Methodological and reporting quality of pediatric clinical practice guidelines: a systematic review

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Background: Pediatric clinical practice guidelines (CPGs) can provide systematically developed clinical recommendations to guide pediatric clinicians and patients making decisions. This study aims to assess the methodological and reporting quality of pediatric CPGs.

Methods: We performed a systematic literature search of MEDLINE from 1 January 1990 to 2 April 2020 to identify pediatric CPGs published in the ten highest-impact pediatric journals and four highest-impact general medical journals. Two researchers evaluated the methodological and reporting quality of pediatric CPGs using the Appraisal of Guidelines Research and Evaluation (AGREE) II instrument and Reporting Items for Practice Guidelines in Health care (RIGHT) checklist. We calculated the mean AGREE II scores and compliance to RIGHT overall, and for each domain of the respective tools. We compared the methodological and reporting quality by different time periods and calculated the correlation between the AGREE II score and compliance to RIGHT.

Results: A total of 159 pediatric CPGs were identified. The mean (± standard deviation) scores for the six domains of the AGREE II instrument were as follows: scope and purpose 74.5%±14.2%, stakeholder involvement 42.7%±16.2%, rigour of development 18.7%±14.2%, clarity of presentation 56.5%±17.0%, applicability 8.9%±12.7% and editorial independence 25.2%±34.6%. The overall assessment score was 37.8%±12.4%. The mean compliance to RIGHT items in the seven domains of the checklist were: basic information 73.6%±14.9%, background 67.1%±16.4%, evidence 32.7%±27.2%, recommendations 32.4%±22.5%, review and quality assurance 22.9%±40.4%, funding and declaration and management of interests 24.1%±36.3%, and other information 45.3%±30.1%. The overall reporting rate for RIGHT was 46.4%±16.6%. Both the AGREE II scores and RIGHT reporting rates increased over time. We found a high positive correlation between AGREE II scores and RIGHT reporting compliance (r=0.645, P<0.001).

Discussion: The methodological and reporting quality of pediatric CPGs have improved over time, but remain still suboptimal and needs to be further improved. An international database of pediatric guidelines is urgently needed to identify and promote high-quality guidelines and guide clinical practice in pediatrics.

Keywords: Methodological quality; reporting quality; pediatric; clinical practice guideline (CPGs)

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Introduction

Clinical practice guidelines (CPGs) are one of the most important sources of evidence-based medical practice. According to the definition of the Institute of Medicine (IOM) in 1990, clinical guidelines are syntheses of the best available evidence that support clinicians, managers and policy makers in decision making about the organization and delivery of health care (1). In 2011, IOM redefined their definition as follows: CPGs are statements that include recommendations intended to optimize patient care that are informed by a systematic review of evidence and an assessment of the benefits and harms of alternative care options (2). Clear, explicit and transparent CPGs can enable health care practitioners, health administrators, program managers and the public to understand and implement recommendations that can positively affect the health patients and population group (3). Good CPGs in pediatrics can thus help pediatric professionals make clinical decisions and integrate the best available evidence into patient care.

In recent years, the number of available CPGs had grown rapidly. However, some studies have suggested that many existing guidelines are of poor quality. Guidelines on the same topic may make different or even contradictory recommendations (4,5). For example, there are conflicting recommendations in the currently valid guidelines for breast cancer and prostate cancer. An organization dedicated to reducing harm from cancer may place greater value on intensive cancer screening interventions, even though such interventions may prove to be extremely costly for the magnitude of the benefit they provide. Another organization, whose purpose is to promote the overall health of society, may view the same evidence differently, preferring to concentrate on other interventions with greater impact on overall public health (6,7). In fact, many guidelines published in the past have been proven to be unreliable and some even had recommendation with serious errors in the accuracy of clinical test (8-11). The adoption of low-quality guidelines may result in widespread use of ineffective treatments, inefficient practices and ultimately harm the patients (5,12). Therefore, identifying and promoting high-quality guidelines for physicians is of great importance (13).

At present, with the rapid increase in the number of pediatric CPGs, an increasing amount of quality assessment studies for pediatric CPGs have also risen. Appraisal of Guidelines Research and Evaluation (AGREE) and Reporting Items for Practice Guidelines in Health care (RIGHT) are two authoritative tools to evaluate the quality of clinical guidelines. The AGREE was established in 2003 by an international group of researchers from 13 countries (14). The improved version, AGREE II, was officially released in 2009 (15). The purpose of the AGREE II tool is to provide a framework for evaluating the quality of guidelines and a strategy for developing guidelines (16,17). The RIGHT standard can assist developers in reporting guidelines, support journal editors and peer reviewers in considering guideline reports and help health-care practitioners understand and implement guidelines. RIGHT standard was established by a multidisciplinary international team and officially launched in 2017 (18). The RIGHT checklist highlights the importance of reporting PICO (population, intervention, comparisons, outcomes) questions and the quality of the evidence. The RIGHT explanation and elaboration statement (Supplement) provides detailed information and examples, which are lacking in the AGREE tool (18,19).

However, few studies have systematically evaluated the methodological and reporting quality of pediatric CPGs. The quality assessments of CPGs in the field of pediatrics have so far been limited to guidelines included in professional guideline database such as National Guideline Clearinghouse (NGC), and there have been no studies that comprehensively assess the quality of pediatric CPGs published in the common literature databases. But the main channel for pediatricians to obtain CPGs is to search common databases such as MEDLINE via PubMed, and they are unable to identify the quality of pediatric CPGs from these databases. Therefore, this study selected published pediatric CPGs from common literature search databases (MEDLINE via PubMed), and used AGREE II tool and RIGHT standard to evaluate and analyze the methodological quality and reporting quality of these CPGs. We aimed to provide reference for clinical decision-making, and to provide suggestions for the standardized

development and evidence-based formulation of pediatric CPGs.

We present the following article in accordance with the PRISMA reporting checklist (available at https://dx.doi.org/10.21037/atm-21-2686).

Methods

Search strategy and selection criteria

We searched MEDLINE via PubMed (1 Jan 1990 to 31 Dec 2019) and selected guideline documents published in the 10 pedicatric journals with the highest impact factors in 2018 and 4 general medical journals [*The New England Journal of Medicine* (*NEJM*), *The Lancet*, *The Journal of the American Medical Association* (*JAMA*) and *The BMJ*]. These journals have the highest impact factors among the journals that are most likely to publish pediatric CPGs. It is therefore likely that the pediatric CPGs published in these journals are among those most cited, and will be the primary choices of readers and users when selecting recommendations to guide their clinical practice. The full search strategy is shown in Appendix 1.

Guideline documents meeting all of following criteria were included: (I) the document accorded with the definition of guidelines issued by the Institute of Medicine (IOM); (II) the language of publication was English; (III) the focus was only on children or adolescents aged <18 years (the target group is only children); and (IV) the focus was on topics related to clinical practice. The following types of documents were excluded: (I) documents interpreting existing guidelines; (II) consensus statements; and (III) documents that could not be obtained after contacting the journal and the developer institution.

Data extraction

Prior to data extraction, two investigators (Lei Wu, Yang Wang) reviewed the RIGHT statement and AGREE-II instrument manuals to become familiar with the checklist items. Data extraction forms were designed for both tools. Two investigators (Lei Wu, Yang Wang) extracted data for all items of both tools independently while masked to each other's decisions. Basic information such as publication year, country, organization and clinical discipline were also extracted. Any discrepancies in data extraction were resolved through discussion.

The quality assessment tools

Methodological quality

AGREE II instrument was used to evaluate the methodological quality of the included pediatric CPGs. The AGREE II instrument is a 23-item tool that addresses six guideline quality-related domains, and it is available on the website for the AGREE II Research Trust (http://www.agreetrust.org) (20). The two investigators had to respond to 23 questions for each guideline using a scale of 1, 'strongly disagree', to 7, 'strongly agree', based on examples and instructions described in the AGREE II manual. The reviewers were not allowed to communicate with each other during the evaluation process. In accordance with the AGREE II manual, we summed up the scores of items within each domain, and calculated a scaled domain score for each domain for each CPG as follows: (Obtained Score – Minimum Score)/(Maximum Score – Minimum Score). And the average score of six domain scores was calculated as the overall mean score.

Reporting quality

The RIGHT checklist is divided into seven domains, which include 22 items divided further into 35 sub items (18). The two investigators independently assessed the compliance of the guidelines to the RIGHT checklist after assessing the content reported in the guideline. For each sub item, we assigned a dichotomous score of Yes (compliant) or No (not compliant).

Data analysis

We performed an intra-class correlation coefficient (ICC) consistency analysis to calculate the Kappa value for the two evaluations. Kappa value >0.7 indicates good consistency, and <0.4 indicates poor consistency. We conducted subgroup analysis of AGREE-II and RIGHT evaluation results by journal and time period using the rank sum test. We divided the publication years into three categories according too the release years of the AGREE and AGREE II instruments: 1991–2003, 2004–2009 and 2010–2019. Finally, Spearman rank correlation analysis was used to evaluate the correlation between AGREE II and RIGHT evaluation results. SPSS 22.0 software was used to analyze the data.

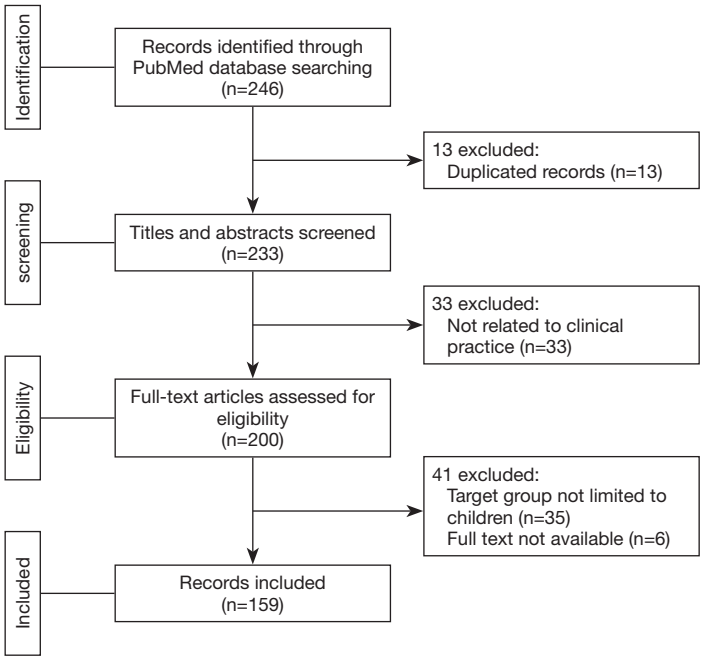


Figure 1 Flow chart detailing the selection process.

Results

Literature Search

A total of 246 records were initially identified. Thirteen documents were excluded as duplicates, and after screening titles and abstracts, 33 guideline documents were excluded because their topics were not relevant to clinical practice. After screening the full texts of the remaining 200 records, 41 documents were excluded because their target population were not restricted to children and/or the full text was not available. Finally, 159 guideline documents were included (*Figure 1*).

Basic characteristics

A summary of the characteristics of the included CPGs is presented in *Table 1*. Three types of guideline articles were included, 85 documents were identified as guidelines, 59 documents were identified as recommendations, and 15 documents were identified as statements. Most guidelines were published in the journal Pediatrics (n=119, 74.8%). The included guidelines were developed by 42 different organizations, including AAP, USPSTF, AHA, NICE, International Liaison Committee on Resuscitation, Committee on Practice and Ambulatory Medicine, Cystic Fibrosis Foundation, GLAD-PC Steering Group, American Society of Dentistry for Children, EAACI including government departments, academic groups, foundations, the World Health Organization (WHO) and universities. The CPGs covered 25 clinical disciplines according to the ICD-11 classification, including mental, behavioral or neurodevelopmental disorders, diseases of the respiratory system, diseases of the circulatory system, certain infectious or parasitic diseases, and factors affecting health status or contact with health services.

Evaluation of the methodological quality (AGREE II)

The ICCs between the two reviewers were high (>0.8) in all six domains of AGREE II instrument, which indicates good overall agreement between the reviewers (*Table 2*).

In the evaluation of methodological quality of pediatric CPGs with the AGREE-II instrument, the overall mean score ± standard deviation (SD) of the six domains was 37.8%±12.4%. The lowest score among the guidelines was 16.0%, and the highest score was 86.5%. Only eight (5.0%) guidelines scored above 60%. The mean ± SD domain scores were the following: domain 1 (Scope and purpose) 74.5%±14.2%, domain 2 (Stakeholder involvement) 42.7%±16.2%, domain 3 (Rigour of development)

Table 1 Basic information of the included pediatric CPGs

Characteristic		Number of articles	Percentage (%)
Type of article/study	Guideline	85	53.5
	Recommendation	59	37.1
	Statement	15	9.4
Year of publication or posting	1991–2003 (AGREE)	52	32.7
	2004–2009 (AGREE II)	43	27.0
	2010–2019	64	40.3
Journal	*Pediatrics*	119	74.8
	The Journal of the American Medical Associatoon	9	5.7
	The BMJ	8	5.0
	The Journal of Pediatrics	8	5.0
	Developmental Medicine & Child Neurology	3	1.9
	European child & adolescent psychiatry	2	1.3
	Journal of the American Academy of Child and Adolescent Psychiatry	2	1.3
	Pediatr Allergy Immunol	2	1.3
	Pediatric Dentistry	2	1.3
	The Journal of adolescent health	2	1.3
	JAMA Pediatrics	1	0.6
	Pediatric Diabetes	1	0.6
Country or international organization	North America: United States [140]; Canada [2]	142	89.3
	Europe: United Kingdom [8]; Germany [3]; Finland [1]; Italy [1]; Sweden [1]; Denmark [1]; Switzerland [1]]	16	10.0
	WHO	1	0.6
Developer organization	AAP	74	46.5
	USPSTF	17	10.7
	AHA	12	7.5
	NICE	5	3.1
	International Liaison Committee on Resuscitation	4	2.5
	Committee on Practice and Ambulatory Medicine	3	1.9
	Cystic Fibrosis Foundation	3	1.9
	GLAD-PC Steering Group	2	1.3
	American Society of Dentistry for Children	2	1.3
	EAACI	2	1.3
	Others	35	22.0
Total		159	100.0

AAP, American Academy of Pediatrics; USPSTF, U.S.Preventive Services Task Force; AHA, American Heart Association; NICE, National Institute for Health and Clinical Excellence; EAACI, The European Academy of Allergy and Clinical Immunology.

Table 2 AGREE II domain scores of the included guidelines

Domain	Score (%), Mean ± SD	Quartiles of the scores (%)				ICC (95% CI)
		<25	≥25 and ≤50	>50 and ≤75	>75	
Scope and purpose	74.5±14.2	1 (0.6)	14 (8.8)	32 (20.1)	112 (70.4)	0.825 (0.759–0.873)
Stakeholder involvement	42.7±16.2	26 (16.4)	103 (64.8)	24 (15.1)	6 (3.8)	0.894 (0.854–0.923)
Rigour of development	18.7±14.2	121 (76.1)	33 (20.8)	5 (3.1)	0 (0)	0.904 (0.868–0.931)
Clarity of presentation	56.5±17.0	1 (0.6)	85 (53.5)	42 (26.4)	31 (19.5)	0.889 (0.846–0.919)
Applicability	8.9±12.7	137 (86.2)	19 (12.0)	2 (1.3)	1 (0.6)	0.947 (0.926–0.961)
Editorial independence	25.2±34.6	95 (59.8)	34 (21.4)	3 (1.9)	27 (17.0)	0.978 (0.969–0.984)

CI, confidence interval; ICC, intraclass correlation coefficient; SD, standard deviation.

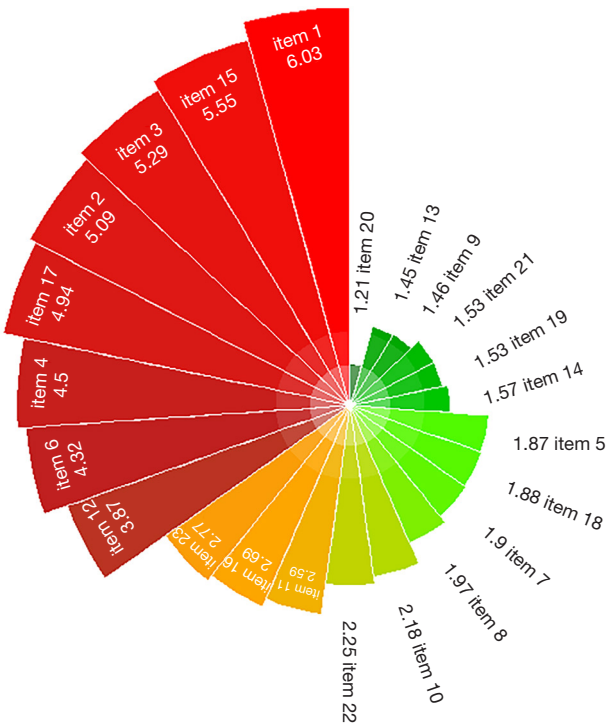


Figure 2 Mean AGREE- II scores of each item in the included pediatric clinical practice guidelines. A description of each item is available at http://right-statement.org/

18.7%±14.2%, domain 4 (Clarity of presentation) 56.5%±17.0%, domain 5 (Applicability) 8.9%±12.7%, domain 6 (Editorial independence) 25.2%±34.6%. And domain 1 was the only domain with a score above 60% (*Table 2*). *Figure 2* shows the scores of the 23 AGREE items in a rose chart. The mean score of item 1 (The overall purpose of the guideline is clearly stated) was the highest (6.03), and the score of item 20 (The potential resource inputs are considered when applying recommendations) was the lowest (1.21). Ten items [5, 7, 8, 9, 13, 14, 18, 19, 20, 21] had a score below 2. The mean AGREE scores tended to increase over time (*Figure 3*).

Table 3 and *Figure 4* show the standardized scores of each AGREE II domain of guidelines published in different time periods and different journals. Except for the domain 1 (scope and purpose), the mean AGREE II domain scores in the other five domains significantly increased from the period 1991–2003 to 2010–2019. The improvement was particularly pronounced in the domain 3 (Rigour of development), domain 5 (Applicability), and domain 6 (Editorial independence). In the Pediatrics journal, the mean overall AGREE II score was 36.8%±10.3%, and the overall scores varied broadly across the guidelines published in Pediatrics (16.0–68.9%). Of the four journals with highest number of guidelines (Pediatrics, JAMA, BMJ and The Journal of Pediatrics), BMJ and JAMA are high-ranking general medicine journals. In BMJ and JAMA, the overall mean AGREE II scores were 42.4%±17.3% and 41.5%±16.4% respectively, and in The Journal of Pediatrics, 33.6%±9.3%.

Evaluation of the reporting quality (RIGHT Statement)

The mean overall reporting rate was 46.4%±16.6%, ranging between 13.9% to 91.7% across the guidelines. Thirty-one (19.5%) guidelines had an overall reporting rate above 60%. The mean domain reporting rates were the following: domain 1 (Basic information) 73.6%±14.9%, domain 2 (Background) 67.1%±16.4%, domain 3 (Evidence) 32.7%±27.2%, domain 4 (Recommendations) 32.4%±22.5%, domain 5 (Review and quality assurance)

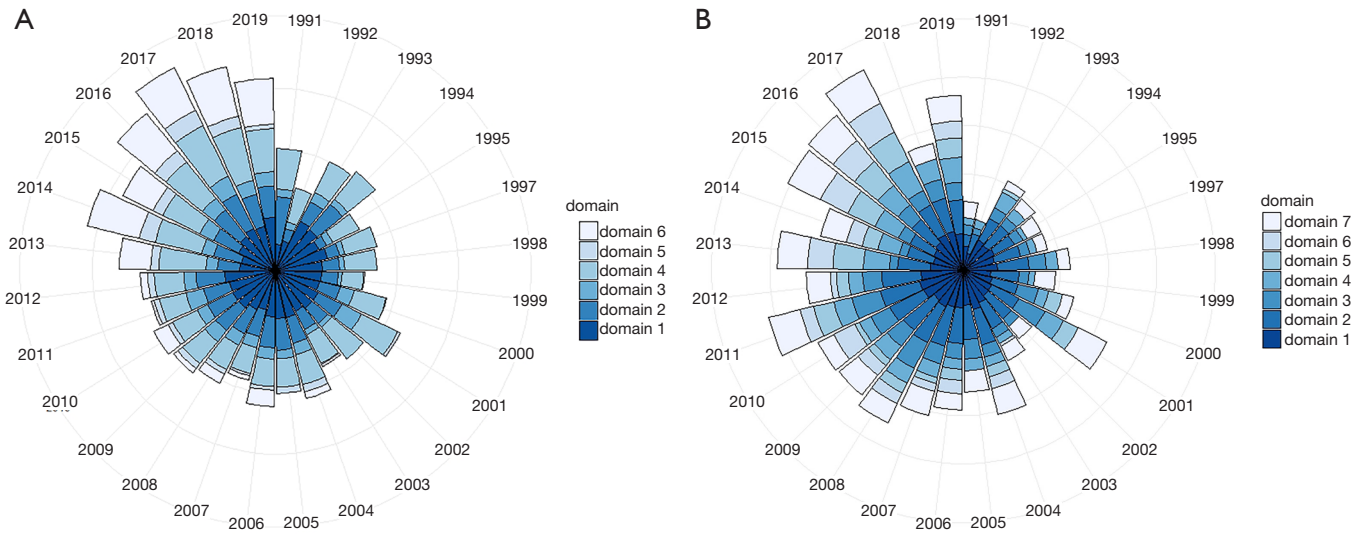


Figure 3 AGREE- II scores and RIGHT reporting compliance by domain and year of publication in the included clinical practice guidelines. (A) AGREE- II scores by domain and year of publication in the included clinical practice guidelines. Domain 1, Scope and purpose; domain 2, Stakeholder involvement; domain 3, Rigour of development; domain 4, Clarity of presentation; domain 5, Applicability; domain 6, Editorial independence. (B) RIGHT reporting compliance by domain and year of publication in the included clinical practice guidelines. Domain 1, Basic information; domain 2, Background; domain 3, Evidence; domain 4, Recommendations; domain 5, Review and quality assurance; domain 6, Funding and declaration and management of interests; domain 7, Other information.

22.9%±40.4%, domain 6 (Funding and declaration and management of interests) 24.1%±36.3%, domain 7 (Other information) 45.3%±30.1% (*Table 4*). The compliance to item 7a (The main target population for the implementation of the guideline is described) was the highest (99.4%), and the compliance to item 14c (Whether the factors such as fairness, feasibility and acceptability are also considered in the formation of recommendation) was the lowest (11.3%) among the 36 RIGHT checklist items. Eighteen items [1b, 9a, 10b, 11a, 11b, 12, 13b, 13c, 14a, 14b, 14c, 15, 16, 17, 18a, 18b, 21, 22] had a reporting rate below 30%.

Table 5 and *Figure 5* show the reporting rates of each RIGHT domain of guidelines published in different time periods and different journals. The RIGHT reporting rates in the seven domains increased significantly from the period 1991–2003 to 2010–2019. The improvement was particularly notable in the domains (Recommendations), (Review and quality assurance), (Funding and declaration and management of interests) and (Other information). In the Pediatrics journal, the overall mean ± SD reporting rate was 44.8%±13.1%, and the reporting rates of guidelines published in Pediatrics were also widely distributed (16.7–83.3%). In *BMJ* and *JAMA*, the overall reporting rates were 59.0%±26.3% and 37.0%±19.4%, respectively, and in *The Journal of Pediatrics*, 48.3%±22.6%.

Correlation of AGREE II and RIGHT scores

There was a high positive correlation between AGREE II scores and RIGHT reporting rates (r=0.645, P<0.001). This correlation is also clear in the scatter plot (*Figure 6*). The results showed that there was a high correlation between AGREE II and RIGHT, and pediatric CPGs with good methodological quality also had good reporting quality.

Discussion

The quality of the pediatric CPGs included in our study was lower when compared with adult CPGs. Wayant *et al.* used AGREE-II to evaluate 48 adult CPGs for cancer treatment in the NCCN guidelines library (21). As all guidelines from the study of Wayant were published after 2009, we could compare these findings with the results from the last time period (2010–2019) of our study. The scores of pediatric CPGs in Rigour of development (23.4% *vs.* 62.4%, P<0.001), Clarity of presentation (67.6% *vs.* 84.4%, P<0.001), Applicability (16.3% *vs.* 57.5%, P<0.001), and Editorial independence (53.4% *vs.* 94.4%, P<0.001) were

Table 3 AGREE II domain scores across the different subgroups

Subgroups	Domains (mean ± standard deviation)					
	Scope and purpose (%)	Stakeholder involvement (%)	Rigour of development (%)	Clarity of presentation (%)	Applicability (%)	Editorial independence (%)
Time period						
1991–2003 (n=52)	76.8±13.6	31.7±14.2	12.3±10.3	52.0±11.1	0.8±2.6	0.6±4.6
2004–2009 (n=43)	73.9±10.8	47.6±10.6	19.6±13.6	45.5±5.5	7.9±10.3	12.8±18.8
2010–2019 (n=64)	73.1±16.5	48.4±16.5	23.4±15.4	67.6±19.6	16.3±14.8	53.4±36.6
P value	0.110	<0.001	<0.001	<0.001	<0.001	<0.001
Journals						
BMJ (n=8)	61.8±28.7	53.5±21.6	24.5±23.5	66.7±23.8	18.8±22.3	29.2±28.9
JAMA (n=9)	74.7±19.3	42.6±23.7	15.7±8.2	64.8±13.3	8.3±13.2	42.6±50.8
JAMAPED (n=1)	72.2±0.00	61.1±0.00	25.0±0.00	88.9±0.00	8.3±0.00	83.3±0.00
JAACAP (n=2)	88.9±15.7	66.7±0.0	31.3±26.5	58.3±19.6	16.7±11.8	0.0±0.0
PED (n=119)	75.4±10.4	41.6±14.2	17.3±12.0	54.7±16.3	7.8±10.0	24.1±33.9
PAI (n=2)	69.4±27.5	50.0±47.1	38.5±42.7	86.1±11.8	43.8±55.9	66.7±47.1
JAH (n=2)	50.0±7.9	19.4±3.9	10.4±3.0	63.9±3.9	4.2±5.9	8.3±11.8
ECAP (n=2)	77.8±0.0	33.3±15.7	13.5±13.3	44.4±0.0	4.2±5.9	0.0±0.0
JPEDS (n=8)	75.0±7.9	38.2±10.9	18.8±13.4	54.9±17.9	6.3±13.00	8.3±15.4
DMCN (n=3)	100.0±0.0	66.7±0.0	50.0±4.2	64.8±12.8	19.4±9.6	55.6±41.9
PEDDIA (n=1)	100.0±0.0	66.7±0.0	54.2±0.0	61.1±0.0	16.7±0.0	50.0±0.0
PEDDEN (n=2)	33.3±0.0	27.7±0.00	8.3±0.0	38.9±0.0	0.0±0.0	0.0±0.0
Total (n=159)	74.5±14.2	42.7±16.2	18.7±14.2	56.5±17.0	8.9±12.7	25.2±34.6

BMJ, *The British Medical Journal*; *JAMA*, *The Journal of the American Medical Association*; *JAMAPED*, *JAMA Pediatrics*; *JAACAP*, *Journal of the American Academy of Child and Adolescent Psychiatry*; *PED*, *Pediatrics*; *PAI*, *Pediatric Allergy and Immunology*; *JAH*, *The Journal of Adolescent Health*; *ECAP*, *European Child & Adolescent Psychiatry*; *JPEDS*, *The Journal of Pediatrics*; *DMCN*, *The Developmental Medicine & Child Neurology*; *PEDDIA*, *Pediatric Diabetes*; *PEDDEN*, *Pediatric Dentistry*.

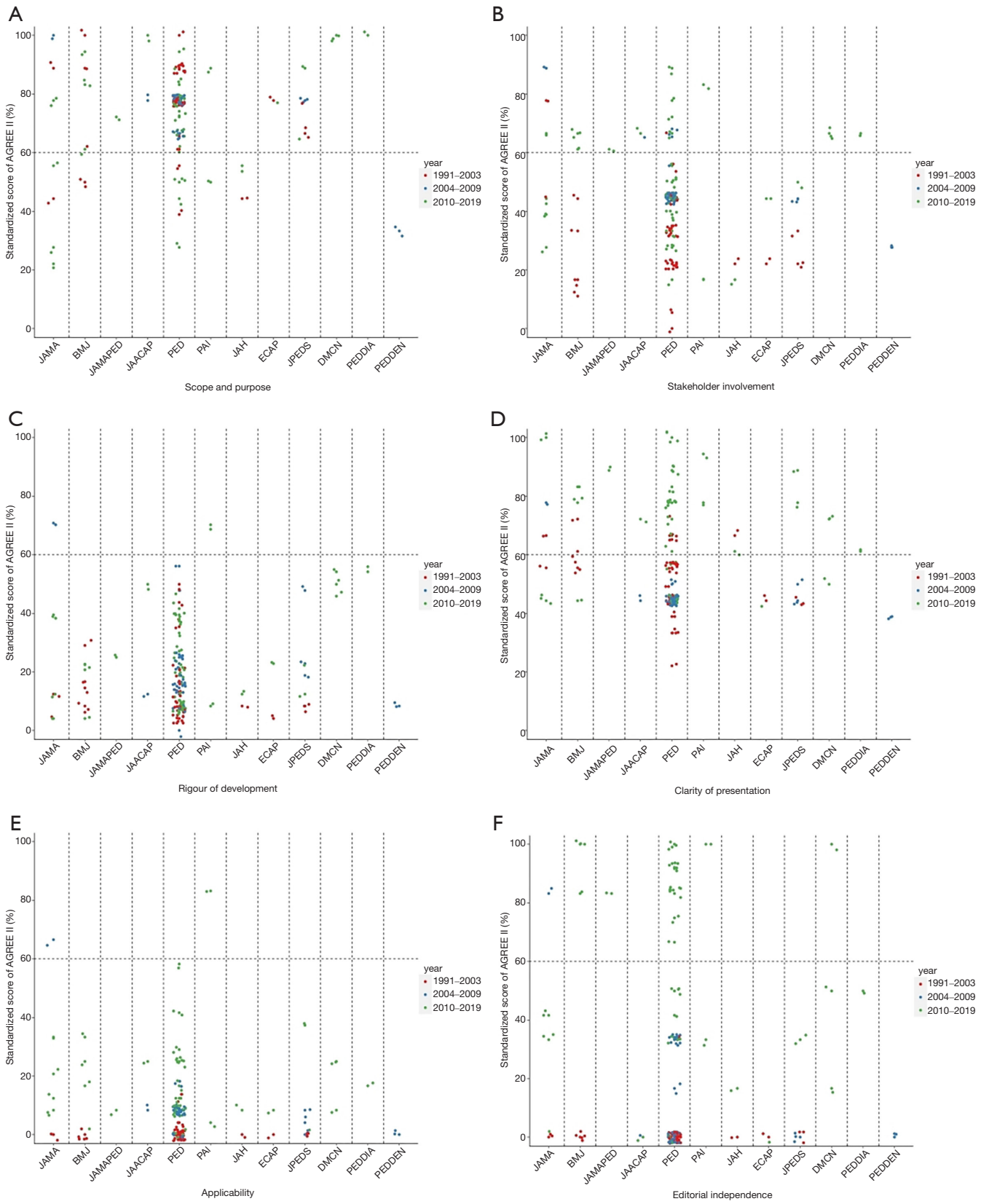
significantly lower than the scores of adult cancer CPGs.

The quality of the pediatric CPGs included in our study may be also lower than those indexed in professional guideline libraries such as RIGHT. Sun *et al.* assessed the methodological quality of 50 pediatric CPGs in NGC using the AGREE-II instrument (22). According to their findings, only one domain (domain 5, Applicability, 54.6%) had a mean AGREE II score below 60%. In another study of the NGC guidelines, the average scores of six AGREE II domains were 84%, 42%, 54%, 78%, 19%, 40% respectively (23), which were all higher than those observed in our study.

In recent years, although the number of CPGs has increased, the quality of CPGs is uneven, and some researches even showed that the quality of some CPGs is poor (9,13). Since recommendations of poor quality CPGs can cause harm to the patients, it is particularly important to identify and develop high-quality CPGs for clinicians and health care professionals to use. This study found that the methodological and reporting quality of pediatric CPGs published as journal articles tended to increase over time. But as a whole, the methodological and reporting quality was still poor, and further improvement is needed.

Recommendations for improving the quality of pediatric CPGs

The development process of guidelines needs to follow



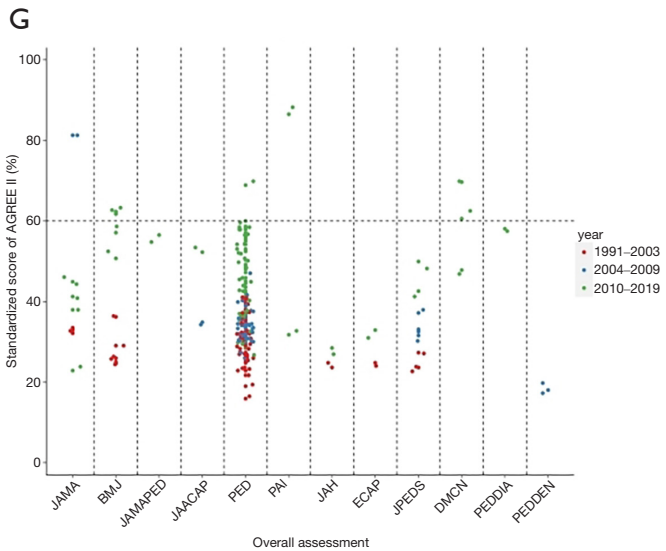


Figure 4 Mean AGREE-II scores in the included pediatric clinical practice guidelines by journal. In the scatter diagram, the red dots represent the scores of guidelines published between 1991 and 2003, the blue dots represent the scores of guidelines published between 2004 and 2009, and green dots represent the scores of guidelines published between 2010 and 2019. (A) Standardized AGREE-II scores of different journals in domain 1 (Scope and purpose), (B) Standardized AGREE-II scores of different journals in domain 2 (Stakeholder involvement), (C) Standardized AGREE-II scores of different journals in domain 3 (Rigour of development), (D) Standardized AGREE-II scores of different journals in domain 4 (Clarity of presentation), (E) Standardized AGREE-II scores of different journals in domain 5 (Applicability), (F) Standardized AGREE-II scores of different journals in domain 6 (Editorial independence), (G) Standardized AGREE-II scores of different journals in overall assessment. *BMJ*, *The British Medical Journal*; *JAMA*, *The Journal of the American Medical Association*; *JAMAPED*, *JAMA Pediatrics*; *JAACAP*, *Journal of the American Academy of Child and Adolescent Psychiatry*; *PED*, *Pediatrics*; *PAI*, *Pediatric Allergy and Immunology*; *JAH*, *The Journal of Adolescent Health*; *ECAP*, *European Child & Adolescent Psychiatry*; *JPEDS*, *The Journal of pediatrics*; *DMCN*, *The Developmental Medicine & Child Neurology*; *PEDDIA*, *Pediatric Diabetes*; *PEDDEN*, *Pediatric Dentistry*.

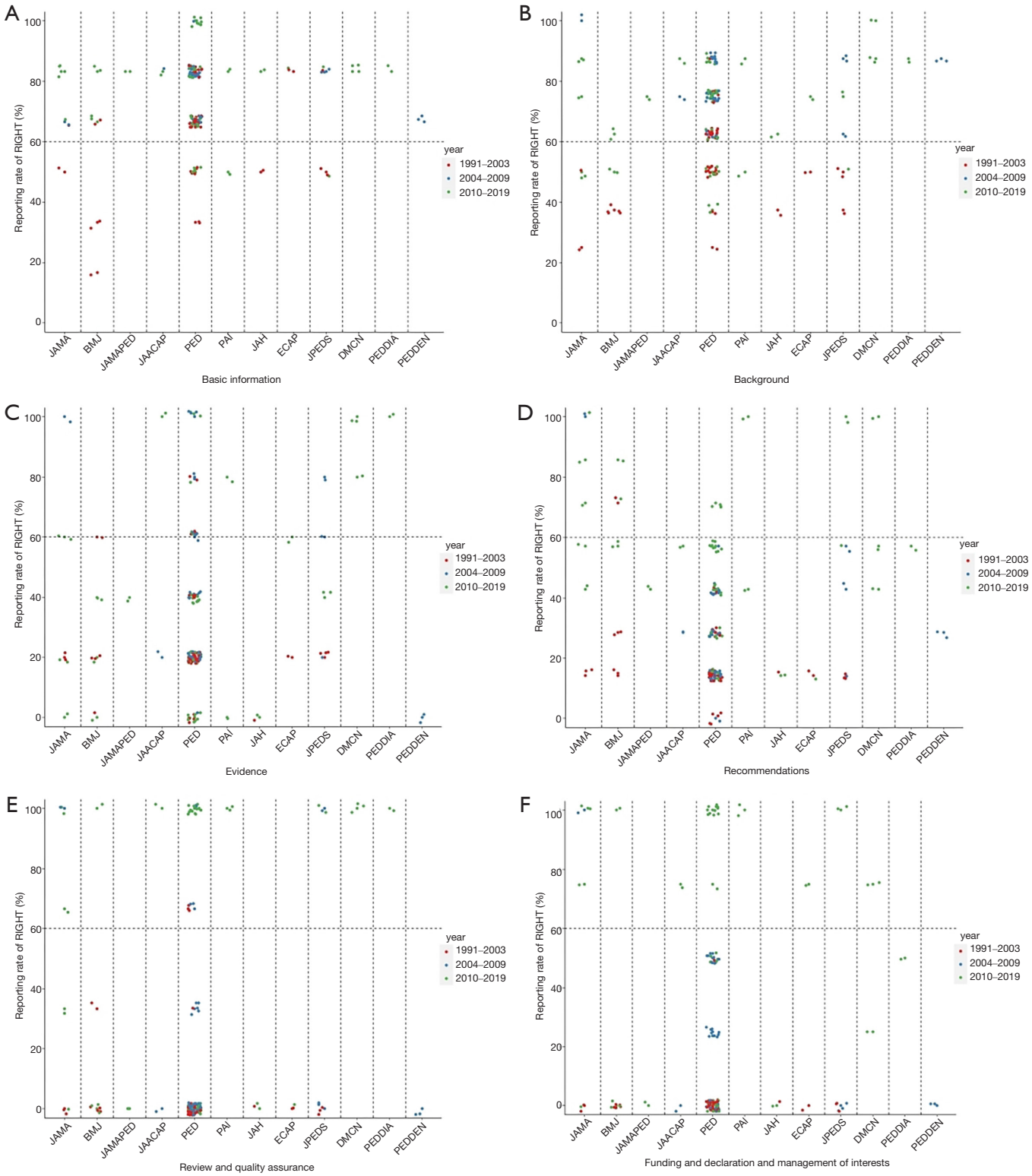
Table 4 Compliance to the RIGHT checklist in the included guidelines

Domains	Compliance (%), Mean ± SD	Quartiles of the compliance (%)			
		<25	≥25 and ≤50	>50 and ≤75	>75
Basic information	73.6±14.9	1 (0.6)	20 (12.6)	55 (34.6)	83 (52.2)
Background	67.1±16.4	0 (0.0)	45 (28.3)	79 (49.7)	35 (22.0)
Evidence	32.7±27.2	99 (62.3)	26 (16.4)	15 (9.4)	19 (12.0)
Recommendations	32.4±22.5	67 (42.1)	59 (37.1)	26 (16.4)	7 (4.4)
Review and quality assurance	22.9±40.4	114 (71.7)	8 (5.0)	6 (3.8)	31 (19.5)
Funding and declaration and management of interests	24.1±36.3	101 (63.5)	31 (19.5)	6 (3.8)	21 (13.2)
Other information	45.3±30.1	18 (11.3)	94 (59.1)	19 (12.0)	28 (17.6)

Table 5 Compliance to the RIGHT checklist in the different subgroups

Subgroups	Domains (Mean ± standard deviation)						
	Basic information (%)	Background (%)	Evidence (%)	Recommendations (%)	Review and quality assurance (%)	Funding and declaration and management of interests (%)	Other information (%)
Time period							
1991–2003 (n=52)	63.8±15.4	54.8±13.8	24.6±18.0	18.7±12.5	5.1±16.7	1.0±6.9	26.9±21.9
2004–2009 (n=43)	77.9±8.7	79.1±9.3	39.1±28.6	28.6±17.4	13.2±31.8	22.1±24.5	46.5±24.3
2010–2019 (n=64)	78.7±14.1	69.0±15.4	35.0±31.1	46.2±24.3	43.8±49.3	44.1±44.9	59.4±31.7
P value	<0.001	<0.001	0.038	<0.001	<0.001	<0.001	<0.001
Journals							
BMJ (n=8)	72.9±12.4	65.6±25.7	37.5±32.8	60.7±34.8	50.0±47.1	59.4±49.9	58.3±34.5
JAMA (n=9)	57.4±23.7	45.8±10.8	24.4±19.4	47.6±26.7	14.8±33.8	11.1±33.3	25.9±32.4
JAMAPED (n=1)	83.3±0.0	75.0±0.0	40.0±0.0	42.9±0.0	0.0±0.0	0.0±0.0	33.3±0.0
JAACAP (n=2)	83.3±0.0	81.3±8.8	60.0±56.6	42.9±20.2	50.0±70.7	37.5±53.0	50.0±23.6
PED (n=119)	74.7±13.9	68.0±14.4	30.9±24.8	27.6±17.2	18.8±36.5	20.8±32.9	44.8±27.6
PAI (n=2)	66.7±23.6	68.8±26.5	40.0±56.6	71.4±40.4	100.0±0.0	100.0±0.0	100.0±0.0
JAH (n=2)	66.7±23.6	50.0±17.7	0.0±0.0	14.3±0.0	0.0±0.0	0.0±0.0	16.7±23.6
ECAP (n=2)	83.3±0.0	62.5±17.7	40.0±28.3	14.3±0.0	0.0±0.0	37.5±53.0	50.0±70.7
JPEDS (n=8)	70.8±17.3	62.5±18.9	37.5±22.5	39.3±31.3	37.5±51.8	25.0±46.3	45.83±46.9
DMCN (n=3)	83.3±0.0	91.7±7.2	93.3±11.6	66.7±29.7	100.0±0.0	58.3±28.9	66.7±0.0
PEDDIA (n=1)	83.3±0.0	87.5±0.0	100.0±0.0	57.1±0.0	100.0±0.0	50.0±0.0	66.7±0.0
PEDDEN (n=2)	66.7±0.0	87.5±0.0	0.0±0.0	28.6±0.0	0.0±0.0	0.0±0.0	33.3±0.0
Total (n=159)	73.6±14.9	67.1±16.4	32.7±27.2	32.4±22.5	22.9±40.4	24.1±36.3	45.3±30.1

BMJ, *The British Medical Journal*; *JAMA*, *The Journal of the American Medical Association*; *JAMAPED*, *JAMA Pediatrics*; *JAACAP*, *Journal of the American Academy of Child and Adolescent Psychiatry*; *PED*, *Pediatrics*; *PAI*, *Pediatric Allergy and Immunology*; *JAH*, *The Journal of Adolescent Health*; *ECAP*, *European Child & Adolescent Psychiatry*; *JPEDS*, *The Journal of Pediatrics*; *DMCN*, *The Developmental Medicine & Child Neurology*; *PEDDIA*, *Pediatric Diabetes*; *PEDDEN*, *Pediatric Dentistry*.



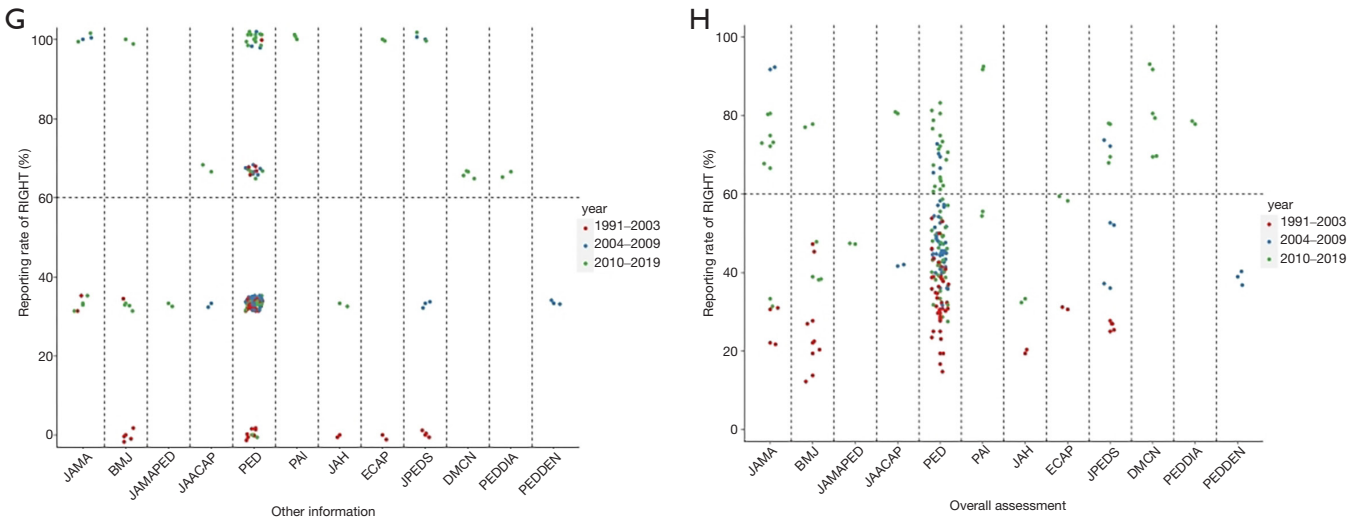


Figure 5 Compliance to the RIGHT checklist in the included pediatric clinical practice guidelines by journal. In the scatter diagram, the red dots represent the compliance of guidelines published between 1991 and 2003, the blue dots represent the compliance of guidelines published between 2004 and 2009, and green dots represent the compliance of guidelines published between 2010 and 2019. (A) RIGHT reporting rates of different journals in domain 1 (Basic information), (B) RIGHT reporting rates of different journals in domain 2 (Background), (C) RIGHT reporting rates of different journals in domain 3 (Evidence), (D) RIGHT reporting rates of different journals in domain 4 (Recommendations), (E) RIGHT reporting rates of different journals in domain 5 (Review and quality assurance), (F) RIGHT reporting rates of different journals in domain 6 (Funding and declaration and management of interests), (G) RIGHT reporting rates of different journals in domain 7 (Other information). (H) RIGHT reporting rates of different journals in overall assessment. *BMJ*, *The British Medical Journal*; *JAMA*, *The Journal of the American Medical Association*; *JAMAPED*, *JAMA Pediatrics*; *JAACAP*, *Journal of the American Academy of Child and Adolescent Psychiatry*; *PED*, *Pediatrics*; *PAI*, *Pediatric Allergy and Immunology*; *JAH*, *The Journal of Adolescent Health*; *ECAP*, *European child & Adolescent Psychiatry*; *JPEDS*, *The Journal of Pediatrics*; *DMCN*, *The Developmental Medicine & Child Neurology*; *PEDDIA*, *Pediatric Diabetes*; *PEDDEN*, *Pediatric Dentistry*.

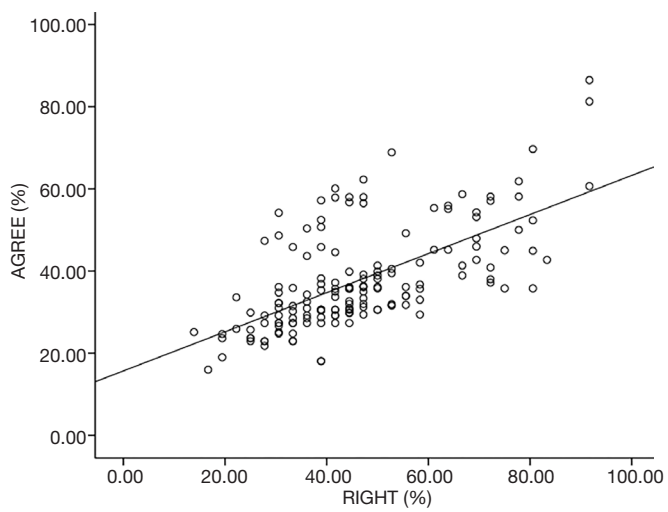


Figure 6 Scatter plot of AGREE-II overall scores versus overall compliance to the RIGHT checklist. The dots represent the overall scores of AGREE-II and the overall compliance to RIGHT for each guideline.

a rigorous systematic methodology. In order to ensure the quality of the guidelines, strict standards need to be developed. WHO, the Scottish Inter-Collegiate Guideline Network (SIGN), NHMRC, and the Council of Europe and NICE have all published standards for guideline development. The key steps are basically the same, which can be divided into subject selection, evidence synthesis, formation of recommendations, peer review, publication, implementation, and update (24-27). With the progress of guideline methodology, the quality of pediatric CPGs has been improved in various domains, especially those we found to have the lowest scores: rigor of development, conflict of interest management, applicability, and editorial independence. There is however still room for improvement:

Methodological design

At the beginning of the development of pediatric CPGs,

guideline makers should determine reasonable outcome selection method, such as systematic review, survey or voting. For example, a guideline developed by Halken *et al.* identified outcome indicators through systematic review and meta-analysis, which were divided into two categories: primary outcome indicators and secondary outcome indicators (28). At the same time, it is necessary to determine the external evaluation scheme of the guideline, including the list of evaluation experts and the treatment method of evaluation opinions. Guideline makers can also refer to the guideline of Halken *et al.* (28). The guideline was sent to experts in relevant topics for review after the draft was completed. At the same time, the draft guideline was made publicly available on the Internet for the public to give their feedback. Finally, the collected opinions were assessed and contributed to the revision of the guideline.

Sources and evaluation of evidence

The inclusion and exclusion criteria of evidence should be clearly defined and strictly implemented. At the same time, formal tools or methods (such as Jadad scale, GRADE method) should be used to evaluate the strength and limitations of evidence. In addition to ensuring that these practices are strictly implemented in the formulation of guidelines, attention should be paid to the completeness of expression in the formulation of guideline document. For example, for the description of the systematic review, the whole process of reference retrieval should be described in detail, including time period, database, keywords, etc.

The formation method and strength of recommendations

The method of forming recommendations should be determined, such as how to reach a consensus among the members of the guideline development group. In addition to the strict implementation of this method, the guideline document should give a detailed description of the formation process of the recommendations. The guideline document should also describe the strength of recommendations and the quality of evidence. For example, the guideline developed by Halken *et al.* defined the grade of evidence, recommendation and the strength of recommendation, and described them clearly for each recommendation (28).

Disclosure and management of conflicts of interest

The disclosure of conflicts of interest has an important impact on the publication quality of the guidelines and the promotion and implementation of the guidelines. Therefore, the guideline documents should pay attention to the disclosure and management of conflicts of interest, and collect detailed information of conflicts of interest as far as possible. As an example, the guidelines formulated by AHA and American Academy of Pediatrics require each team member to submit a statement of conflict of interest disclosure, which can be used as a reference for guideline developers. The conflict of interest disclosure questionnaire in AHA's guidelines includes a declaration of employment, research grants, other research support, and speaker' bureaus of the reviewer (29).

Promotion and application of the guidelines

At the beginning of the guideline development process, the promotion and application plan of the guideline should be formulated, including the target users, the advantages and disadvantages of the recommendation, and the costs and resources to be invested in the promotion of guideline. For example, a guideline of the American Academy of Pediatrics contains a large number of content items to guide the application of the guideline, including all aspects to be considered in the application of the guideline, different measures to be taken in the application of the guideline in children of different races and genders, and the cost-effectiveness of the application of the guideline is analyzed in detail (30). The guideline by Halken *et al.* provides a detailed summary of the promoting factors, barrier factors, audit criteria and resource need in the application of the recommendations in a table (28).

Construction of a professional pediatric guideline library

After the formulation of the guidelines, external measures must be relied on to promote the clinical use of guidelines. A series of problems such as that the clinical guidelines did not attracted enough attention from medical societies, the quality of some guidelines is low, or that doctors rarely use guidelines, have brought great challenges to the promotion and implementation of clinical guidelines. At present, there are few public platforms that provide a large number of high-quality CPGs for free.

However, most pediatric clinical staff and researchers generally use the common literature database such as MEDLINE to search and view the pediatric guidelines. But the quality of pediatric guidelines indexed in such database that cover a large part of the worldwide medical literature is uneven, and the quality seems also to be lower than

professional guideline library such as NGC.

Our study also found that even the highest-ranking general medicine journals may also publish low-quality guidelines. Therefore, the readers should not select guidelines solely by the impact factor of journal. The highly variable quality affects greatly the application of pediatric guidelines by pediatric clinical staff and researchers, and limit the role of pediatric guidelines in pediatric clinical practice.

Therefore, it is necessary to form a multi-disciplinary joint expert group to evaluate and screen the published pediatric guidelines, establish a professional pediatric guideline library based on evidence-based methods, and make it available to pediatric clinical staff and researchers with the aim of effectively improving the overall quality of pediatric guidelines. Such professional database would help pediatric health care providers to select the highest-quality pediatric guidelines to better guide pediatric clinical practice. The National Clinical Medical Research Center of Children's Hospital of Chongqing Medical University is at present making effort to build a database of high-quality pediatric evidence-based guideline.

Limitations

This study has some limitations. We only searched Medline, even though several other databases such as the Web of Science, EMBASE, and Cochrane Library could also include relevant articles. In particular, we only included 12 journals with high impact factors. Therefore, the CPGs included in this research are not necessarily fully representative of the pediatric CPGs published worldwide, which may lead to some bias in the results.

Conclusions

There are exist a large number of pediatric guidelines that are accessible through the PubMed search tool. The methodological and reporting quality of these pediatric guidelines seems to have improved over time together with the launch and development of assessment tools, but their overall quality is still poor. Compared with clinical guidelines for adults and pediatric CPGs indexed in professional guideline libraries, the quality of pediatric CPGs published in common databases is clearly lower. Therefore there is an urgent need to establish a guideline library specifically focusing on pediatric guidelines, which can help to select and promote high-quality rigorously developed CPGs. We also found a high correlation between the methodological quality and the reporting quality in the pediatric CPGs. When developing pediatric guidelines, guideline makers should make full use of both ARGEE and RIGHT tools.

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Footnote

Reporting Checklist: The authors have completed the PRISMA reporting checklist. Available at https://dx.doi.org/10.21037/atm-21-2686

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://dx.doi.org/10.21037/atm-21-2686). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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