent if rankings for each item differed by 6 points on the rating scale (i.e., if 1 item received a score of 1 and 7 by separate investigators). In these situations, the CPG was returned to the original investigators for reassessment. Investigators were not specifically asked to change their scores, but were requested to reassess the guideline as a quality measure and only change their ratings if deemed necessary. No other action was taken if scores were not changed. Final scores from this second analysis were then incorporated into the overall results.

Statistical analysis

Standardized domain scores were calculated according to methods described in the AGREE II user manual [7]. Domain scores for each CPG were combined and descriptive statistics (mean, standard deviation, and 95 % confidence intervals) were used to summarize the data. Pooling of each separate domain across all the evaluated CPGs allowed for the estimation of an overall score for domains of pediatric infectious disease guidelines as a whole. For each guideline, one of three possible endorsements/recommendations (recommended, recommended with modifications, or not recommended) was given by each of the four assessors. The endorsement with the most support amongst the assessors was accepted as the final decision. In the event of a tie, the CPG was redistributed for reassessment. If a tie remained at this point, the most conservative endorsement was documented. Inter-rater reliability for each guideline was calculated using intra-class correlation coefficients (two-way random model) for all items including the overall assessment but not the subjective recommendation. All statistics were calculated using IBM SPSS Statistics v. 22 (IBM Corporation).

Results

The literature search identified 24 CPGs that met inclusion criteria [13–36]. After further screening, 20 guidelines meeting inclusion criteria were included for review and analysis [13–32]. Two guidelines were excluded because

newer updates were available [33, 34], and two were excluded based on their language of publication [35, 36]. Guideline topics included meningitis [13, 14], acute otitis media [15], upper respiratory tract infections [16–19], lower respiratory tract infections [20–22], gastroenteritis [23], intra-abdominal infections [24], urinary tract infections [25–28], septic shock [29], and pathogen-specific infections [30–32]. The CPGs were all published between 1997 and 2013. Nineteen of 20 (95 %) guidelines were affiliated or endorsed by one or more professional associations or societies. Fifteen (75 %) were developed solely for pediatric populations, while the remainder included recommendations for both children and adults. Guidelines were typically targeted to physicians and other healthcare professionals involved in disease management of pediatric infectious diseases. All the CPGs in this review are summarized in Table 1.

Four appraisers reviewed each of the 20 CPGs, which resulted in 80 independent AGREE II assessments. After an initial screen, 16 (out of a possible 480) inconsistencies were identified and these CPGs were returned to the appraisers for reassessment. After a second evaluation, no inconsistencies remained.

The overall assessment standardized mean AGREE II score for all CPGs was 55.8 out of a possible 100 points (95 % CI 46.9–64.4), with scores ranging from 8.3 to 83.3. The highest scoring standardized mean domains were for "clarity of guideline presentation" [73.4 (95 % CI 65.8–80.3)], "scope and purpose of guideline" [69.9 (95 % CI 59.0–78.9)] and "rigour of development" [47.1 (95 % CI 36.4–57.6)] while the lowest scores were for "applicability of guideline" [23.8 (95 % CI 16.1–33.0)], "stakeholder involvement" [40.1 (95 % CI 31.5–49.3)] and "editorial independence" [46.7 (95 % CI 35.3–57.5)]. Two (10 %) guidelines were endorsed by appraisers as "recommended without revision," [14, 19] and 13 (65 %) guidelines were "recommended with modifications;" [13, 15, 18, 21–26, 28, 29, 31, 32] however, assessors indicated that 5 (25 %) guidelines should "not be recommended for implementation into practice" [16, 17, 20, 27, 30]. Inter-rater reliability was moderate to good with intra-class correlations of 0.65–0.93 per all items assessed for each guideline (Table 2). The peer-reviewed recommendations and standardized mean scores by CPG and domain are summarized in Table 2, and the overall pooled domain scores are illustrated in Fig. 1.

Discussion

This paper reports a qualitative evaluation of the CPGs in pediatric infectious diseases. Twenty CPGs were identified and evaluated using the AGREE II standardized assessment criteria. Overall, the quality associated with pediatric guidelines were relatively low, with the domains of "applicability of guideline" and "stakeholder involvement in guideline development" performing the worst. Domains of "clarity of guideline presentation" and "scope and purpose of guideline" obtained the highest scores. These results suggest that a closer examination of the pediatric guidelines development process is warranted.

In our study, only 2 of the 20 CPGs were deemed to be endorsable for use in their current form based on their assessed attributes (i.e., majority of assessors rated as "recommended without modifications") [14, 19]. Even more disconcerting, 5 CPGs were considered inappropriate for use in clinical practice [16, 17, 20, 27, 30]. As pediatric patients are generally more vulnerable in nature, it is essential to ensure that CPGs are developed under strict criteria and implemented with the appropriate supports; however, these results suggest that the guideline development process is largely suboptimal. Efforts are needed to standardize guideline methodology and to produce high quality CPGs in order to rectify these discrepancies and promote evidence-based practices to enhance patient outcomes. Based on our findings, numerous recommendations can be made to assist in the formation of higher quality CPGs that are readily applicable for use by practitioners in clinical practice.

Firstly, it is fundamental to focus on the "applicability of the guideline" as this domain had the lowest ranking overall. The AGREE II defines "applicability" as the facilitators, barriers and resource implications that are associated with guideline use [7]. For example, a guideline would be rated highly if it provided insight into facilitators and barriers associated with guideline implementation, resource implication analyses related with guideline utilization, support tools (e.g., pocket guides, checklists, etc.) that assisted clinicians in using the guideline, and monitoring or audit criteria for evaluation of the guideline. These components were consistently lacking in the CPGs that were reviewed, which significantly decreased the domain score and may negatively influence uptake of these guidelines into practice. At a minimum, we believe guideline developers should consider cost and resource implications related to recommendations, as implementation of specific recommendations may not be feasible in resource-constrained settings.

Details regarding the involvement of each stakeholder during the guideline development process were often absent, which resulted in low scores reported for most CPGs. The importance of this domain cannot be undervalued, especially due to biases that may arise from both inclusion and exclusion of certain stakeholders, such as drug manufacturers [37]. More significantly, patients were often not reported as stakeholders in CPG development, while these guidelines were designed for their management.

Table 1 Summary of included clinical practice guidelines for pediatric infectious diseases

Clinical practice guideline	Publication date	Journal	Population	Affiliation and/or Endorsement Organization
A practical guide for the diagnosis and treatment of pediatric pneumonia [20]	1997	Canadian medical association journal	Infants and children up to 18 years of age	Sponsored by an unrestricted educational grant from Abbott Laboratories
Therapy for children with invasive pneumococcal infections [30]	1997	Pediatrics	Children	American Academy of Pediatrics
Clinical practice guidelines: management of sinusitis [16]	2001	Pediatrics	Children (1–21 years of age)	American Academy of Pediatrics and Agency for Healthcare Research and Quality
Practice guidelines for the management of bacterial meningitis [13]	2004	Clinical infectious diseases	Infants, children, and adults	Infectious Diseases Society of America
Diagnosis and management of bronchiolitis [21]	2006	Pediatrics	Infants and children	American Academy of Pediatrics, Agency for Healthcare Research and Quality, Quality and RTI International University of North Carolina Evidence-Based Practice Center, American Academy of Family Physicians, American College of Chest Physicians, and American Thoracic Society
Urinary tract infection in children: diagnosis, treatment and long-term management [25]	2007	NICE clinical guideline 54	Infants and children <16 years of age	National Institute for Health and Clinical Excellence
Evidence-based guidelines for the management of acute gastroenteritis in children in Europe [23]	2008	Journal of pediatric gastroenterology and nutrition	Children <6 years of age	European Society for Pediatric Gastroenterology, Hepatology, and Nutrition and European Society for Paediatric Infectious Diseases
Clinical practice parameters for hemodynamic support of pediatric and neonatal septic shock: 2007 update from the American College of Critical Care Medicine [29]	2009	Critical care medicine	Neonates and children	Society of Critical Care Medicine
Prevention of rheumatic fever and diagnosis and treatment of acute streptococcal pharyngitis [17]	2009	Circulation	Children and adults	American Heart Association and American Academy of Pediatrics
Management of bacterial meningitis and meningococcal septicaemia in children and young people younger than 16 Years in primary and secondary care [14]	2010	NICE clinical guideline 102	Children <16 years of age	National Institute for Health and Clinical Excellence
Diagnosis and management of complicated intra-abdominal infection in adults and children: guidelines by the surgical infection society and the infectious diseases Society of America [24]	2010	Clinical infectious diseases	Children and adults	Infectious Disease Society of America, Surgical Infection Society, American Society for Microbiology, American Society of Health-System Pharmacists, Pediatric Infectious Diseases Society, and Society of Infectious Diseases Pharmacists
Urinary tract infection: clinical practice guideline for the diagnosis and management of the initial UTI in febrile infants and children 2 to 24 Months [26]	2011	Pediatrics	Children 2–24 months of age	American Academy of Pediatrics
Evidence-based guidelines from ESPGHAN and NASPGHAN for *Helicobacter pylori* infection in children [31]	2011	Journal of pediatric gastroenterology and nutrition	Children younger than 20 years of age	European Society for Pediatric Gastroenterology, Hepatology, and Nutrition and North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition

Table 1 continued

Clinical practice guideline	Publication date	Journal	Population	Affiliation and/or Endorsement Organization
The management of community-acquired pneumonia in infants and children older than 3 months of age: clinical practice guidelines by the pediatric infectious diseases society and the infectious diseases Society of America [22]	2011	Clinical infectious diseases	Children >3 months of age	Infectious Disease Society of America, Pediatric Infectious Diseases Society, American Academy of Pediatrics, American College of Emergency Physicians, American Society of Microbiology, American Thoracic Society, Society for Hospital Medicine, Society of Critical Care Medicine
Clinical practice guidelines by the infectious diseases Society of America for the treatment of methicillin-resistant *Staphylococcus aureus* infections in adults and children [32]	2011	Clinical infectious diseases	Adults and children	Infectious Disease Society of America, Pediatric Infectious Diseases Society, American College of Emergency Physicians, American Academy of Pediatrics
Revised statement on management of urinary tract infections [27]	2011	Indian pediatrics	Infants and children	Indian Society of Pediatric Nephrology
Febrile urinary tract infections in young children: recommendations for the diagnosis, treatment and follow-up [28]	2012	Acta pediatrica	Children 2 months to 3 years of age	Italian Society of Pediatric Nephrology
Clinical practice guideline for the diagnosis and management of group A streptococcal pharyngitis: 2012 update by the infectious diseases Society of America [18]	2012	Clinical infectious diseases	Children and adults	Infectious Disease Society of America
IDSA clinical practice guideline for acute bacterial rhinosinusitis in children and adults [19]	2012	Clinical infectious diseases	Children and adults	Infectious Disease Society of America
The diagnosis and management of acute otitis media [15]	2013	Pediatrics	Children 6 months to 12 years of age	American Academy of Pediatrics, Agency for Healthcare Research and Quality, and Southern California Evidence-Based Medicine Practice Center

Clinical decision-making has evolved over recent years to become more patient-centred with an emphasis on patient preferences when selecting treatment alternatives. Additionally, the advent of a team-based approach has given allied health professionals, such as nurses and pharmacist's greater influences over patient care [38]. For these reasons, inclusion of patients, their caregivers, and allied health professionals in guideline development is essential to ensure recommendations are comprehensive, applicable, and achievable. The preferences of the pediatric patient and/or those of their caregivers are especially valuable, since children have special considerations that may greatly influence how care is delivered. Some of these may include medication palatability, dosing intervals, specific monitoring frequencies for efficacy parameters (e.g., measurement of body temperature, blood glucose, etc. during school hours), aversion to needle use, or other specialized medical procedures, among others. By addressing these components, guideline developers would be able to more readily increase acceptance and uptake of their recommendations into clinical practice.

The "rigour of development," which ranked moderately amongst CPGs, refers to the evaluation of the evidence used to formulate the guideline as per AGREE II [7]. Although pediatrics infectious diseases may not be a specialty that is supported by numerous evidence-based clinical trials, it is still an expectation that the strength of recommendations in a CPG be graded based on the quality of evidence available. For example, a strong recommendation should not be solely based on expert opinion. Guideline developers need to adhere to a standardized evidence-based evaluation system, such as the one developed by the GRADE working group [4]. Other factors that would increase scoring in this domain include the inclusion of appendices with detailed literature search strategies and the acknowledgement of external reviewers with their titles and roles.

Comparatively, findings from other studies in critical care and occupational medicine assessing CPG quality found similar results [9, 10]. The highest scoring domains were consistently the "scope and purpose" and the "clarity of the guideline", while lowest scores were "stakeholder

Table 2 Standardized domain scores and final endorsement for each guideline

Guideline	Scope and purpose	Stakeholder involvement	Rigour of development	Clarity of presentation	Applicability	Editorial independence	Overall assessment	Recommend endorsement	ICC
Pneumonia, 1997 [20]	66.7	27.8	30.2	47.2	10.4	27.1	33.3	No	0.82 (0.66–0.91)
Pneumococcal Infections, 1997 [30]	45.8	11.1	18.8	65.3	11.5	4.2	29.2	No	0.84 (0.69–0.93)
Sinusitis, 2001 [16]	84.7	37.5	34.9	63.9	11.5	0.0	54.2	No	0.90 (0.82–0.96)
Meningitis, 2004 [13]	70.8	23.6	20.3	58.3	3.1	22.9	45.8	Yes with modifications	0.93 (0.84–0.97)
Bronchiolitis, 2006 [21]	93.1	47.2	65.6	88.9	24.0	37.5	66.7	Yes with modifications	0.83 (0.61–0.92)
Urinary tract infection, 2007 [25]	95.8	81.9	80.2	91.7	70.8	50.0	83.3	Yes with modifications	0.71 (0.38–0.87)
Gastroenteritis, 2008 [23]	80.6	56.9	71.4	80.6	35.4	83.3	50.0	Yes with modifications	0.88 (0.72–0.95)
Septic shock, 2009 [29]	55.6	20.8	40.1	66.7	16.7	35.4	45.8	Yes with modifications	0.74 (0.51–0.88)
Pharyngitis, 2009 [17]	16.7	13.9	16.1	52.8	18.8	56.3	25	No	0.83 (0.66–0.92)
Meningitis, 2010 [14]	97.2	80.6	80.7	94.4	71.9	70.8	83.3	Yes	0.65 (0.54–0.83)
Intra-abdominal infections, 2010 [24]	70.8	34.7	54.2	77.8	16.7	70.8	70.8	Yes with modifications	0.79 (0.61–0.90)
Urinary tract infection—pediatrics, 2011 [26]	81.9	48.6	76.0	87.5	36.5	58.3	70.8	Yes with modifications	0.68 (0.36–0.85)
H. pylori, 2011 [31]	65.3	44.4	63.5	76.4	25	50	70.8	Yes with modifications	0.81 (0.64–0.91)
Community acquired pneumonia, 2011 [22]	90.3	47.2	39.1	86.1	27.1	70.8	62.5	Yes with modifications	0.90 (0.82–0.95)
MRSA, 2011 [32]	69.4	47.2	53.1	83.3	26.0	64.6	62.5	Yes with modifications	0.79 (0.57–0.90)
Urinary tract infection—Indian nephrology, 2011 [27]	16.7	5.6	5.7	41.7	5.2	2.1	8.3	No	0.82 (0.67–0.91)
Urinary tract infection, 2012 [28]	61.1	37.5	11.5	48.6	8.3	29.2	41.7	Yes with modifications	0.92 (0.85–0.96)
Pharyngitis, 2012 [18]	76.4	37.5	54.2	83.3	21.9	77.1	66.7	Yes with modifications	0.88 (0.78–0.94)
Rhinosinusitis, 2012 [19]	84.7	51.4	69.8	88.9	22.9	70.8	79.2	Yes	0.93 (0.86–0.97)
Acute otitis media, 2013 [15]	75.0	47.2	56.8	84.7	9.4	52.1	66.7	Yes with modifications	0.83 (0.67–0.93)
Overall	69.9 (95 % CI 59.0–78.9)	40.1 (95 % CI 31.5–49.3)	47.1 (95 % CI 36.4–57.6)	73.4 (95 % CI 65.8–80.3)	23.7 (95 % CI 16.1–33.0)	46.7 (95 % CI 35.3–57.5)	55.8 (95 % CI 46.9–64.4)		

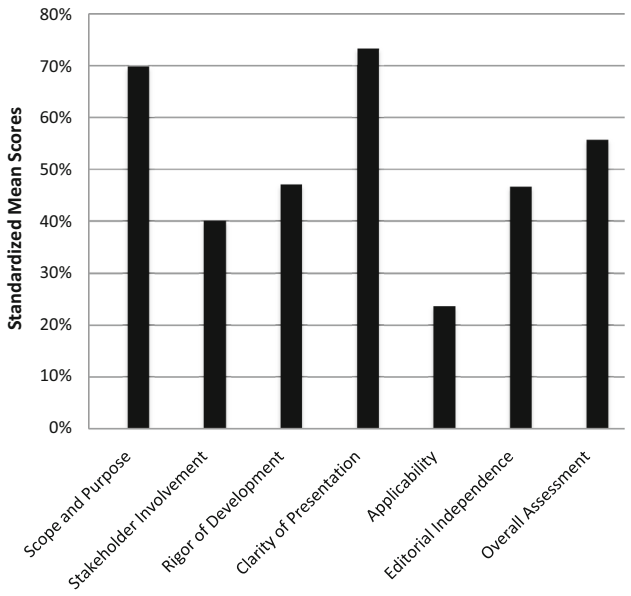

Fig. 1 Pooled domain scores for pediatric infectious diseases guidelines

involvement" and "applicability of the guideline." The additional results from our study reflect the quality of current CPGs, and highlight the areas that need to be improved upon in guideline development across all patient populations. Being cognizant of these limitations would allow developers to address these issues, which would subsequently increase the domain scores and improve the quality of CPGs to ultimately optimize patient outcomes. In order to assess the impact of domain scores on clinical practice, longitudinal studies could be designed to evaluate quality and usability over time, in addition to capturing patient outcome data.

This study has limitations that should be addressed. Firstly, the literature search identified only published CPGs in pediatric infectious diseases. It is possible that some guidelines may have been missed by the search, especially those that combined pediatric and adult recommendations; however, a review of the association websites that endorsed these CPGs should have captured any additional guidelines in practice. Secondly, there is currently no pre-determined threshold that defines whether a CPG is of a "high quality" when using the AGREE II instrument. This makes it difficult to interpret domain scores as a whole, but analyses of the individual items that have lower scores within a CPG can provide valuable insight for improving the quality and usability of guidelines. Additionally, CPGs that cover the same disease state or topic may be compared using these tools. Next, we acknowledge that the definition of an inconsistency between assessors (6 points) is large and inconsistencies could be defined with narrower margins. However, the moderate to high ICCs found allow for confidence with inter-rater reliability. Lastly, some CPGs were published at an earlier date (i.e., 1997) and may not have been subjected to the same rigorous development processes as compared to more recent publications. Exclusion of these earlier studies would be inappropriate, since recommendations from these CPGs may still be in use today. Despite these limitations, this study provides useful information for guideline creators and users when considering quality of published guidelines.

Conclusion

The critical appraisal of primary literature is a standard practice in both academic and clinical settings today. CPGs should undergo the same evaluation process (i.e. using AGREE II) by users/clinicians, in order to ensure efficacy and safety of recommendations. This study summarized assessment scores of guidelines used in the treatment of pediatric infectious diseases and provided recommendations for future improvement. Findings suggest that guidelines should address applicability by providing insight regarding facilitators and barriers for use in practice (including resource implications) and should attempt to include all stakeholders (caregivers, patients, and allied health professionals) during development to promote utility and generalizability. By doing so, higher quality guidelines will be developed and recommendations will be more applicable to practice.

Funding This study was funded by a Qatar University Internal Grant (QUUG-CPH-CPH-12/12-3).

Conflicts of interest The authors report no conflicts of interest to declare.

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