

Development of the Gastrointestinal Endoscopy Competency Assessment Tool for Pediatric Colonoscopy (GiECAT_{KIDS})

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See “Assessment Tools: the Next Frontier in Competency-Based Medical Education” by Sauer et al on page 425 and “Endoscopy Assessment: From Case Logs to Competency” by Sauer and Kramer on page 427.

ABSTRACT

Objectives: Many aspects of pediatric colonoscopy differ from adult practice. To date, there is no validated measure of endoscopic competence for use in pediatrics. Using Delphi methodology, we aimed to determine

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expert consensus regarding items required on a checklist and global rating scale designed to assess the competence of clinicians performing colonoscopy on pediatric patients.

Methods: A total of 41 North American pediatric endoscopy experts rated potential checklist and global rating items for their importance as indicators of the competence of trainees learning to perform pediatric colonoscopy. Responses were analyzed and re-sent to the panel for further ratings until consensus was reached. Items that ≥80% of experts rated as ≥4 out of 5 were included in the final instrument. Consensus items were compared with those items deemed by adult endoscopy experts as fundamental to assessing the performance of adult colonoscopy.

Results: Five rounds of surveys were completed with response rates ranging from 76% to 100%. Seventy-five checklist and 38 global rating items were reduced to 18 checklist and 7 global rating items that reached consensus. Three pediatric checklist items differed from those considered to be critical adult indicators, whereas 4 items on the latter did not reach consensus among pediatric experts.

Conclusions: Delphi methodology allowed for achievement of expert consensus regarding essential items to be included in the Gastrointestinal Endoscopy Competency Assessment Tool for Pediatric Colonoscopy (GiECAT_{KIDS}), a measure of endoscopic competence specific to performing pediatric colonoscopy. Key differences in the checklist items, compared with items reaching consensus during a separate adult Delphi process using the same indicators, emphasize the need for a pediatric-specific tool.

Key Words: competency-based education, Delphi technique, educational measurement, endoscopy gastrointestinal/education, endoscopy gastrointestinal/standards

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Ensuring that endoscopists are competent to deliver the necessary services to their patients remains a key objective of training programs, professional organizations, and accreditation bodies. The acquisition of competence is a developmental process that occurs over time with deliberate practice (1), nurtured by reflection on experiences (2). In relation to the skill of gastrointestinal endoscopy, competence has been defined as the minimum level of knowledge, skills, and expertise, derived through training and experience, required to perform endoscopy safely and proficiently (3,4). Delivery of quality endoscopic care requires proficiency in 3 main competency domains: technical (psychomotor), cognitive, and integrative competencies required for safe, intelligent performance in varied contexts (eg, communication, professional judgment, clinical reasoning).

Training in pediatric gastrointestinal endoscopy has typically followed an apprenticeship model, in which critical assessment of the trainee’s performance is the responsibility of the supervisor. The development of an objective, valid, and reliable assessment process has been identified as an important goal (5). Integration of

standardized and reproducible assessment tools into pediatric endoscopy training programs would provide more structured evaluations of trainees, facilitate the provision of feedback along the learning curve, document trainees' progress over time, and aid in the establishment of performance-based competency thresholds.

Previous measures of clinical ability in performing colonoscopy have been developed and validated (6–19), but none specifically within the pediatric context. There are a number of endoscopic practice issues that differ between colonoscopy in children and colonoscopy in adults, including differences in informed consent and sedation practices, procedural indications, the need to individualize procedural preparation according to the patient's age and size, and the emphasis placed on routine tissue sampling and terminal ileum intubation (20). These differences highlight the need for the development of a pediatric-specific assessment tool that is validated within the pediatric setting.

Using Delphi methodology, the present study aimed to achieve expert consensus regarding performance indicators to be included in the Gastrointestinal Endoscopy Competency Assessment Tool for Pediatric Colonoscopy (GiECAT_{KIDS}), designed to assess the competence of clinicians performing colonoscopy on pediatric patients.

METHODS

Study Design

The present study used the Delphi technique to achieve consensus among experts regarding essential items to be included on a checklist and global rating scale designed to assess the competence of clinicians performing colonoscopy on pediatric patients. The Delphi method involves an iterative, multistep process to reach consensus on factors that are subjective, when experts are not physically together (21). It is based on the premise that “pooled intelligence” enhances individual judgment and captures the collective opinion of experts (21–23). A separate Delphi process was carried out with adult endoscopy experts using the same initial indicators derived from our survey of core committee members and systematic literature review and is reported elsewhere (24). Consensus items identified through both the pediatric and adult Delphi processes were compared. Approval for the present study was granted by the University of Toronto research ethics board.

Selection of Delphi Panelists

A group of pediatric endoscopy experts from across North America was established to finalize item generation and aid with item reduction and gradation. To enhance the content validity of the Delphi process and ensure that the most appropriate experts participated, panelists were identified in 2 ways. First, we identified leaders in pediatric endoscopy as evidenced by their roles as opinion makers within national and international organizations, including members of the North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition's committees on endoscopy and procedures, clinical care and quality, and professional education and training; the Canadian Association of Gastroenterology Education Committee; and the American Society for Gastrointestinal Endoscopy's Committees on Standards of Practice, Practice Management, Research and Training. Second, we identified individuals who authored ≥ 2 papers concerned directly with pediatric endoscopy assessment or performance in peer-reviewed journals during the preceding 3 years. We aimed to bring together a heterogeneous group of at least 30 experts with broad expertise in pediatric endoscopy to increase the reliability of the Delphi group's composite judgment (25,26). A total of 54 prospective panelists were invited to participate, because a 60% to 75% rate of acceptance was expected based on previous Delphi

studies (21,27). Prospective panelists were sent an e-mail invitation that explained the purpose of the study and provided them with a description of the Delphi process. As is standard, participants were assured that their participation and the composition of the expert panel would be kept confidential.

Item Generation

Checklist and global rating items were initially generated from the following 2 sources: a survey of core committee members and a systematic search of the relevant literature. Five core committee members were selected from diverse backgrounds related to endoscopy, including individuals with expertise in educational methodology, clinical and therapeutic endoscopy, and motor learning, to ensure a breadth of opinion was represented. Members of the core committee were sent a survey, which was open-ended in design. Respondents were asked independently to indicate which variables (both checklist and global rating items) they rely on when assessing the competence of clinicians performing colonoscopy on pediatric patients. Suggested headings, used as prompts, included preprocedural assessment and consent, preparation for procedure, procedural components (technical, cognitive, and nontechnical aspects), and postprocedure care. The published literature on the topic of endoscopic performance and assessment was systematically reviewed for additional variables. Relevant items were extracted from the literature and integrated into the initial pool of checklist and global rating items. The list of items was then distributed to the expert panelists who were asked to comment on the list and identify further indicators as part of the round 1 of the Delphi survey.

Item Reduction

To minimize redundancy, the number of items was initially reduced by combining like items. Two investigators (C.M.W. and S.C.L.) reviewed the checklist and global rating items independently for redundancy, and then met on 2 occasions to compare items and establish consensus where there were differences in opinion.

Further item reduction was accomplished through iterative rounds of Delphi surveys. To optimize response rate, the survey design and distribution process was based on the principles outlined by Dillman's tailored design method (28). Up to 4 contacts were made by e-mail for each round; all correspondence was personalized, and the cover letter was brief. The survey was respondent friendly and used easy-to-use language. Panelists were provided with a link to the online survey. In addition, a printable paper-based version of the survey was provided that they could return via mail or e-mail.

In the first iteration experts were asked to rate the proposed checklist and global rating items on a 1 (“somewhat important”) to 5 (“extremely important”) ordinal scale for their importance as an indicator of the competence of trainees learning to perform colonoscopy on pediatric patients. Panelists were also asked to identify up to 10 global rating and 10 checklist items that they viewed to be critical indicators of the competence of trainees learning to perform colonoscopy. In addition, panelists were given the opportunity to provide open-ended comments. After each round panelists' anonymized responses were analyzed. Checklist and global rating items were removed from subsequent rounds if they had received a mean rating < 4 , and < 5 panelists had assigned a critical rating. The views of all participating experts were given equal weight.

In the subsequent rounds panelists were asked to rate the remaining checklist and global rating items using the same 5-point

ordinal scale, and identify any items that they viewed to be critical. Participants were informed what the group mean score and number of critical ratings was for each item in the preceding round. Once again, they were given the opportunity to comment on the process. Five iterations of the process were carried out until consensus was reached among the panelists. The concept of consensus was defined a priori—80% or more of respondents scored ≥ 4 on all remaining checklist and global rating items.

Item Gradation

Logical gradations and clear definitions for scoring each item are essential to minimize the interobserver variability. To generate an appropriate grading framework, gradations used in similar instruments were analyzed. Delphi group members were asked for their proposed weightings of the items within the checklist and global rating scale. In addition, Delphi panelists were asked to provide feedback on proposed definitions and anchors for each global rating item. All comments were reviewed, and the instrument was refined to reflect consensus opinion.

RESULTS

A total of 41 of the 54 pediatric endoscopy experts contacted agreed to be part of the Delphi panel. Participants were from 28 centers across North America, and they had completed an average of 105 (range 12–400) colonoscopies during the previous year. A total of 24 had >10 years' experience in performing colonoscopy, 11 had performed colonoscopy for 6 to 10 years, and 6 had performed colonoscopy for <5 years. Of the experts who agreed to participate, 41 (100%) completed the first Delphi survey, and 31 (75.61%) completed rounds 2 to 5 of the Delphi process. A total of 0.34% of items had missing ratings across the 5 rounds of surveys.

A total of 274 checklist items (202 from the core committee, 72 from the systematic literature review) and 82 global rating items (core committee 56; systematic literature review 26) were generated initially. These were reduced by C.M.W. and S.C.L. to 73 checklist and 34 global rating items by combining like items (Appendix 1, <http://links.lww.com/MPG/A312>). An additional 2 checklist and 4 global rating items were added by the expert panel during round 1 of the Delphi process.

In round 1, based on a priori criteria, the list was reduced by 3 checklist items and 1 global rating item. Items were retained if the mean score was ≥ 4 and/or ≥ 5 panelists rated them as critical, and the survey was revised to reflect these changes for round 2. In the second round panelists were sent the revised list of items along with the group mean score and the number of critical ratings each item received in round 1. In a few instances items were reworded to increase clarity, based on suggestions generated by the expert panel. Because few items were eliminated in round 1, the purpose of the Delphi process as an item reduction strategy was emphasized in the round 2 survey introduction. In round 2, based on a priori criteria, the list of items was reduced by 33 checklist and 21 global rating items. In rounds 3 and 4, respectively, 11 and 10 checklist items and 4 and 5 global rating items were eliminated.

In the fifth round consensus was reached because $\geq 80\%$ of respondents rated all remaining checklist and global rating items ≥ 4 . A total of 18 checklist items, categorized into 5 domains, and 7 global rating items reached consensus as good indicators of the competence of clinicians performing colonoscopy on pediatric patients (Tables 1 and 2).

Based on a review of the gradations used previously in similar instruments, it was decided to grade checklist items on a dichotomous scale: done correctly; or not done or done incorrectly.

The Delphi panel proposed that the mean weighting for each of the 5 domains of the checklist scale should be preprocedure 14.1% (median 15, range 5%–20%); procedure: technical 35.8% (median 35, range 20%–70%); procedure: cognitive 25.5% (median 25, range 15%–35%); procedure: nontechnical 12.7% (median 10, range 5%–20%); and postprocedure: 11.9% (median 10, range 5%–20%).

Wording of the anchor points for global rating items reflects consensus opinion (Table 3), and 94.7% of the panelists agreed that items within the global rating scale should be weighted equally, with the total scale score being the sum of the scores for all global rating items.

Comparison With Indicators for Colonoscopy in Adults

A comparison of global rating items achieving consensus among experts in pediatric versus adult colonoscopy yielded identical results. There were 3 checklist items that achieved consensus during the pediatric Delphi that did not reach consensus during the adult process: checks equipment functioning; attends to recovery of patient; and advances to terminal ileum. Four items achieved consensus during the adult Delphi but not during the pediatric process: uses withdrawal appropriately; uses abdominal pressure and changes in patient position appropriately; withdraws in an appropriate time; and appropriate documentation (24).

DISCUSSION

The present study is the first step in the rigorous development and validation of the GiECAT_{KIDS}, a procedure-specific index of endoscopy performance for use in evaluating the competence of clinicians performing colonoscopy on pediatric patients. Use of the Delphi technique enabled us to determine the importance of potential indicators of endoscopic competence derived from 2 sources: a systematic literature review and a survey of 41 pediatric endoscopy experts from 28 centers across North America. Of the 113 indicators generated initially, 18 checklist and 7 global rating items reached consensus as being most important and are candidates to be part of the GiECAT_{KIDS}. Consensus within the expert panel was achieved after 5 rounds as reflected by at least 80% of respondents rating all remaining items ≥ 4 . In considering our conceptual framework of endoscopic competence, of the final items, 7 checklist and 5 global rating items are reflective of technical competencies, 1 global rating and 6 checklist items are reflective of cognitive competencies, and 8 checklist and 2 global rating items are reflective of integrative competencies that are required to perform endoscopy safely and proficiently.

Previous measures of competence in performing colonoscopy have been produced; however, none have been developed and validated within the pediatric context. Given the differences between adult and pediatric colonoscopy, there was a need to develop an instrument reflective of pediatric endoscopy practice. Use of Delphi methodology allowed for the development of a pediatric-specific tool designed to assess a broad range of competencies (technical, cognitive, integrative). This technique enabled us to elicit opinions from an international group of participants, a process that should help to promote broad acceptance of the resultant tool and strengthens its content validity.

The finding that the global rating items achieving consensus among pediatric versus adult colonoscopists were identical supports the validity of the Delphi technique. The fact that there were different items on the pediatric versus adult checklists may reflect a number of differences between pediatric and adult colonoscopy. For example, there may be a greater emphasis on

TABLE 1. Checklist items reaching consensus as good indicators of the competence of clinicians performing colonoscopy on pediatric patients

Checklist item	Competency domain	Round 5 mean (SD) (maximum score = 5)	Round 5 consensus level (% rating item ≥ 4)
<i>Preprocedure</i>			
1. Reviews relevant patient information (health records, relevant investigations) and obtains history as appropriate (indications, contraindications, medical history, medications, allergies)	Cognitive and integrative	4.65 (0.55)	96.8%
2. Takes action in response to patient history and investigations where appropriate (eg, prophylactic antibiotics, anesthetic risk factors)	Integrative	4.67 (0.55)	96.7%
3. Demonstrates a sound knowledge of the indications and contraindications to colonoscopy, its benefits and risks, potential alternative investigations and/or therapies, and an awareness of the sequelae of endoscopic or nonendoscopic management	Cognitive	4.74 (0.44)	100.0%
4. Explains to the patient and/or caregivers the perioperative process and procedure (likely outcome, time to recovery, benefits, potential risks/complications, and rates), checks for understanding and addresses concerns and questions	Integrative	4.77 (0.43)	100.0%
5. Checks to ensure the equipment is functioning appropriately (suction, water, air, light, image) before intubation	Technical and cognitive	4.27 (0.91)	83.3%
<i>Procedure—technical</i>			
6. Recognizes loop formation and avoids or reduces appropriately during the procedure (using pullback, torque, external pressure, patient position change)	Technical	4.74 (0.44)	100.0%
7. Uses rotation and/or torque appropriately	Technical	4.39 (0.67)	90.3%
8. Advances to cecum (in an appropriate time)	Technical	4.61 (0.80)	96.8%
9. Advances to terminal ileum (in an appropriate time)	Technical	4.58 (0.50)	100.0%
10. Withdraws endoscope in a controlled manner	Technical	4.68 (0.65)	90.3%
11. Performs therapeutic maneuvers (biopsy and/or polypectomy) independently, appropriately, and safely	Technical	4.48 (1.0)	87.1%
<i>Procedure—cognitive</i>			
12. Demonstrates recognition of anatomical landmarks (rectum, flexures, ileocecal valve, appendiceal orifice, etc) and/or incomplete examination	Cognitive	4.68 (0.60)	93.6%
13. Demonstrates recognition of pathological and anatomical abnormalities	Cognitive	4.74 (0.51)	96.8%
14. Describes findings accurately, interprets abnormalities in the context of the patient, and selects the appropriate strategy/technique to deal with them	Integrative	4.84 (0.52)	93.6%
<i>Procedure—nontechnical aspects</i>			
15. Administers sedation appropriately (type, dose), monitors the patient's vitals and comfort level throughout the procedure, and responds appropriately and/or demonstrates appropriate interaction with the anesthetist to ensure appropriate sedation and monitoring throughout the procedure	Cognitive and integrative	4.26 (0.96)	80.7%

(Continued)

TABLE 1. (Continued)

Checklist item	Competency domain	Round 5 mean (SD) (maximum score = 5)	Round 5 consensus level (% rating item ≥ 4)
16. Demonstrates appropriate interaction and communication with the procedure nurses and/or assistants throughout the procedure	Integrative	4.53 (0.68)	90.0%
<i>Postprocedure</i>			
17. Attends to recovery of patient (ie, monitoring, checking for, and managing complications as required)	Integrative	4.16 (0.73)	87.1%
18. Educates the patient and/or caregiver about the colonoscopic findings (explanation, significance) and follow-up plan, and provides advice regarding potential postprocedure complications, recommended course of action, etc	Integrative	4.77 (0.50)	96.8%

SD = standard deviation.

the need for terminal ileum intubation based on the differing indications for colonoscopy in children as compared with adults (5) (eg, evaluation of suspected inflammatory bowel disease is a common indication for colonoscopy in children,

whereas colorectal cancer screening/surveillance is the most common indication in adults). Although both abdominal pressure and changes in patient position are known to be effective ancillary maneuvers to aid scope advancement (29–31), it is

TABLE 2. Global rating items reaching consensus as good indicators of the competence of clinicians performing colonoscopy on pediatric patients

Global rating item	Definition	Competency domain	Round 5 mean (SD) (maximum score = 5)	Round 5 consensus level (% rating item ≥ 4)
1. Technical skill	Demonstrates an ability to manipulate the endoscope using angulation control knobs, advancement/withdrawal, and torque steering for smooth navigation	Technical	4.87 (0.56)	96.8%
2. Strategies for scope advancement	Demonstrates an ability to use insufflation, pullback, suction, loop reduction, external pressure, and patient position change to advance the endoscope independently, expediently, and safely	Technical	4.68 (0.60)	93.5%
3. Visualization of mucosa	Demonstrates an ability to maintain a clear luminal view required for safe scope navigation and complete mucosal evaluation	Technical	4.84 (0.37)	100.0%
4. Independent procedure completion (need for assistance)	Demonstrates an ability to complete the procedure expediently and safely without verbal and/or manual guidance	Technical	4.39 (0.62)	93.5%
5. Knowledge of procedure	Demonstrates general procedural knowledge including procedural sequence, endoscopy techniques, equipment maintenance and troubleshooting, indications and contraindications, and potential complications	Cognitive	4.68 (0.60)	93.5%
6. Interpretation and management of findings	Demonstrates an ability to accurately identify, interpret, and appropriately manage pathology and/or complications	Integrative	4.74 (0.51)	96.8%
7. Patient safety	Demonstrates an ability to perform the procedure in a manner that minimizes patient risk (atraumatic technique, minimal force, minimal redout, recognition of personal and procedural limitations, safe sedation practices)	Technical and integrative	4.87 (0.43)	96.8%

SD = standard deviation.

TABLE 3. Global rating scale anchors

1	Unable to achieve tasks despite significant verbal and/or hands-on guidance
2	Achieves some of the tasks but requires significant verbal and/or hands-on guidance
3	Achieves most of the tasks independently, with minimal verbal and/or manual guidance
4	Competent for independent performance of all tasks without the need for any guidance
5	Highly skilled advanced performance of all tasks

possible that they are more commonly used when performing colonoscopy in adults, as compared with children.

As a consensus technique, the Delphi process enabled us to elicit opinions from a diverse group of geographically dispersed pediatric endoscopy experts in an anonymous fashion. Panelists, who represent approximately 3% of North American pediatric gastroenterologists, were specifically chosen to represent a variety of viewpoints and a wide geographic area to ensure a breadth of opinion. The anonymous nature of the Delphi process is thought to minimize the detrimental effects of group interactions because it allows panelists to express their own opinions without bias introduced by the effects of prejudice, social pressures, and interpersonal relationships (32). In addition, use of the Delphi technique should help to facilitate rapid knowledge transfer, effective uptake, and acceptance of the resultant tool, through the early involvement of key opinion leaders. The systematic approach that we have used to identify pertinent performance indicators strengthens the content and face validity of the GiECAT_{KIDS} (33).

Although the Delphi technique is considered one of the most optimal methods of eliciting and refining expert opinion (26), there are several limitations to this methodology. Critics suggest that the Delphi process may be subject to bias because the scope of the issue under consideration is, to some degree, controlled by the investigators (22). To mitigate this issue, our item-generation process was designed to help ensure a broad conceptualization of endoscopic competence. A survey of core committee members, a systematic review of the literature, and input from Delphi panelists were used to generate an extensive list of potential indicators. In the literature there are no formal guidelines for selection of the expert panel in terms of size or composition. To minimize this issue we defined selection criteria a priori to help ensure that panelists were representative of a wide geographic area and had broad expertise in pediatric endoscopy. We were, however, limited by the fact that participating experts were from North America and their opinions may differ from pediatric endoscopists in other jurisdictions. We aimed to include at least 30 experts because it has been observed that there are only minimal improvements in the reliability of a group's aggregate judgment beyond 30 panelists (26). Finally, Delphi methodology requires a continued commitment from the panelists. Although only 31 of the 41 (75.61%) experts who agreed to participate completed 5 rounds of surveys, this response rate is higher than the 70% response rate required for each round to maintain external validity (34).

The results of our study also substantiate the fact that performance of colonoscopy in children differs from colonoscopy in adults in a number of ways such as patient preparation, sedation, technique, the frequency with which terminal ileum intubation is desirable, and the spectrum of therapeutic manipulations used. In the same way that performance of colonoscopy in children requires pediatric-specific medical knowledge and technical competency (5), assessment of pediatric endoscopists requires use of a tool that has been developed and validated within the pediatric context. Key

differences in checklist items between the pediatric and adult Delphi processes highlight the differential nature of pediatric and adult colonoscopy and the need for pediatric-specific training and assessment processes. As a next step we plan to assess the reliability, validity, and responsiveness of the GiECAT_{KIDS} within the clinical setting. In the long term we aim to create a validated instrument that can be used throughout the learning cycle, from training to accreditation to independent practice, to aid in the assessment of competency in pediatric colonoscopy.

In conclusion, the use of the Delphi technique enabled us to develop a pediatric-specific measure of endoscopic competence. We note that the guidelines for training in pediatric gastroenterology (5) outline 3 requirements for the evaluation of trainees performing procedural skills: direct observation of performance, evaluation to promote improvement and avoid errors, and documentation of skills. Development of a validated assessment tool will serve to aid all of the above-mentioned aspects of trainee evaluation through the provision of a framework on which supervising attending physicians can structure their direct observations to generate constructive and informative feedback and formally document trainees' skills over time. The development of a reliable and valid measure of competence also has the potential to facilitate the evaluation of novel teaching methods (eg, simulation) and to strengthen future research aimed at identifying predictors of quality of endoscopic care.

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