



# Development of a core set of quality indicators for paediatric primary care practices in Europe, COSI-PPC-EU

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## Abstract

Paediatric ambulatory healthcare systems in Europe are, because of historical reasons, diverse and show strikingly different outcomes. All across Europe, the benchmarking of structures, processes and outcomes could reveal opportunities for improving Paediatric Primary Care (PPC). The aim of this study was to develop a set of Quality Indicators (QIs) to assess and monitor PPC in Europe. In a three-step process, we used the available external evidence and European expert consensus in a modified RAND/UCLA Appropriateness Method (RAM) to develop an indicator set. (1) A broad literature and online research of published QI and guidelines yielded an inventory of 1516 QI. (2) A collaborative panel of paediatric senior experts from the European Academy of Paediatrics (EAP) and the European Confederation of Primary Care Paediatricians (ECPCP) from 15 European countries participated in a first consensus process to reduce the initial indicator inventory by eliminating not PPC-focused indicators and duplicates. (3) In a second consensus process, the panel rated the QI regarding validity and feasibility. The final QI set “COSI-PPC-EU” consists of 42 indicators in five categories of PPC: (A) health promotion/prevention/screening (13 QI), (B) acute care (9 QI), (C) chronic care (8 QI), (D) practice management (3 QI) and (E) patient safety (9 QI).

**Conclusion:** COSI-PPC-EU represents a consented set of a limited number of valid quality indicators for the application in paediatric primary care in different healthcare systems throughout Europe.

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**What is Known:**

- Paediatric ambulatory healthcare systems in Europe are diverse and show strikingly different outcomes.
- There are known gaps in quality performance measures of paediatric primary care in Europe. Pre-existing sets of quality indicators are predominantly limited to national populations, specific diseases and hospital care.

**What is New:**

- A set of 42 quality indicators for primary paediatric care in Europe was developed in a multi-country collaborative effort. The method combined a systematic literature review and a consensus process among European paediatric experts.
- The quality indicator set can facilitate quality improvement of PPC. After studying the feasibility, providers can use COSI-PPC-EU to monitor, compare and improve performance of practices, regions and countries.

**Keywords** Quality indicator · Quality improvement · Quality management · Paediatric primary care · Community child care · Europe · Benchmarking · EAP · ECPCP · RAND/UCLA appropriateness method

**Abbreviations**

COSI	Core set of quality indicators
COSI-PPC-EU	Core set of quality indicators for Paediatric primary care practices in Europe
DGAAP	German Academic Society for General Paediatrics
EAP	European Academy of Paediatrics
ECPCP	European Confederation of Primary Care Paediatricians
EU	Europe
GP	General practitioner
GRADE	Grading of Recommendations Assessment, Development and Evaluation, UK
NHS	National Health Service, UK
NICE	National Institute for Health and Care Excellence, UK
OECD	Organisation for Economic Co-operation and Development
PPC	Paediatric Primary Care
QI	Quality indicator
RAM	RAND/UCLA appropriateness method
UEMS	Union of European Medical Specialists
UNICEF	United Nations International Children's Emergency Fund
WHO	World Health Organization

**Introduction**

Ambulatory paediatric healthcare systems in Europe suffer from serious quality care discrepancies. In primary paediatric care (PPC), adherence to established treatment guidelines is sometimes as low as 35% [27]. A literature review estimates medication errors to be the most common type of error in the paediatric population [48]. Low quality of care in primary paediatric care is also reflected in unnecessary hospital admissions [19] and preventable deaths [47]. Errors can cause serious harm in children [25].

European health systems do not provide consistent high-quality care to all people [39]. Paediatric care in European countries shows a striking variety of inequalities [7]. Wide

gaps in outcomes of paediatric care can only partly be explained by demographic and economic differences [47].

Another challenging aspect of the variety of the systems is that PPC in Europe is provided either by paediatricians or family doctors/general practitioners (GPs) with different paediatric training [23]. Moreover, in several countries, community child care is provided by GPs and nurses only [23]. The presence of paediatricians in the community as first-line providers declines in Europe [16, 23]. Additionally, the availability of paediatricians in PPC is exacerbated by the freedom of movement in the European Union [34]. Doctors have the right to work in any European country, leading to qualitative shifts in their country of origin, as well as in their new host country [3, 5]. In turn, patients in the EU have the right to receive at least the quality of medical care in each member state as in their home country [50, 51].

How the mentioned characteristics of the work force in a healthcare system attribute to outcomes has not yet been well studied but seems to be recognized as science and policy issues. Thus, the law text on the third EU health program reads: “The program should be used to promote action in... exchange of best practices between Member States, promotion of networks for the exchange of knowledge or learning together, ..., measures to eventually develop a benchmarking system to make informed decisions at Union level increase efficiency...” [52]. The EU thus created the political basis for the development of valid quality measurement tools.

The European Academy of Paediatrics (EAP) is committed to develop Europe-wide standards for paediatric training and services. EAP which is the paediatric section of UEMS (Union of European Medical Specialists) and the represented sub-specialties are engaged to develop and update all syllabuses related to paediatrics. In addition, EAP is responsible for the certification of training centers [9, 53]. To fill the gap between training and good performance in clinical work, the competency of any caretaker should be assessed to assure the skills of all caretakers who treat children.

Against this background, EAP initiated in 2011 the COSI-PPC-EU project to develop a set of quality indicators (QIs) that helps to describe and possibly standardize important PPC

activities and interventions in Europe. These QIs should be usable in all European countries and healthcare systems, regardless of whether the medical practitioner is a paediatrician or a general practitioner. The individual PPC units should become comparable regionally, nationally and internationally on the basis of QI and be open to benchmarking. This set of reasonable, valid and feasible paediatric QIs should include medical aspects of prevention, diagnosis and treatment as well as organizational aspects, patient safety and patient-centeredness.

## Method

The project followed a three-step process based on the RAND/ UCLA appropriateness method (RAM) [4, 18]. First, a comprehensive database of QI was compiled by using a systematic literature research. Second, an international European paediatric consensus panel recruited from the EAP delegates and members reduced and revised the initial QI inventory. Third, the panel rated the QI regarding validity and feasibility to merge the aimed set of QI.

### Initial literature search to establish a comprehensive QI inventory

The comprehensive literature search aimed to identify any previously developed QI, including quality standards and recommendations with incomplete QI specification. QI had to meet the inclusion and exclusion criteria shown in Table 1.

Two sources were used to establish the QI inventory: scientific literature and online databases. Medline, EMBASE and Cochrane were browsed with terms from the thesauruses and free search terms combined to numerous searches; see Table 2.

Additionally, an investigation was performed accessing the databases of the institutions shown in Table 3.

The initial QI set contained numerous specifications which are shown in Table 4. Only the marked specifications were part of the later version for the panel rating process.

### Expert consensus process to reduce and revise the initial QI inventory, define missing subjects and complement the QI set for the rating process

Between November 2011 and January 2013, a European paediatric panel of seven officially nominated country delegates from EAP met several times. Additional paediatric primary care practitioners were recruited among country delegates and members of EAP, the European Confederation of Primary Care Paediatricians (ECPCP) and the German Association for Ambulatory General Paediatrics (DGAAP).

Considering specific aspects of the different countries, panel members rated each QI with regard to validity and feasibility.

**Table 1** Sources for COSI-PPC-EU QI have to meet the following inclusion and exclusion criteria

- ☑ Evidence-based performance-QI with focus on primary care providers.
- ☑ Relevant for patients aged 0 to 17 years (excluding neonates).
- ☑ Excluded were QI focussing on obstetrics, inpatient hospital care, specific questionnaires (e.g. patient experiences), populations/geographical regions (public health measures) and on accreditation/certification.
- ☑ Original publication in English or German language.
- ☑ Published before January 2013.

These ratings facilitated further exclusions of QI. Topics not yet covered by the QI set were identified by the panel.

A second, supplementary search for the missing QI identified by the panel was conducted. Based on recommendations by established national guidelines and institutions (see Table 3), QIs were extracted. In a series of meetings, the number of QI was further reduced by eliminating duplicates, consented and prepared for the formal rating process.

### Formal rating process following the RAM

During a two-step process (first: online rating; second: rating in a moderated session during a personal meeting), the expert panel rated each QI by validity and feasibility on a nine-point Likert scale (1 = low validity/feasibility; 9 = high validity/feasibility). The underlying definitions of validity and feasibility have been formulated by McGlynn [33] as shown in Table 5.

Ninety-eight European country delegates from EAP and ECPCP were invited to participate. Twenty-two of these paediatric experts took part in the first rating and 14 took part in the second rating. Countries represented in the expert panel were Cyprus, Czech Republic, France, Germany, Israel, Italy,

**Table 2** Search terms to find PPC-QI in scientific literature and online databases

Search terms operationalizing “QI”:

quality of care, healthcare quality, quality management, quality improvement, performance, assessment, practice assessment, audit, evaluation, performance indicator, quality indicator, measures, standards, organizational, structure, outcome, results and effective

Search terms specifying “PPC”:

paediatrics, pediatrics, paediatrician, pediatrician, family doctor, general practitioner, primary care, ambulatory, nurse, infant, child, adolescent, health care, child health services, child health, prevention, emergency, infectious disease, vaccination, well baby, well child, developmental screening, milestones, new-born metabolic screening, new-born screening, prescription, diagnostic, chronic disease, asthma, diabetes, epilepsy, poverty, advance directive adherence, clinical competence, guideline adherence, peer review, patient satisfaction, safety, teamwork, cooperation, referral, integration of services, safety, errors prevention, security, child friendly and adolescent friendly

**Table 3** Institutions and online databases which were searched through for PPC-QI. Successful sources for PPC-QI are marked

• Agency for Healthcare Research and Quality (AHRQ) [USA]	
a. National Quality Measures Clearinghouse (NQMC)	☑
b. National Advisory Council on Healthcare Research and Quality Subcommittee (SNAC)-recommended Initial Core Set on Children's Healthcare Quality Measures for Medicaid and Children's Health Insurance Program (CHIP)	☑
c. The Ambulatory Care Quality Alliance (AQA)	☑
• RAND Corporation [USA]	☑
• National Quality Forum [USA]	☑
• Centre for quality assessment and improvement in mental health (CQAIMH) [USA]	☑
• National Health Service (NHS) Quality and Outcomes Framework (QOF) [UK]	☑
• District Health Board New Zealand (DHBNZ) [New Zealand]	☑
• National Association of Statutory Health Insurance Physicians' Ambulatory Quality Indicators and Key Measures (AQUIK®) [Germany]	☑
• The National Association of Statutory Health Insurance Funds' Quality Indicator Thesaurus (QUINTH) [Germany]	☑
• Joint Commission on Accreditation of Healthcare Organizations (JCAHO) [USA]	
• Title V of the US Social Security Act (Maternal and Child Health Programs) [USA]	
• Young Adult Health Care Survey (YAHCS) in the framework of the Child and Adolescent Health Measurement Initiative (CAHMI) [USA]	
• Promoting Healthy Development Survey (PHDS) in the framework of the Child and Adolescent Health Measurement Initiative (CAHMI) [USA]	
• Australian Council on Healthcare Standards (ACHS) [Australia]	
• Victorian Government Health Information [Australia]	
• Danish Institute for Quality and Accreditation in Healthcare (IKAS) [Denmark]	

Lithuania, Luxembourg, The Netherlands, Slovenia, Spain, Sweden and the UK. The countries represented healthcare systems with all three types of PPC as listed by van Esso 2010 [16]: GP-based, paediatrician-based, mixed.

In the first rating, the panellists rated validity and feasibility on the nine-point Likert scale for each QI online by clicking a choice box.

The second and last rating took place at one of the EAP's regular meetings on December 15, 2013, in Brussels. The majority of the 14 delegates had participated in the first rating as well. In a moderated session, the participants accepted all QIs with a median of at least seven for validity and feasibility. Those QIs with a high level of disagreement among the panellists were excluded.

## Results

### Initial literature and online database search

The literature search revealed 163 relevant articles. Thirty-six articles contained paediatric QI. In these articles, 773 QIs were identified concerning PPC.

In the systematic online search, 17 relevant medical organizations and institutions were discovered; see Table 3. Together, they contained 10 paediatric QI sets with a total of 2190 QIs. Seven hundred forty-three were considered relevant.

In November 2011, the total of 1516 QI was aggregated into the initial inventory; see Fig. 1.

### Expert consensus process

The first expert round rated as not relevant or duplicates 1474 of the 1516 QIs of the first inventory. The experts also proposed ten additional QI or topics, which the inventory did not yet cover.

After a new literature and online database search, another 93 QIs supplemented the remaining 53 QIs. Six QIs were reduced by merging. The second consensus round had to decide on 139 QIs. These were reduced to 50 QIs; see Fig. 1.

### Formal rating process following RAM

The 50 resulting QIs from the consensus process were rated online by the 22-member expert panel in July 2013. As a result, there were

- Thirty-four QIs with consistent high ratings of validity and feasibility (median of at least 7 and no high level of disagreement among the panellists, i.e. less than 30% rated 1–3),
- No QI with consistent low ratings of validity and feasibility (median of at the most 3 and no high level of disagreement among the panellists, i.e. less than 30% rated 7–9),
- Sixteen QI with disagreements regarding the ratings, i.e. those with major deviations between the ratings and QIs with equivocal ratings (median 4–6)

The 16 QI with disagreements were discussed and re-rated in a moderated, personal meeting of 14 panellists

**Table 4** Specifications for each researched QI or standard/guideline; information about the author and sources: (1) refers only to literature references, (2) institution/QI database/QI program

Specification in quality indicator (QI) inventory	Description	Category is part of rating version
No.	Running number	X
QI category	Broad category (for overview purposes)	X
QI subject	Subject area covered by QI	X
QI focus	Specific topic covered by QI in keywords	X
QI rationale	Further explanatory statement (background, practical relevance, justification)	
QI numerator		X
QI denominator		X
QI evidence	Empirical evidence on quality criteria of QI	
Source	(1) Journal/ article (2) Institution/organization via internet	
Bibliographic source	(1) Full bibliographic citation (2) URL	
Bibliographic source with further detailed information	(2) “Yes” if URL offered detailed information on QI	
Author	(1) First author of journal/article (2) Name of institution/QI database/QI program	
Author 2	(1) If the article deals with QI from an institution/organization, “author 2” lists the respective institution/organization; (2) If “author” is an online meta-portal organization, “author 2” lists the name(s) of original QI developer(s)	
Sector	Sector according to author	
Type of QI	Structural QI - process QI - outcome QI	
Country	Country of QI developer	
Method	Method used for indicator development (e.g. Delphi, RAND/UCLA)	
QI currently in use	“Yes” if applicable	
QI currently used in	Name(s) of country(-ies), in which the QI is in use	

in December 2013. As a result of the second rating, there were

- Eight QIs with consistent high ratings of validity and feasibility

**Table 5** Definitions of validity and feasibility [33]

A quality indicator is defined as *valid* if:

1. Adequate scientific evidence or professional consensus exists supporting the indicator.
2. There are identifiable health benefits to patients who receive care specified by the indicator.
3. Based on the panellists’ professional experience, health professionals with significantly higher rates of adherence to an indicator would be considered higher quality providers
4. The majority of factors that determine adherence to an indicator are under the control of the health professional (or are subject to influence by the health professional, for example, smoking cessation).

Ratings of 1–3 mean that the indicator is not a valid criterion for evaluating quality.

Ratings of 4–6 mean that the indicator is an uncertain or equivocal criterion for evaluating quality.

Ratings of 7–9 mean that the indicator is clearly a valid criterion for evaluating quality.

A quality indicator is defined as *feasible* if:

1. The information necessary to determine adherence is likely to be found in a typical medical record.
2. Estimates of adherence to the indicator based on medical record data are likely to be reliable and unbiased.
3. Failure to document relevant information about the indicator is itself a marker for poor quality.

Ratings of 1–3 mean that it is not feasible to use the indicator for evaluating quality.

Ratings of 4–6 mean that there will be considerable variability in the feasibility of using the indicator to evaluate quality.

Ratings of 7–9 mean that it is clearly feasible to use the indicator for evaluating quality.

- No QI with consistent low ratings of validity and feasibility
- Eight QIs with disagreements (Table 6)

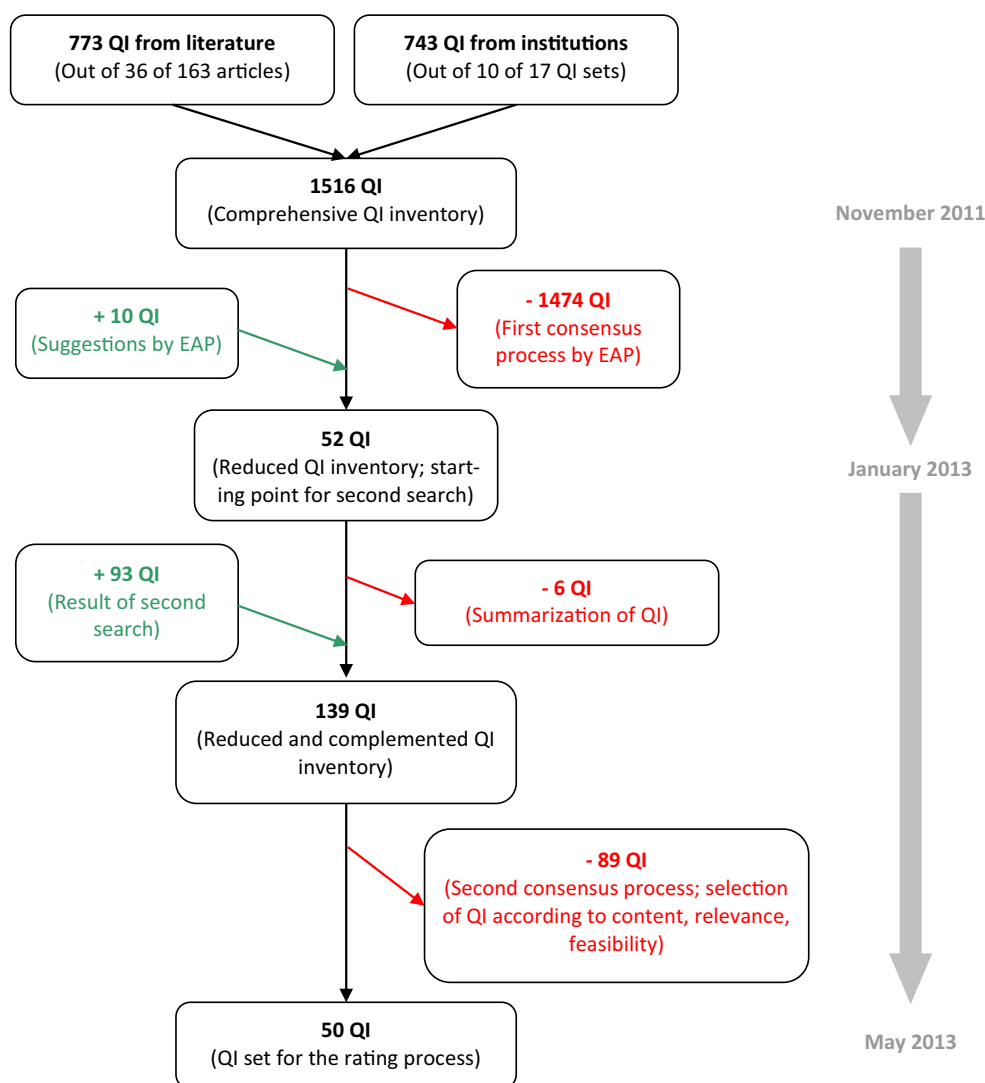
Of the eight QIs with disagreements, all QIs had disagreements in feasibility ratings whereas only one QI also had disagreements in validity ratings. All five QIs from the category patient-centeredness and child-friendly healthcare were excluded from the QI set due to disagreements in feasibility in the first and second rating; see Table 6.

The final 42 COSI-PPC-EU QI reflect PPC in five categories:

- A. Thirteen QIs represent *health promotion, prevention and screening*, considered as the most important aspect of PPC.
- B. Nine QIs describe a selection of the most common disease patterns in *acute care*.
- C. Eight QIs of *chronic diseases* include asthma, migraine and ADHD.
- D. Three QIs relate to *practice organization*.
- E. Nine QIs refer to *patient safety*.



**Fig. 1** Development steps to reduce the researched quality indicators from 1516 QI (in the comprehensive QI inventory) to 50 QI (QI set for the rating process) (2011–2013)



QI in categories A to C have a numerator and denominator for each item and no defined value statement. They fulfil the criteria required by a QI to be quantified [11, 32]. An indicator value can be calculated from these, which makes it possible to express changes and trends as a percentage at this stage. On the other hand, the items in categories D and E as well as one QI in category A are to be regarded as standard which may be not applicable. All 42 indicators of the final set, COSI-PPC-EU, are listed in Table 7 with their category, subject and focus, as well as numerator and denominator.

## Discussion

The aim of the study was to identify a core set of paediatric quality indicators for doctors treating children and adolescents in primary care. The set should be usable in all European countries and enable interested parties to benchmark PPC

practices. COSI-PPC-EU is such a set of QI consented by European PPC experts.

The set contains QI to evaluate medical care in the three quality dimensions as described by Donabedian [10]: structure, process and outcome, including QI for the quality of diagnosis and indication, which are the basis for qualified medical practice [21, 26]. COSI-PPC-EU covers a range of essential issues from five categories: prevention, acute care, chronic care, practice management and patient safety.

Other topics as patient-centeredness and child-friendly healthcare were also regarded as important for PPC; however, the available QIs were considered by the panel of experts to be not valid and feasible.

COSI-PPC-EU represents a new approach of QI for the PPC practice and practitioners. It bases on former developed paediatric QI sets, which however do not reflect the qualitative performance of paediatric PPC-teams in a region. The QI sets by the OECD [2, 24, 29, 30, 37], WHO [54], and UNICEF [43, 44] involve population-based global health indicators,

**Table 6** The results of the two rating rounds. The 16 QIs, for which disagreement was found in the first round, were re-rated in the second round. All QIs are summarized by their category

QI category	No. of QI before the two ratings	Results of first rating [no. of QI] - online				Results of 2nd rating [no. of QI] - personal meeting				Selected as COSI-PPC-EU
		Consistent high validity and feasibility	Consistent low validity and feasibility	Disagreements		Consistent high validity and feasibility	Consistent low validity and feasibility	Disagreements		
Health promotion/ prevention/ screening	14	12	–	2	1	1	–	1	13	
Acute care	9	8	–	1	1	1	–	0	9	
Chronic care	8	5	–	3	3	3	–	0	8	
Practice management	5	3	–	2	0	0	–	2	3	
Patient safety	9	6	–	3	3	3	–	0	9	
Patient-centeredness/ child-friendly health care	5	0	–	5	0	0	–	5	0	
<i>Total</i>	<i>50</i>	<i>34</i>	<i>–</i>	<i>16</i>	<i>8</i>	<i>8</i>	<i>–</i>	<i>8</i>	<i>42</i>	

such as mortality rates, immunization rates, access to care, alcohol consumption, cost structures and others, but not QI related to the typical PPC processes of care. The Child Health Indicators of Life and Development (CHILD) project, published by Rigby in 2003, was designed to be the only (until then) population-specific project, namely for children, which seeks to establish a holistic and societal set of measures [36].

The majority of the published QI sets serve to standardize disease-related diagnosis and therapy. QI sets are found for the most common but also for very complex diseases in children and adults, e.g. diabetes [31, 35], asthma [42, 46, 49], epilepsy [6], ADHD [40], mental illness [20, 22], Down syndrome [13], or Sickle cell anaemia [17]. The initial results of the literature search for COSI-PPC-EU have been used by Spanish paediatricians to derive a series of asthma QI [38].

The most comprehensive set with 175 QI for paediatric treatment was published in the USA. But those QIs cannot be easily transferred to Europe as they picture characteristic features of the US healthcare system [12, 27, 28].

Gill et al. published a PPC-QI set in 2014, which was developed in the UK around the same time as COSI-PPC-EU. The expert panels were GPs and paediatricians from the UK and the USA. The set is oriented to the needs of the British healthcare system (NHS) and its pay for performance compensation system [19]. Unlike in COSI-PPC-EU, it does not include patient safety QI, as well as other organizational aspects.

Engels, on the other hand, developed [14] and tested a whole set of European QI for the evaluation of medical practices [15]. It became the European Practice Assessment (EPA). With its European claim, it represents a standard for practice management. COSI-PPC-EU has derived its QI category (D) practice management from EPA.

Germany's National Association of Statutory Health Insurance Physicians (NASHIP) developed a GP-QI set called "AQUIK®-Ambulante Qualitätsindikatoren und Kennzahlen" and tested its feasibility, containing just some QI for paediatric epilepsy and ADHD patients [8].

COSI-PPC-EU cannot be compared with previously developed paediatric QI sets. It is obvious that every compilation is developed for another setting and target population. COSI-PPC-EU has been developed by European paediatricians with experience and expertise in PPC—tailored for European countries where paediatricians work together with other providers offering comprehensive healthcare services for children and adolescents including prevention and immunization. The application of COSI-PPC-EU in countries where ambulatory child health systems are more fragmented has to be explored in the future.

COSI-PPC-EU aims to be used by PPC-doctors in Europe to benchmark their performance and learn from each other. The acceptance of the QI will depend on its applicability and usability, as well as the possibility to change QI values

**Table 7** Final core set of indicators for primary paediatric care in Europe, COSI-PPC-EU

No.	QI category	QI subject	QI focus	QI numerator	QI denominator
1	Health promotion/ prevention/screening	Accident prevention handouts	Routine provision of accident prevention information for parents	Number of well baby checks in which accident prevention handouts were provided and explained.	All well baby checks
2		Breastfeeding promotion	Regular breastfeeding counselling	Number of patients whose parents were well informed about breastfeeding.	All newborns at first visit in the practice
3		Sudden infant death syndrome (SIDS) prevention	SIDS counselling	Number of patients whose parents received a SIDS counselling.	All newborn's aged < 4 weeks
4		Tracking of newborn hearing screening	Timely verification of accomplished newborn hearing screening	Number of patients who received newborn hearing screening using OAE or BERA/ABR.	All patients aged < 1 month
5		Tracking of newborn metabolic screening	Timely verification of accomplished newborn metabolic screening	Number of patients, who received metabolic screening in hospital or at primary care provider.	All infants in the first 10 days of life
6		Newborn hip screening	Early recognition of hip dysplasia or dislocation (DDH)	Number of patients whose hips were checked with sonography or other standardised exam for hip dysplasia or dislocation.	All infants aged < 6 weeks
7		Vision screening	Early recognition of visual deficits	Number of patients whose vision was tested with a standardised procedure by trained personal.	All patients aged < 5 years
8		Developmental screening	Regular annual developmental screening in the first 6 years of life	Number of patients who were regularly screened for neurological, social and emotional development with standardised, documented tools at intervals following national standards.	All patients aged 0 to 6 years
9		Growth and weight monitoring	Regular assessment and documentation of weight, height and body mass index (BMI)	Number of patients whose weight, height and BMI were measured, plotted on standardised gender specific curves and used for nutritional advice at intervals following national standards.	All infants and adolescents
10		Promotion of healthy lifestyles	Education/advice to quit smoking	Number of patients who received at least one short educational intervention/ advice to quit smoking.	All adolescents
11		Vaccination coverage	Checking vaccination status routinely	Every patient contact is used as an opportunity to check vaccination status and for recall.	N/A
12		Vaccination coverage	Completeness of recommended immunizations at 2 years of age	Number of patients who had documentation of complete nationally recommended immunizations by the age of 2 years.	All patients who turned 2 years of age between January 1 of the measurement year and December 31 of the measurement year
13		Vaccination coverage	Completeness of recommended booster immunizations	Number of adolescents who had documentation of complete nationally recommended booster immunizations	All adolescents
14	Acute care	Acute otitis media (AOM)	Robust diagnosis of AOM	Number of patients who were screened for all three relevant clinical criteria of AOM (acute onset, middle ear effusion, middle ear inflammation).	All patients with suspected AOM
15		Acute otitis media (AOM)	Appropriate therapy of uncomplicated AOM	Number of patients who at first received symptomatic analgetic treatment instead of initial antibiotic treatment.	All patients with AOM without any risk factors



**Table 7** (continued)

No.	QI category	QI subject	QI focus	QI numerator	QI denominator
16		Pharyngitis	Appropriate Streptococcus A testing as indication for antibiotic treatment in children with pharyngitis	Number of patients who did not receive antibiotics prior to a positive Group A Streptococcus test.	All patients aged >2 years with pharyngitis
17		Upper respiratory tract infection	Appropriate therapy of respiratory tract infection	Number of patients who did not receive antibiotics.	All patients with respiratory tract infection and normal respiratory rate
18		Community-acquired pneumonia (CAP)	Appropriate use of antibiotics for therapy of CAP	Number of patients who received first-line antibiotics according to guidelines.	All patients with CAP and persistent or repetitive fever > 38.5°C together with chest recession and a raised respiratory rate
19		Community-acquired pneumonia (CAP)	Timely evaluation of response to CAP treatment	Number of patients who were reassessed medically within 48 h after initiation of treatment.	All patients with CAP
20		Pulmonary distress	Hospital treatment of patients with respiratory distress	Number of patients who were transferred to the hospital.	All patients with respiratory distress and desaturation <92% SaO <sub>2</sub>
21		Management of febrile infants	Extended assessment of febrile children with serious illness	Number of patients for whom the following investigations were performed: full blood count, C-reactive protein, urine testing for urinary tract infection.	All patients aged 3 months to 5 years with fever without apparent source and with symptoms or signs of serious illness
22		Urinary tract infection (UTI)	Robust diagnosis of UTI	Number of patients who received antibiotics after obtaining urine for culture from one of the following methods of urine collection: bladder tap, catheterization, or clean catch.	All patients with UTI
23	Chronic care	Attention deficit hyperactivity disorder (ADHD)	Diagnosis of ADHD	Number of patients whose medical records contain documentation of internationally accepted criteria (e.g. DSM) used to diagnose ADHD.	All patients aged > 4 years with symptoms suspicious of ADHD
24		Asthma long-term management	Baseline spirometry in chronic asthma patients	Number of patients who have baseline spirometry performed within 6 months of diagnosis.	All asthma patients aged 5 years or older
25		Asthma long-term management	Asthma action plan	Number of patients who have a written asthma action plan.	All asthma patients
26		Asthma long-term management	Regular demonstration of inhaler technique by asthma patients	Number of patients who regularly demonstrate their inhaler technique.	All asthma patients
27		Asthma long-term management	Severity adjusted stepwise pharmacotherapy for asthma patients	Number of patients whose pharmacological treatment conforms to the patient's asthma severity.	All asthma patients
28		Asthma long-term management	Asthma-associated hospitalizations	Number of patients who got hospitalized due to asthma symptoms in the past 6 months.	All asthma patients
29		Early detection of Diabetes mellitus	Early detection of Type 1 Diabetes mellitus	Number of patients tested for hyperglycemia and glycosuria with point of care test techniques.	All patients who present with symptoms suspicious for primary manifestation of Diabetes
30		Migraine headache	Education and treatment planning for patients with migraine headache	Number of patients whose medical records contain treatment plans for mild, moderate and severe headaches (pharmacological treatment, adjunctive therapy) and	All patients who presented with migraine headache

**Table 7** (continued)

QI category No.	QI subject	QI focus	QI numerator	QI denominator
31	Practice management	Access and equipment for disabled	Barrier free access to practice facilities	documentation of receiving written educational materials about migraine.
32	Continuing medical education (CME) for the child care team	Annual job-related CME for practice team	Physicians' participation in quality circles	Practice facilities are accessible for wheelchairs—in case the practice is not located in the ground floor, there is an elevator.
33	Participation in quality circles	Evidence of guideline implementation	Documentation of medication in medical records	Every member of the team has taken part in at least one job-related CME training event in the past 12 months.
34	Guideline implementation	Documentation of medication in medical records	Documentation of guideline implementation	Physicians of the practice take part in accredited quality circles.
35	Drug management	Documentation of medication in medical records	Documentation of medication in medical records	The practice can provide evidence of guideline implementation with instructions for the practice team in the past 12 months.
36	Drug management	Documentation of medication in medical records	Documentation of medication in medical records	Every medical record contains an overview about the patients' current medication.
37	Drug and vaccines management	Timely checks of drug and vaccines expiration dates	Documentation of checking expiration dates of emergency and all other drugs and vaccines at least once every 3 months is available.	Every medical record contains information about the patients' intolerances and contraindications to medication.
38	Drug and vaccines management	Safe storage of vaccines and drugs in the refrigerator	Safe storage of vaccines and drugs in the refrigerator	Documentation of checking expiration dates of emergency and all other drugs and vaccines at least once every 3 months is available.
39	Equipment and devices management	Checks of medical equipment and devices	Checks of medical equipment and devices	The refrigerator for vaccines and drugs has a min/max-thermometer that is read and recorded daily and has a temperature of 2°C to 8°C.
40	Emergency preparedness	Annual training in resuscitation and managing acute emergencies	Annual training in resuscitation and managing acute emergencies	All medical equipment and devices are checked according to legal requirements periodically.
41	Handling complaints and critical incidents	Management of patient complaints and suggestions	Management of patient complaints and suggestions	For every member of the practice team is documented at least one practical training in resuscitation and management of acute emergencies in the past 12 months.
42	Handling complaints and critical incidents	Documentation of critical incidents and participation in a critical incidents reporting system (CIRS)	Documentation of critical incidents and participation in a critical incidents reporting system (CIRS)	The practice documents patient complaints and suggestions and identifies areas for improvement.

**Table 8** Strengths and limitations of COSI-PPC-EU**Strengths**

- ⊕ First paediatric QI set for primary care practices in Europe.
- ⊕ Participation of a broad international European expert panel.
- ⊕ Coverage of medical and organizational aspects, in particular patient safety and quality management.
- ⊕ Based on a comprehensive literature search in evidence-based databases and guidelines.
- ⊕ All stakeholders consider the development for PPC-QI as necessary and useful.
- ⊕ Most of the found QIs are derived from evidence-based guidelines and tested QI sets.

**Limitations**

- ⊖ In the expert panel, not all European countries were represented.
- ⊖ The participation of the selected experts was not consistent during the 3 years of research.
- ⊖ The personal and cultural bias of the paediatric experts from the participating countries cannot be neglected.
- ⊖ The panel was consisted only of primary care paediatricians. GPs and other stakeholders, especially patients or patients' parents, were not involved.
- ⊖ Evidence of the found QI partly reaches only expert opinion.

through the behaviour of the individual doctor [1]. Within the rating process, the expert panel rated the feasibility according to the definition in Table 5; however, COSI-PPC-EU still needs to be tested regarding its technical feasibility and availability rate in a pilot practice setting. While some hospital QI sets have the advantage to base on the exploration of routine data which can be derived from standardized nationwide computer systems, comparable to the QI of the German Institute for Quality Assurance and Transparency (IQTIG) regarding surgical subjects or the British National Institute for Health and Care Excellence (NICE), the electronic data processing structures in European countries—even for routine data—are different in PPC [45].

Testing the technical feasibility of COSI-PPC-EU will possibly encounter difficulties in relation to the availability of the data needed to compute QI values: Does the practice have the electronic database as a source to evaluate the QI? Does the practice have enough resources for the periodic and continuous assessment of the QI? Is the effort considered worthwhile? Will national societies and child healthcare providers adopt the approach and use the set for further adaptation?

Last but not least—like former studies which derived QI for PPC—COSI-PPC-EU QI partly lacks a consistent high grade of evidence. Although most of the QIs are derived from guidelines and tested QI sets, some topics were even not taken up at all, because of missing or too little evidence in the literature: child protection, patient satisfaction, inclusion of patients in the medical performance process and other illnesses. Van den Driessen Mareeuw complains for her set of QIs for Down syndrome healthcare that most QIs found in the internet databases

were incomplete [13]—a circumstance with which also the COSI-PPC-EU study had to fight. And Gill complains that only seven out of his 35 British PPC-QIs had a GRADE level [41] above 1, meaning most QIs are no more than an expert opinion. He means, this shows how much the existing evidence base has its origin in proofing the effectiveness of drugs and procedures and less the optimal mechanism of their use (for example, when, to whom and how much medicine is given) [19]. He seems to be right.

Table 8 shows the strengths and limitations of COSI-PPC-EU.

## Conclusion

COSI-PPC-EU provides for the first time an internationally developed QI set for European paediatric primary care practitioners. Simply measuring will not automatically improve healthcare. The existence of this tool is an opportunity for peer review comparisons, standardization, benchmarking, harmonization and improvement of primary care for children and adolescents in Europe. The diverse PPC setting in Europe continues to offer challenging opportunities for improvement in paediatric healthcare and will be an important field for training paediatricians in patient safety and quality in healthcare for the next generation.

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**Authors' contributions** Dominik A. Ewald and Gottfried Huss acted as European and national study coordinators from 2011 to 2013 and wrote the main part of the manuscript. Silke Auras prepared a draft of the methods and results sections. Juan Ruiz Canela was responsible for the literature research and screened with Gottfried Huss the scientific literature. Adamos Hadjipanayis is the secretary general of the EAP; he reviewed the manuscript and gave valuable advice, and he supported the project through all the years. Max Geraedts was the principal investigator who coordinated the evidence reviews, the foundation of the database and the statistical evaluation of the rating process. All the authors revised the manuscript before submission.

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## Compliance with ethical standards

**Conflict of interest** The authors declare that they have no conflict of interest.

**Compliance with ethical standards** This article does not contain any studies with human participants or animals performed by any of the authors.

**Informed consent** Informed consent was not necessary to obtain from individual participants, because there were none included in the study.

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