

Pediatric Endoscopy Quality Improvement Network (PEnQuIN) Quality Standards and Indicators for Pediatric Endoscopists and Endoscopists in Training: A Joint NASPGHAN/ESPGHAN Guideline

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ABBREVIATIONS

- American Society for Gastrointestinal Endoscopy: ASGE
- Appraisal of Guidelines for REsearch and Evaluation: AGREE

- Direct Observation of Procedural Skills: DOPS
- European Society for Paediatric Gastroenterology Hepatology and Nutrition: ESPGHAN
- European Society of Gastrointestinal Endoscopy: ESGE
- Gastrointestinal Endoscopy Competency Assessment Tool for pediatric endoscopy: GiECAT_{kids}
- Grading of Recommendation Assessment, Development, and Evaluation: GRADE
- Inflammatory bowel disease: IBD
- Joint Advisory Group on Gastrointestinal Endoscopy's Electronic Training System: JETS
- North American Society for Pediatric Gastroenterology, Hepatology and Nutrition: NASPGHAN
- Pediatric Endoscopy Quality Improvement Network: PEnQuIN
- Population, Intervention, Comparator, Outcome: PICO
- United Kingdom: UK

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ABSTRACT

Introduction:

High quality pediatric endoscopy requires reliable performance of procedures by competent individual providers who consistently uphold all standards determined to assure optimal patient outcomes. Establishing consensus expectations for ongoing monitoring and assessment of individual pediatric endoscopists is a method for confirming the highest possible quality of care for such procedures worldwide. We aim to provide guidance to define and measure quality of endoscopic care for children.

Methods:

With support from the North American and European Societies of Pediatric Gastroenterology Hepatology and Nutrition (NASPGHAN and ESPGHAN), an international working group of the Pediatric Endoscopy Quality Improvement Network (PEnQuIN) used the methodological strategy of the Appraisal of Guidelines for REsearch and Evaluation (AGREE) II instrument to develop standards and indicators relevant for assessing the quality of endoscopists.

Consensus was sought via an iterative online Delphi process and finalized at an in-person conference. The quality of evidence and strength of recommendations were rated according to the GRADE (Grading of Recommendation Assessment, Development, and Evaluation) approach.

Results:

The PEnQuIN working group achieved consensus on 6 standards that all providers who perform pediatric endoscopy should uphold and 2 standards for pediatric endoscopists in training, with a corresponding 7 indicators that can be used to identify high quality endoscopists. Additionally, these can inform continuous quality improvement at the provider level. Minimum targets for defining high quality pediatric ileocolonoscopy were set for 2 key indicators: cecal intubation rate ($\geq 90\%$) and terminal ileal intubation rate ($\geq 85\%$).

Discussion:

It is recommended that all individual providers performing or training to perform pediatric endoscopy initiate and engage with these international endoscopist-related standards and indicators developed by PEnQuIN.

KEYWORDS:

- Pediatric Gastroenterology/*standards
- Endoscopy, Gastrointestinal/*standards
- Clinical competence/standards
- Performance measures
- Key Performance Indicators

INTRODUCTION

Defining high quality pediatric endoscopy involves regular surveillance of procedural processes and outcomes at the level of the individual provider to ensure they attain and maintain competence to perform these procedures in children. Endoscopic competence has been defined as the minimum level of knowledge, skills and expertise required to perform endoscopy safely and proficiently without assistance or supervision.¹ Measuring the quality of endoscopic skills involves routine monitoring of technical, cognitive and non-technical components of procedures that directly and indirectly impact patient outcomes.²⁻⁵ Pediatric endoscopists in training are expected to develop and achieve defined levels of procedural competence during a formal training program or equivalent training.^{2,4,6,7} As trainees transition to fully credentialed staff, procedural competence should be formally assessed as part of gaining facility privileges to perform endoscopy in children.⁴ Maintenance of competence over an individual provider's career is also of considerable importance and requires continuous ongoing assessment, performance measurement and oversight.^{1,4,8} As the goal of continuous assessment is overall improvement of endoscopic care, monitoring individual pediatric endoscopists should not be used for punitive purposes; rather, its conduct by facilities and by individual providers should be heralded as a marker of the highest quality of care.⁹

From an international perspective, pediatric endoscopies (i.e., gastrointestinal endoscopic procedures in children) are typically performed by providers who have received formalized training in pediatric medicine, as well as subspecialty training in pediatric gastroenterology. However, there remain regions of the world where such training or trained subspecialists do not exist, as well as many settings worldwide where pediatric gastroenterologists are not present or available. Furthermore, indications for advanced procedures may be rare, making it difficult for pediatric-focused providers to maintain specific competencies. For these and other reasons, pediatric endoscopy may be performed by gastroenterologists trained in the performance of adult procedures, as well as by other specialists, including general surgeons and pediatric surgeons.

For the purposes of this document, pediatric endoscopists are defined as any provider who performs gastrointestinal procedures in children. All pediatric endoscopists, regardless of specialty or training pathway, should be held to the same standards, to ensure that all children undergoing gastrointestinal procedures receive the highest quality of care. Both trainees and fully credentialed endoscopists should also be engaged in continuous quality improvement initiatives, with the goal of identifying opportunities for improving healthcare processes and patient outcomes.⁹ Data from quality improvement initiatives should be reviewed regularly by trainees and endoscopists themselves, as well as by appropriate oversight committees dedicated to ensuring that standards are upheld. Ultimately, by reviewing individual data and benchmarking individual provider performance metrics with that of peers, pediatric endoscopists will best be able to take mitigating steps to reduce aspects of potential vulnerability across their clinical practice.

A principal aim of the Pediatric Endoscopy Quality Improvement Network (PEnQuIN) has been to outline international standards for pediatric *Endoscopists* and *Endoscopists in*

Training, as a key *domain* of pediatric endoscopy, as well as indicators that can be used to measure the quality of individual providers (**Table 1**). Two specific subdomains of endoscopist quality are outlined: (1) Endoscopists; and (2) Endoscopists in Training. The PEnQuIN process was sponsored by both the North American and European Societies of Pediatric Gastroenterology Hepatology and Nutrition (NASPGHAN and ESPGHAN). Its primary assumptions are that all standards and indicators identified through rigorous evidence review and consensus will be useful in the following ways: (1) To assess the quality of procedural performance; (2) To serve as a basis for quality improvement activities at the individual provider level; and (3) To provide guidance for individual providers and their facilities seeking to assess procedural performance and identify areas for improvement.

METHODS

With approval from NASPGHAN and ESPGHAN, a rigorous multi-step guideline development process, guided by the Appraisal of Guidelines for REsearch and Evaluation (AGREE) II instrument¹⁰, was used to structure the development of the PEnQuIN standards and indicators. Proposed quality standards and indicators were derived from three sources: (1) a systematic literature review of Medline, EMBASE and Cochrane Central Register of Controlled Trials (CENTRAL); (2) a hand-search of lists of references from published adult consensus statements¹¹⁻¹⁴; and (3) a survey of PEnQuIN working group members. Titles and abstracts from 4505 records were reviewed and 54 potential quality standards and 62 indicators were generated from the three aforementioned sources. The Population, Intervention, Comparator, Outcome (PICO) approach was used to frame questions relevant to each potential quality standard and corresponding indicator(s).^{15,16} Evidence was mapped to each standard and corresponding indicator(s), and the Grading of Recommendation Assessment, Development and Evaluation (GRADE) system was then used to assess the quality of evidence ('very low,' 'low,' 'moderate' or 'high').¹⁷ Consensus among the PEnQuIN working group was subsequently achieved via an iterative online Delphi process followed by an in-person consensus conference. The GRADE approach was then utilized to determine the strength of recommendation as 'strong' (recommended) versus 'conditional' (suggested) for each quality standard that reached consensus.¹⁸ As per GRADE methodology, a 'strong' recommendation was defined as a broadly applicable standard that can be adopted across endoscopists and endoscopy services despite variability in practice, whereas a 'conditional' recommendation was defined as suggesting that implementation may vary. The choice to implement a 'conditional' standard should take into account patient values and preferences, available resources and the setting of implementation.¹⁸ At each stage of the process, consensus was defined as $\geq 80\%$ agreement.

Afterward, the quality standards and indicators reaching consensus were mapped to their relevant domain: (1) Facilities; (2) Procedures; or (3) Endoscopists and Endoscopists in Training. Standards related to pediatric endoscopists and endoscopists in training are presented within this document along with related indicators and their definitions (e.g., binary (yes/no), rate (numerator representing actual performance numbers and a denominator representing the number of opportunities for correct performance in a given setting or timeframe). Detailed methodology is outlined within the PEnQuIN overview document.¹⁹

At the in-person consensus conference, the working group members voted on minimum targets (minimum accepted threshold of performance) for cecal and terminal ileal intubation rates. Published adult guidelines were reviewed for minimum target cecal intubation rates, which were found to be at least $\geq 90\%$ (unadjusted)^{11,13,20,21} with some societies recommending $\geq 95\%$ (unadjusted) for screening colonoscopies.^{11,21} A review of pediatric data on cecal and ileal intubation rates was also presented to the PEnQuIN working group, in part to facilitate an understanding of feasibility. All data was used as a starting point for discussion and voting on minimum targets for both cecal and terminal ileal intubation rates for pediatric ileocolonoscopy. Iterative rounds of voting were then used to determine minimum targets, with consensus defined as $\geq 80\%$ agreement.

RESULTS

The PEnQuIN working group achieved consensus for a total of 8 standards related to pediatric endoscopists, with 7 related indicators that can be used to define high quality endoscopists, while providing a means for continuous quality improvement at the individual provider level. Consensus was not reached, and no recommendations were made, for an additional 2 standards and 5 indicators (*Supplemental Appendix 1*, <http://links.lww.com/MPG/C459>). All standards that achieved consensus can be mapped to one of 2 subdomains, with associated indicators: Endoscopists (6 standards, 5 indicators) and Endoscopists in Training (2 standards, 2 indicators). In addition, minimum targets for defining high quality pediatric ileocolonoscopy were set by consensus for 2 key indicators related to pediatric endoscopists:

- (1) an unadjusted cecal intubation rate of $\geq 90\%$ (Indicator 44);
- (2) an unadjusted terminal ileal intubation rate of $\geq 85\%$ (Indicator 45).

Each standard that reached consensus for inclusion in this PEnQuIN guideline on endoscopists and endoscopists in training is presented below, with the strength of recommendation and quality of supporting evidence (according to the GRADE approach), a short discussion of the evidence considered and the voting results. Indicators related to each standard are listed in accompanying tables, organized by the subdomains of endoscopist quality. The PEnQuIN working group assumed the likely use of electronic endoscopy reporting systems for facilitating data retrieval for specific indicators but did not mandate this or specify any particular system.

SUBDOMAIN 1: ENDOSCOPISTS

To assure high quality endoscopy, gastrointestinal procedures in children should only be performed by appropriately trained providers who are procedurally competent and who maintain their competence (e.g., by performing endoscopy regularly over time). Privileges to perform endoscopy should be granted once procedural competency has been determined by formal assessment and must be maintained through ongoing formal assessment on a routine basis, at the credentialing facility and/or by a certifying/credentialing organization(s). Individual providers should have a way to self-monitor their performance on a regular basis, with the goal of identifying opportunities for personal improvement. In addition, high quality

endoscopy facilities should include an appropriately formed oversight committee that regularly reviews performance data of all providers to ensure standards are upheld.

The great majority of endoscopic procedures in children are diagnostic (e.g., upper endoscopy, ileocolonoscopy), but some can be performed for therapeutic purposes (e.g., endoscopy for treatment of stenosis, foreign body removal, hemostasis; endoscopic retrograde cholangiopancreatography with stent placement; percutaneous endoscopic gastrostomy insertion). Although many gastrointestinal procedures performed in children may involve specific aspects of care that can serve as valid and reliable markers of procedural quality, such indicators have not been fully developed to date. Nevertheless, in the interest of providing formative guidance on assuring quality for common pediatric endoscopic scenarios that may be most vulnerable to extremes in practice variation, the PEnQuIN working group did specifically coalesce around a standard for pediatric ileocolonoscopy (Standard 47).

The following achieved consensus within the PEnQuIN working group as minimum standards of high quality practice for pediatric Endoscopists, as measured by their 5 associated indicators (**Table 2**).

Standard 42: All endoscopists engaged, directly or indirectly, in endoscopy service delivery to pediatric patients should be trained and certified as having competence to perform specified routine and/or emergency pediatric endoscopic procedures according to appropriate standards.

GRADE: Conditional recommendation, very low quality evidence. Vote: strongly agree, 50.0%; agree, 33.3%; uncertain, 16.7%

Key evidence: There is consensus that pediatric endoscopy should be undertaken only by those specifically trained and certified to perform endoscopic procedures in children. Nevertheless, evidence for this standard is indirect and there is low quality evidence to suggest at least some endoscopists trained to perform ileocolonoscopy in adults may be capable of performing high quality (i.e., high ileal intubation rates, high diagnostic yield) procedures in children.²² The peer-reviewed literature does include several studies that have examined clinical outcomes of endoscopy performed by non-gastroenterologists in adult patients, such as perforation rates, adenoma detection rates and missed colorectal cancers.²³⁻²⁶ Most of this work suggests that non-specialist endoscopists (e.g., internists, nurse practitioners, family physicians and general surgeons) are less competent at endoscopy than gastroenterologists who have been trained in accredited fellowships.²⁴⁻²⁶

Standard 43: Endoscopists who perform procedures on pediatric patients should be granted privileges to perform specified pediatric procedures based on a formal assessment of their competence consistent with appropriate standards, when available.

GRADE: Conditional recommendation, no evidence. Vote: strongly agree, 60.9%; agree, 26.1%; uncertain, 8.7%; disagree, 4.3%

Key evidence: There is consensus that pediatric endoscopists should be granted privileges to perform procedures after formal assessment, despite no guidance nor evidence as to how that formal assessment should occur. There are also no relevant studies to determine an appropriate frequency with which the competence of credentialed endoscopists performing

pediatric upper endoscopy and/or ileocolonoscopy should be assessed. Among gastroenterologists performing procedures in adults, some studies have shown a correlation between annual endoscopy volume, as well as cumulative lifelong volume, and endoscopy quality indicators, such as adenoma detection rate.^{23,27-29} However, a large prospective study failed to show a relationship between annual screening case volume and adenoma detection, although number of continuing medical education meetings attended annually was associated with superior adenoma detection.³⁰

Standard 44: The privileges of endoscopists who perform procedures on pediatric patients should be subject to formal, regular, scheduled review to ensure that renewal is based on documented competence to perform specified pediatric procedures consistent with appropriate current standards, when available.

GRADE: Conditional recommendation, no evidence. Vote: strongly agree, 33.3%; agree, 62.5%; uncertain, 4.2%

Key evidence: There is consensus that privileges to perform endoscopy in children should be formally reviewed on a regular basis to document procedural competence consistent with appropriate standards. However, there is no evidence with which to define optimal intervals between assessments or to identify the best indicators of pediatric procedural quality. There are also no evidence-based standards to which we should hold practicing pediatric endoscopists accountable. In the context of endoscopy performed in adults, both the European Society for Gastrointestinal Endoscopy (ESGE) and the American Society for Gastrointestinal Endoscopy (ASGE) recognize the need for monitoring quality indicators for individual endoscopists.^{12,31} The need for quality metric development and validation, as well as guideline development, has been recognized in pediatrics as well.^{32,33}

Standard 45: Endoscopists who perform procedures on pediatric patients should regularly review their endoscopic practice and outcome data with the aim of continuous professional development.

GRADE: Conditional recommendation, very low quality evidence. Vote: strongly agree, 62.5%; agree, 25.0%; uncertain, 12.5%

Key evidence: There is consensus that pediatric endoscopists should regularly review their own procedural performance, despite only low quality evidence that this improves any clinical outcome of endoscopic procedures and no direct evidence in pediatrics.³⁴⁻⁴⁵ One randomized trial that involved providing formal feedback to trainees in adult gastroenterology found that monthly feedback improved cecal intubation rates but not adenoma detection rates.³⁴ A number of observational studies examining whether adenoma detection rates and other quality indicators improve with regular feedback have produced inconsistent results.^{35,36,38-45} One systematic review on the impact of providing regular standardized feedback to endoscopists suggested that physician behavior may change, but there is no clear evidence that adenoma detection rates improve.³⁷ A recent systematic review of 12 studies showed that feedback was associated with modest improvements in adenoma detection rate, with low performers deriving the greatest benefit.⁴⁶ In contrast, feedback was not associated with improvements in withdrawal time or cecal intubation rate.⁴⁶

Standard 46: Endoscopic practice and outcome data of endoscopists who perform procedures on pediatric patients should be regularly reviewed by the appropriate oversight committee to ensure maintenance of competence.

GRADE: Conditional recommendation, no evidence. Vote: strongly agree, 33.4%; agree, 58.3%; uncertain, 8.3%

Key evidence: While there was consensus that appropriate oversight committees should ensure the maintenance of competence of endoscopists who perform procedures in children, there is no evidence to define membership of such committees, nor what pediatric procedural outcome data should be reviewed. Oversight committees may be facility-based, regional, national or international, and should include pediatric gastroenterology content experts. Similarly, non-evidence-based recommendations concerning oversight have been made for practicing endoscopists who perform procedures in adults. In particular, the ASGE states that the maintenance of continued competency in performance of endoscopic procedures is the responsibility of an institution's credentialing and privileging committee and that a mechanism should be in place for the monitoring of each endoscopist's procedural performance.¹ Likewise, in order to deliver high quality pediatric endoscopy care, it is felt that ongoing assessment is necessary to ensure all practicing endoscopists maintain their competence.³ There is limited evidence that development and measurement of key performance indicators helps skill development and improves clinical outcomes in adult patients.⁴⁷ Although key performance measures have been developed for both upper and lower endoscopy in adults, most do not apply to pediatrics.^{20,48}

Standard 47: Endoscopists who perform lower endoscopic procedures on pediatric patients should aim to complete an ileocolonoscopy unless the procedure is being performed for an indication that does not require this.

GRADE: Conditional recommendation, low quality evidence. Vote: strongly agree, 75.0%; agree, 12.5%; disagree, 12.5%

Key evidence: There is consensus that complete ileocolonoscopy is indicated for the majority of pediatric lower endoscopic procedures. There are select indications where ileal intubation may not be required, including motility catheter placement, sigmoidoscopy for graft versus host disease or monitoring for therapeutic response in ulcerative proctitis.^{49,50} It is important to recognize that a large proportion of pediatric patients undergoing ileocolonoscopy are being investigated for suspected or known inflammatory bowel disease (IBD), which in some cases is only ascertainable by mucosal inspection of the cecum and terminal ileum. A number of low quality studies have demonstrated that completion of full ileocolonoscopy, including examination of the terminal ileum, is essential for the proper diagnosis and management of digestive diseases in most pediatric patients.⁵¹⁻⁵⁴ Incomplete or partial ileocolonoscopy, without inspection and tissue sampling of the ileocecal region, exposes pediatric patients to missed, misdiagnosed and/or delayed diagnosis of IBD.⁵⁵

SUBDOMAIN 2: ENDOSCOPISTS IN TRAINING

Training in pediatric endoscopy should be designed and implemented in a manner that ensures that individual providers progressively attain skills that will ensure they are

competent to perform procedures independently upon completion of their training program.^{2,3} A number of pediatric gastroenterology societies, including NASPGHAN and ESPGHAN^{2,6}, and regional accreditation bodies have developed guidelines and program requirements for training in pediatric endoscopy and defined procedural competency. All guidelines are unified in their assumption that the many differences between pediatric and adult endoscopic practice substantiate the need for pediatric-specific training and assessment processes. The PEnQuIN working group achieved consensus on the following standards and their related indicators (**Table 3**) as defining high quality in regard to pediatric Endoscopists in Training.

Standard 48: All endoscopists in training who perform procedures on pediatric patients should be supervised with regular performance monitoring and constructive feedback, until they have achieved competence to perform specified routine and/or emergency pediatric procedures according to appropriate current standards.

GRADE: Strong recommendation, very low quality evidence. Vote: strongly agree, 87.5%; agree, 12.5%

Key evidence: There is strong consensus that continuous supervised training with regular feedback is the best means of assuring proceduralist competence for the performance of pediatric endoscopy, and some initial pediatric evidence that endoscopy trainers can be taught to use feedback effectively.⁵⁶ There is emerging evidence that standardized feedback during training improves clinical outcomes in adults.^{34,57-59} At least one high quality randomized clinical study³⁴ and two high quality randomized simulation-based trials^{58,59} have shown improved skill acquisition with feedback in trainees learning to perform colonoscopy in adults. There is direct pediatric evidence that procedural volume, a traditionally employed metric of endoscopic competence, is inadequate for this purpose.^{5,60} There is also growing concern that, even in tertiary facilities, obtaining the recommended numbers of specialized procedures required to meet competency standards may be difficult.⁶¹⁻⁶⁴

Standard 49: Competence assessment tools with strong validity evidence should be used to document progress and proficiency level during endoscopy training.

GRADE: Conditional recommendation, low quality evidence. Vote: strongly agree, 54.2%; agree, 41.7%; uncertain, 4.1%

Key evidence: There is consensus that certain well-validated tools should be routinely used for assessment of competence during endoscopy training, despite limited evidence that this practice improves patient outcomes. The only direct observation assessment tool specifically developed for pediatric ileocolonoscopy is the Gastrointestinal Endoscopy Competency Assessment Tool for pediatric endoscopy (GiECAT_{kids}).^{5,6,60,65} The GiECAT_{kids} has been rigorously developed and validated across multiple North American centers, and provides definitions of core technical, cognitive and integrative skills for the procedure,^{5,60,65} however, this tool has yet to be widely utilized. The National Health Service in the United Kingdom (UK) has validated goals that all pediatric endoscopists should achieve by the end of their training, including set terminal ileal intubation rates.^{3,66} Among adult practitioners in the UK, use of the Direct Observation of Procedural Skills (DOPS) assessment is well-established.^{67,68} DOPS are also used during pediatric endoscopy training in the UK, where they are recorded

in the Joint Advisory Group on Gastrointestinal Endoscopy's Electronic Training System (JETS), which feeds into the structured pediatric endoscopy certification pathway developed for pediatric gastroenterology.^{3,6} Low quality evidence from a recent study of the DOPS for pediatric upper endoscopy, which assesses technical and non-technical skills, showed that overall competency can be described by DOPS scores, with high sensitivity and specificity.⁶⁹ Similarly, validity evidence on the DOPS for pediatric ileocolonoscopy was recently published.⁷⁰

DISCUSSION

The goal of the PEnQuIN working group in developing this document was to achieve consensus on a list of key standards that should be upheld by all pediatric endoscopists worldwide, in accordance with best evidence and clinical outcomes. Each indicator that is identified can be continuously measured at an individual provider level, thereby ensuring endoscopists are achieving minimum recommended targets and allowing for comparison across and within groups of providers. Collectively, standards and indicators are intended to guide and measure endoscopic care, identify practices that lead to higher quality care and ensure that high quality procedures are reliably and consistently occurring. Ideally, they provide a guide for regional and national pediatric endoscopist accreditation, and for assuring consumer transparency. Parallel to the effort to measure the quality of performance of pediatric endoscopists to improve patient outcomes, these principles should be applied to the trainee learning process to support the achievement of competence and promote continuous quality improvement throughout one's career.

The development of standards, indicators and processes for quality improvement aims to raise the quality of care for children undergoing endoscopy. This tenet assumes education represents a process for improvement.^{12,71} The PEnQuIN working group does not endorse quality measurement at the level of individual providers for punitive purposes, rather it is for the goal of identifying opportunities for continually improving the quality of pediatric endoscopy universally. Moving forward, PEnQuIN is committed to developing multi-center registries that incorporate these quality metrics, thereby providing automated feedback to endoscopists, benchmarking at the individual level and a means for promoting continuous improvement. Over time, such databases may provide a means to benchmark quality measures for endoscopists who perform higher risk diagnostic and therapeutic procedures.⁷² In accordance with the goal of continuous quality improvement, it is essential for endoscopy facilities to ensure structures are in place to support endoscopists who are identified as requiring improvement with education, mentorship and other resources that can help them attain minimum quality targets.^{3,32}

Two indicators, rate of cecal intubation (Indicator 44) and rate of ileal intubation (Indicator 45), were identified during the PEnQuIN in-person conference as priority indicators related to lower endoscopy, and minimum unadjusted performance targets of $\geq 90\%$ and $\geq 85\%$, respectively, were set by consensus. These indicators and related targets reflect the importance of performing complete ileocolonoscopy (as opposed to colonoscopy) in children, including visualization of the whole cecum and terminal ileum, to ensure proper diagnosis and management of digestive diseases.⁵¹⁻⁵⁴ The PEnQuIN working group discussed the rare

occasions when ileal intubation may not be required (e.g., motility catheter placement), should not be attempted or may not be possible (e.g., severe fibrostenotic disease of the ileocecal valve from Crohn disease). There was consensus that ileocolonoscopy should almost always be pursued and the pediatric literature has shown that these intubation rates are attainable.^{54,73} Incomplete ileocolonoscopy in children can lead to missed diagnoses and the potential need for repeat examinations and/or alternative investigations. The PEnQuIN working group did identify documentation of ‘extent of examination’ and ‘reason for premature termination of procedure’ as key endoscopy reporting elements, as these to help to better elucidate factors affecting the performance of complete pediatric ileocolonoscopy.⁷⁴

The literature also demonstrates that there is substantial performance variation across pediatric endoscopists for rates of cecal and ileal intubation, both of which can be readily measured.^{51,53,64,75–78} Unadjusted minimum targets for these indicators were set by the PEnQuIN working group, partly in acknowledgement that adjustment of rates for procedural indication or inadequate bowel preparation would make their measurement less feasible and prone to ‘gaming the system.’ There was consensus that cecal intubation should be documented both in written form and confirmed with photo or video documentation.^{79,80} Ileal intubation should be documented in written form and confirmed by photo or video documentation, or histologically with biopsy of the ileum.

Overall, there was excellent agreement among PEnQuIN working group members that each standard and indicator included in this document is valuable and relevant to all providers who perform endoscopy in children, and each contributes to assuring optimal outcomes of pediatric endoscopy. Nevertheless, as was perhaps not surprising, the rigorous process that was used to develop and evaluate each standard as part of the PEnQuIN process also underscored the paucity of evidence (and impact on clinically relevant outcomes) for almost every aspect of procedural performance that is assumed to be integral to ensuring the quality of an individual pediatric endoscopist. In turn, this PEnQuIN document provides the basis for future research, with the goal of ensuring that best practices in endoscopic care of children can be evidence-based. An ongoing quest to develop evidence for all PEnQuIN standards and indicators will also increase their value for pediatric endoscopists, as well as for children with digestive disorders who undergo such procedures.

By design, the PEnQuIN working group focused on the feasibility of collecting each standard and indicator at both the endoscopist and facility level. In turn, the PEnQuIN framework for assessing procedural performance of an individual provider includes the methodology by which each indicator can be obtained through manual data extraction. Assuring that measures can be collected manually was important to the PEnQuIN working group, who recognized that use of electronic reporting systems may not be available in all settings. Nevertheless, use of such systems is likely preferable, as it will increase the efficiency by which individual providers can assess whether their practice adheres to PEnQuIN standards and also monitor PEnQuIN indicators. Automated data extraction from electronic reporting systems, as opposed to manual chart extraction, is also more likely to be conducive to regular report generation and thereby more apt to support continuous improvement activities aimed at providers who perform endoscopy in children.

The PEnQuIN working group is now calling upon pediatric endoscopists as a community to commit to the implementation of these standards for pediatric endoscopy and monitoring the accompanying indicators. We do, however, recognize that continual quality monitoring, education and improvement of pediatric endoscopists generally requires investment and support by facilities and oversight agencies (e.g., medical licensing boards, national pediatric specialty boards). Nevertheless, we believe that the international consensus achieved by the PEnQuIN group throughout this process is a testament to how important these standards and indicators are to child health.

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TABLE LEGENDS

Table 1: Quality-related terminology


	Term	Definition
	Domain	<ul style="list-style-type: none"> Broad area of pediatric endoscopic care.
	Quality standard	<ul style="list-style-type: none"> Recommendation on high quality practice for a specific aspect of pediatric endoscopic care. Quality standards may reflect priority areas for quality improvement and may be related to quality indicators.
	Quality indicator	<ul style="list-style-type: none"> A measure of the process, performance, or outcome of pediatric endoscopic service delivery used in determining the quality of care. Can highlight potential targets for quality improvement. Other terms for a quality indicator include performance measure, quality measure, key performance indicator, clinical quality measure, etc.

Table 2: Indicators related to the 'Endoscopist' subdomain

<p>Indicator 41: Rate with which pediatric endoscopies are performed by trained and credentialed endoscopists</p> <ul style="list-style-type: none"> ▪ Numerator: Number of pediatric endoscopies performed by individuals who are fully trained and credentialed to perform specified routine and/or emergency pediatric procedures, in accordance with current standards ▪ Denominator: All pediatric endoscopies ▪ Calculation: Proportion (%) ▪ Associated PEnQuIN Standards: S42
<p>Indicator 42: Rate with which the competence of practicing pediatric endoscopists is assessed</p> <ul style="list-style-type: none"> ▪ Numerator: Number of pediatric endoscopists who have performed a pediatric endoscopy <i>and</i> have had their competence assessed in a given year, using a standardized tool and this assessment is documented ▪ Denominator: All pediatric endoscopists who have performed a pediatric endoscopy in a given year ▪ Calculation: Proportion (%) ▪ Associated PEnQuIN Standards: S43
<p>Indicator 43: Number of procedures performed annually</p> <ul style="list-style-type: none"> ▪ Calculation: Number of pediatric endoscopies performed annually, per endoscopist. This should be reported by procedure type (e.g., upper endoscopy, ileocolonoscopy) ▪ Associated PEnQuIN Standards: S45
<p>Indicator 44: Rate of cecal intubation</p> <ul style="list-style-type: none"> ▪ Numerator: Number of pediatric colonoscopies and ileocolonoscopies that report reaching the cecum. This should be documented in written form and confirmed by at least one photo/video ▪ Denominator: All planned pediatric colonoscopies and ileocolonoscopies that are initiated (i.e., intubation of the anus) ▪ Calculation: Proportion (%) ▪ Minimum Target: ≥ 90% (unadjusted) ▪ Associated PEnQuIN Standards: S47
<p>Indicator 45: Rate of ileal intubation</p> <ul style="list-style-type: none"> ▪ Numerator: Number of pediatric ileocolonoscopies that report reaching the ileum. This should be documented in written form and confirmed by at least one photo/video or histologically with biopsy of the ileum ▪ Denominator: All planned pediatric ileocolonoscopies that are initiated (i.e., intubation of the anus) ▪ Calculation: Proportion (%) ▪ Minimum Target: ≥ 85% (unadjusted) ▪ Associated PEnQuIN Standards: S47

Table 3: Indicators related to the 'Endoscopists in Training' subdomain

<p>Indicator 46: Proportion of endoscopists in training who have achieved competence by the end of their training</p> <ul style="list-style-type: none"> ▪ Numerator: Number of pediatric endoscopists in training who have achieved competence to perform specified routine and/or emergency pediatric procedures, in accordance with current standards, by the end of their training ▪ Denominator: All pediatric endoscopists in training ▪ Calculation: Proportion (%) per procedure type (e.g., upper endoscopy, ileocolonoscopy) ▪ Associated PEnQuIN Standards: S48
<p>Indicator 47: Rate with which the competence of endoscopists in training is assessed longitudinally</p> <ul style="list-style-type: none"> ▪ Numerator: Number of pediatric endoscopists in training whose competence has been longitudinally assessed over the duration of their training, using a standardized tool, and this assessment is documented ▪ Denominator: All pediatric endoscopists in training ▪ Calculation: Proportion (%) ▪ Associated PEnQuIN Standards: S49