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Faecal impaction in children aged 0–18 years: a systematic review and metanarrative analysis of definitions used

Morris Gordon ¹, Amber Balda,² Samantha Arrizabalo,² Vassiliki Sinopoulou ¹, Stephanie Batarseh,³ Jina Shargawi,³ Carlo Di Lorenzo,⁴ Marc A Benninga,⁵ Merit Tabbers,⁵ Miguel Saps²

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¹School of Medicine, University of Central Lancashire, Preston, UK

²University of Miami Miller School of Medicine, Miami, Florida, USA

³University of Central Lancashire, Preston, UK

⁴Nationwide Children's Hospital, Columbus, Ohio, USA

⁵Pediatric Gastroenterology and Nutrition, Emma Children's Hospital UMC, Amsterdam, Noord-Holland, The Netherlands

Correspondence to
Professor Morris Gordon;
Mgordon@uclan.ac.uk

ABSTRACT

Background Faecal impaction is the result of functional constipation in the majority of cases. Surprisingly, a uniform definition for the term faecal impaction is lacking, leading to heterogeneity across study results.

Aim To conduct a metanarrative systematic review to ascertain how trial studies define faecal impaction among children aged 0–18 years with functional constipation.

Methods We conducted a systematic metanarrative review to uncover what criteria are used to define faecal impaction and to recommend directions for creating a globally accepted definition. A comprehensive literature search was conducted using prominent databases, including CENTRAL, MEDLINE, Embase, WHO ICTR (international clinical trials registry) and ClinicalTrials.gov. All relevant publications of RCTs on both faecal impaction and functional constipation from inception to June 2024, including children aged 0–18 years without underlying organic aetiology, were included.

Results 6211 studies were screened, of which 155 were reviewed for eligibility, 76 were included in the review and five are awaiting classification. Seven studies gave an explicit definition, with three referencing a previous consensus definition. 45 studies gave an implicit definition derived from their prescreening or exclusion criteria in a larger piece of research. Clinical assessment was the most common element of definitions, with a mixture of abdominal or rectal assessments reported in 44 studies. A further six studies suggested such clinical assessments are combined with radiographs, and one study reported a definition using radiographs alone. One study reported the duration of symptoms in a definition.

Conclusion There is a clear lack of consensus for defining faecal impaction in children with functional constipation. Despite the clinical, diagnostic and prognostic importance of having a unified definition of faecal impaction, currently there seems to be no universally accepted definition.

INTRODUCTION

Functional constipation (FC) is defined by the Rome IV criteria as a disorder of gut–brain interaction.¹ FC is a common clinical entity in children and is associated with a reduced

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Faecal impaction is a common and potentially serious condition among children aged 0–18 years with functional constipation. Nonetheless, an unambiguous definition does not exist.

WHAT THIS STUDY ADDS

⇒ The current literature shows a severe lack of consensus among definitions used in children with faecal impaction. Some studies have included no definition, and almost all implicitly defined faecal impaction.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ This metanarrative review can lead to recommending directions for creating a globally accepted definition or alternatively discourage the use of the term to describe a standalone clinical paradigm. This clarity will aid in comparing results among studies, co-ordinating appropriate care and improving the utility of clinical practice guidelines.

health-related quality of life.² In a systematic review that meta-analysed 33 paediatric studies from around the globe, FC reported a pooled prevalence of 9.5% (95% CI 7.5 to 12.1).³ FC also incurs considerable healthcare costs estimated to be up to \$3.9 billion annually.⁴

Faecal impaction is a common problem in children with constipation.^{5 6} Timely identification of the impaction minimises complications and poor outcomes.⁷ Multiple items of the Rome IV criteria for FC refer to faecal impaction. Those include a history of large-diameter stools and the presence of large faecal mass in either the abdomen or the rectum. Additionally, the Rome IV criteria recommend differentiating patients with IBS-C (Irritable bowel syndrome–constipation

predominant) from FC, based on the resolution of pain after disimpaction.¹

Overall, there is a gap in the literature for investigating faecal impaction in children with constipation. Some controlled trials and research studies' protocols specifically call for the inclusion or exclusion of participants with faecal impaction.^{8–12} However, a clear definition of faecal impaction is seldom explicitly stated. A precise definition is vital to compare results across studies and for understanding treatment success and failures. Despite the clinical, diagnostic and prognostic importance of having a unified definition of faecal impaction, there is no universally accepted definition for faecal impaction.¹³ Previous researchers have attempted to define faecal impaction. In an effort to mitigate this gap, in 2005, the Paris Consensus on Childhood Constipation Terminology (PACCT) group sought to define faecal impaction. They defined it as the accumulation of hard stools in the rectum or colon with the unlikely ability to pass them spontaneously. They also stated that it should be assessed by physical examination or by abdominal radiography when appropriate.¹³ However, this definition has not been widely taken up, and faecal impaction is not specifically recognised as a clinical paradigm within the ROME criteria.¹ It is unclear if this suggests that the issue is unsolved and a definition is outstanding or whether such a clinical standalone paradigm is not appropriate. Randomised controlled trials are the gold standard for research and are subjected to significant ethical, financial and funding scrutiny. As such, understanding how this condition is defined within such studies has the potential to capture the current operational and most detailed definitions used in practice. We conducted a systematic review to unveil what criteria are currently used to define faecal impaction and to recommend directions for creating a globally accepted definition.

METHODS

The review adhered to the methodologies outlined in a prospectively registered protocol in PROSPERO (CRD42022371846). The project was exempt from full IRB (Institutional research board) requirements for ethical approval. Patient involvement was not part of the scope of the review.

Literature search

A comprehensive literature search was conducted using prominent databases, including CENTRAL, MEDLINE, Embase, WHO ICTR and ClinicalTrials.gov (online supplemental search strategy). Ages ranging from 0 to 18 years were included in the search. Additional hand searches of all Cochrane systematic reviews on chronic constipation were completed, and all such primary studies were checked to evaluate if any explicit or implicit definition of faecal

impaction was reported and included if this was the case. The Meta-Analysis PRISMA 2020 checklist and Reporting Items for Systematic Reviews were followed for reporting.¹⁴

Inclusion criteria

All relevant randomised controlled trials from inception to April 2024 on faecal impaction in children were eligible.

Type of participants

Paediatric patients with faecal impaction or patients with FC between the ages of 0 and 18 years.

Type of intervention

Any interventions, drug dosages or absence of intervention were considered eligible as the specific interventions were not the focus of the review.

Type of outcome

Any outcome measures.

Exclusion criteria

Studies that exclusively focused on adults were excluded. Additionally, studies that were written in another language, opinion papers, commentaries, editorials, secondary evidence and review articles and other non-interventional articles were also not included in the review.

Screening

Titles and abstracts of studies were screened independently by two authors (SB and JS) for eligibility. Full papers containing pertinent information were retrieved and subsequently examined by two authors (AB and SA). A third author (VS or MG) resolved disagreements.

Data extraction

Data extraction was conducted on publications that met inclusion criteria and did not meet the exclusion criteria. The extraction was completed in duplicate by three authors (AB, SB and SA), and disagreements were resolved by a fourth author (MG or VS). Data were extracted using the designated headings:

- ▶ Definitions for fecal impaction
- ▶ Reference for definition utilized (if applicable)
- ▶ Classification of definition as explicit or implicit
- ▶ Inclusion criteria
- ▶ Exclusion criteria
- ▶ Type of study
- ▶ Age of inclusion
- ▶ Location(s) of study

The extraction process was recorded manually within a database file.

Definition of faecal impaction

Studies were organised based on the designated type of definition: explicit or implicit. A common theme among definitions used was identified.

- ▶ Mention of a time frame within the definition

- ▶ Reference
- ▶ Previous therapy
- ▶ Mention of constipation
- ▶ Mention of bowel frequency at the time of definition
- ▶ Method of clinical assessment
- ▶ Terminology used for faecal impaction, including faecaloma, faecal mass and faecalith.

We followed a metanarrative approach, which emphasised the similarities and differences observed among definitions. The execution of this method adhered to the RAMESES (Realist And MEta-narrative Evidence Syntheses: Evolving Standards) publication standards for metanarrative reviews as outlined by Wong *et al.*¹⁵

Data analysis

The data collection process focused on categorical data. All data are presented in the format of tables and figures. No numerical data were analysed in the review.

Risk of bias assessment

Bias analysis is not applicable, as the included studies' level of bias does not affect the definition of faecal impaction. This metanarrative review focuses solely on the definition as its exclusive outcome of interest.

RESULTS

A total of 6211 studies were identified in a search conducted in April, 6055 of which were excluded as they did not meet the inclusion criteria for this review. 155 studies were retrieved for eligibility. 74 studies were excluded: wrong population, duplicates, non-interventional studies, missing information to judge inclusion and five studies are awaiting classification (response awaited from authors or translations are unclear). A total of 76 studies (75 full papers and one abstract)^{6 12 16–89} were included for full extraction (figure 1) with details in the online supplemental table 1.

Reports of definitions

Among the 76 studies, 52 studies^{6 16–27 29–34 36–39 41 44–49 51 53 54 56–59 61–67 70 72 73 76–78 80 81} reported a definition for faecal impaction. Among these, seven studies^{6 16–21} provided an explicit definition, while 45 studies^{22–27 29–34 36–39 41 44–49 51 53 54 56–59 61–67 70 72 73 76–78 80 81} offered an implicit one. In total, 24 studies^{12 28 35 40 42 43 50 52 55 60 68 69 71 74 75 79 82–89} did not report a definition for faecal impaction. The details of the different aspects of definitions among the studies are provided in figure 2.

Terminology for faecal impaction

Faecal impaction was explicitly mentioned in the majority of studies. Four studies^{17 25 47 89} used the term 'faecal retention' but none defined or referenced this. In supporting the diagnosis and describing clinical assessment, faecaloma was mentioned in 10 studies and faecal mass in 21.

Out of the seven studies^{6 16–21} which provided an explicit definition of faecal impaction, only three

studies^{6 18 20} included a reference for the definition. For clinical assessment, two studies^{16 21} included abdominal and rectal examination, one study included abdominal or rectal examination for a mass,²⁰ two studies^{6 17} included both abdominal and rectal examinations along with an abdominal X-ray, one study included abdominal and rectal examinations or abdominal X-ray¹⁹ and one study¹⁸ included a rectal examination and an abdominal X-ray. None of the studies mentioned the duration of the symptoms.

The 45 studies^{22–27 29–34 36–39 41 44–49 51 53 54 56–59 61–67 70 72 73 76–78 80 81} with an implicit definition were reported in the context of constipation trials where faecal impaction had been treated before study entry or was an exclusion criterion, and the description or definition used in that context was recorded. The clinical assessments were more variable than the explicit definitions. Five studies^{22 33 49 70 72} reported an abdominal examination, 15 studies^{25 29 37 38 41 44 47 56 57 61 64–67 81} a rectal examination, 21 studies^{24 26 27 30 31 34 36 39 48 51 53 54 58 59 62 63 73 76–78 80} both abdominal and rectal examinations, one study⁴⁶ an abdominal X-ray, one study⁴⁵ a rectal examination and an abdominal X-ray and one study²³ both abdominal and rectal examinations along with an abdominal X-ray. Among all reports, only a single study³² reported a time-frame for the symptoms, specifying no defecation for >5 days. No study mentioned prior experience or failure of treatment as an element of a definition.

DISCUSSION

The clinical presentation of faecal impaction is a common complication of constipation in children.⁹⁰ It is important to have a consistent and unambiguous definition to compare results among studies, coordinate appropriate care and improve clinical outcomes.

Based on this metanarrative analysis, it is clear that a uniform definition for faecal impaction among children does not exist. Although the PACCT group sought to mitigate this crucial gap,¹³ still only three studies out of the 76 included in this review referred to this publication,^{6 18 20} and most that did not deviated from it. The prevalence of having definitions at all was an issue, with most of those included being implicit in the context of wider discussion or study of constipation. This juxtaposes with a recent study considering a definition for therapy-resistant constipation, which included fewer studies but had more explicit reports of definitions.⁹¹ It is therefore unclear as to whether the lack of definition reflects an appropriate rejection of faecal impaction as a stand-alone sequelae of constipation, and rather it should be seen as a symptom within childhood constipation, perhaps existing within the context of the aforementioned therapy-resistant constipation.⁹¹

The majority of studies did not specify the duration of past symptoms or the length of time participants had experienced faecal impaction or absence of stooling. Only one study³¹ mentioned the duration of impaction. The

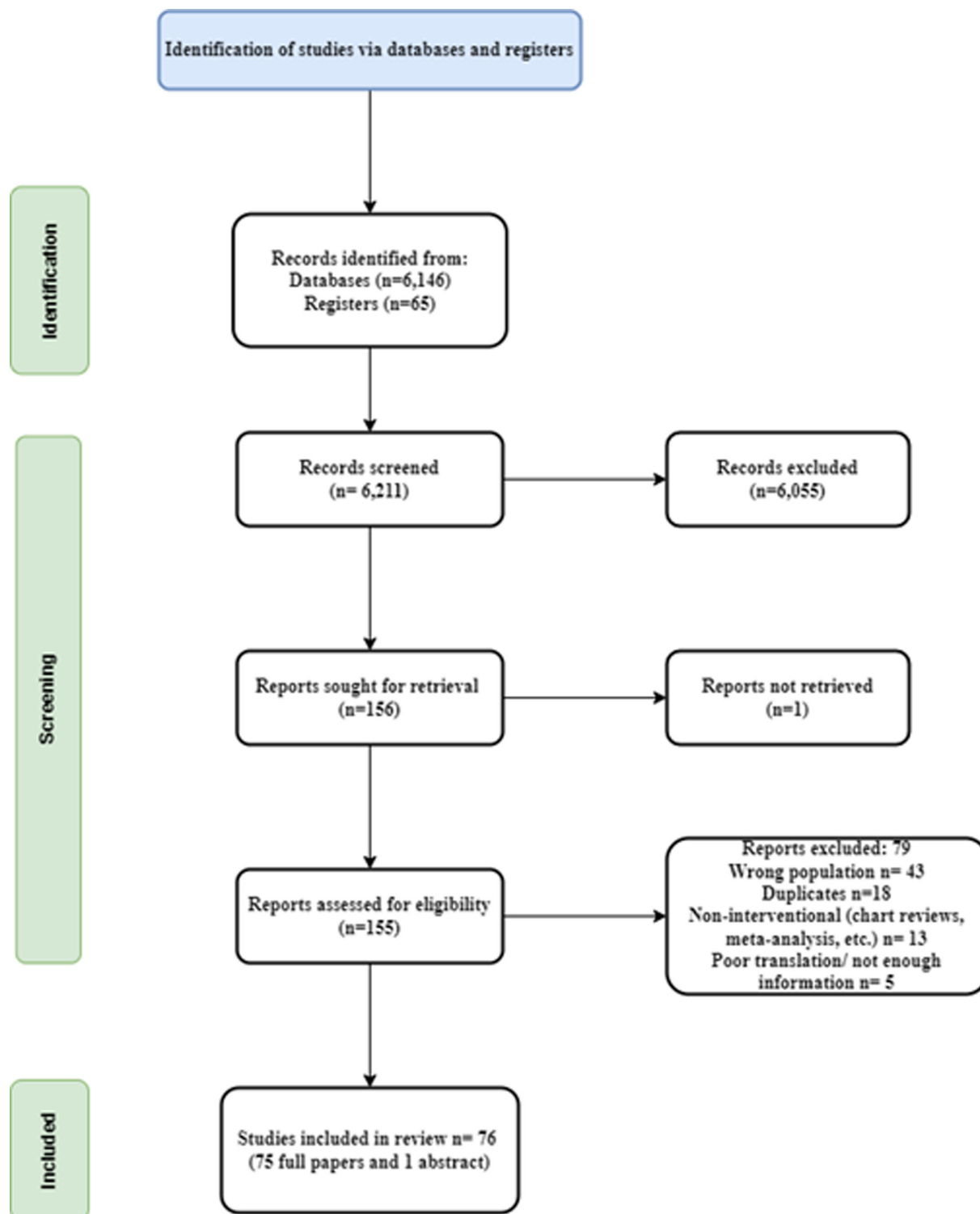


Figure 1 PRISMA flowchart. PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

previous PACCT definition did not explicitly mention the timing of symptoms but did state it should 'be unlikely to pass by itself'. It is potentially important to consider time as a factor in order to prevent normal faecal impaction from being diagnosed when stool consistency may be hard, and so the clinical distinction between constipation and impaction may become difficult.

The majority of definitions in the reviewed studies, as detailed above, incorporated core clinical characteristics for assessment. In summary, five studies mentioned conducting abdominal physical examination to detect palpable masses indicative of faecal impaction. For the assessment of hard stools, 15 studies reported performing digital rectal examination to evaluate stool consistency

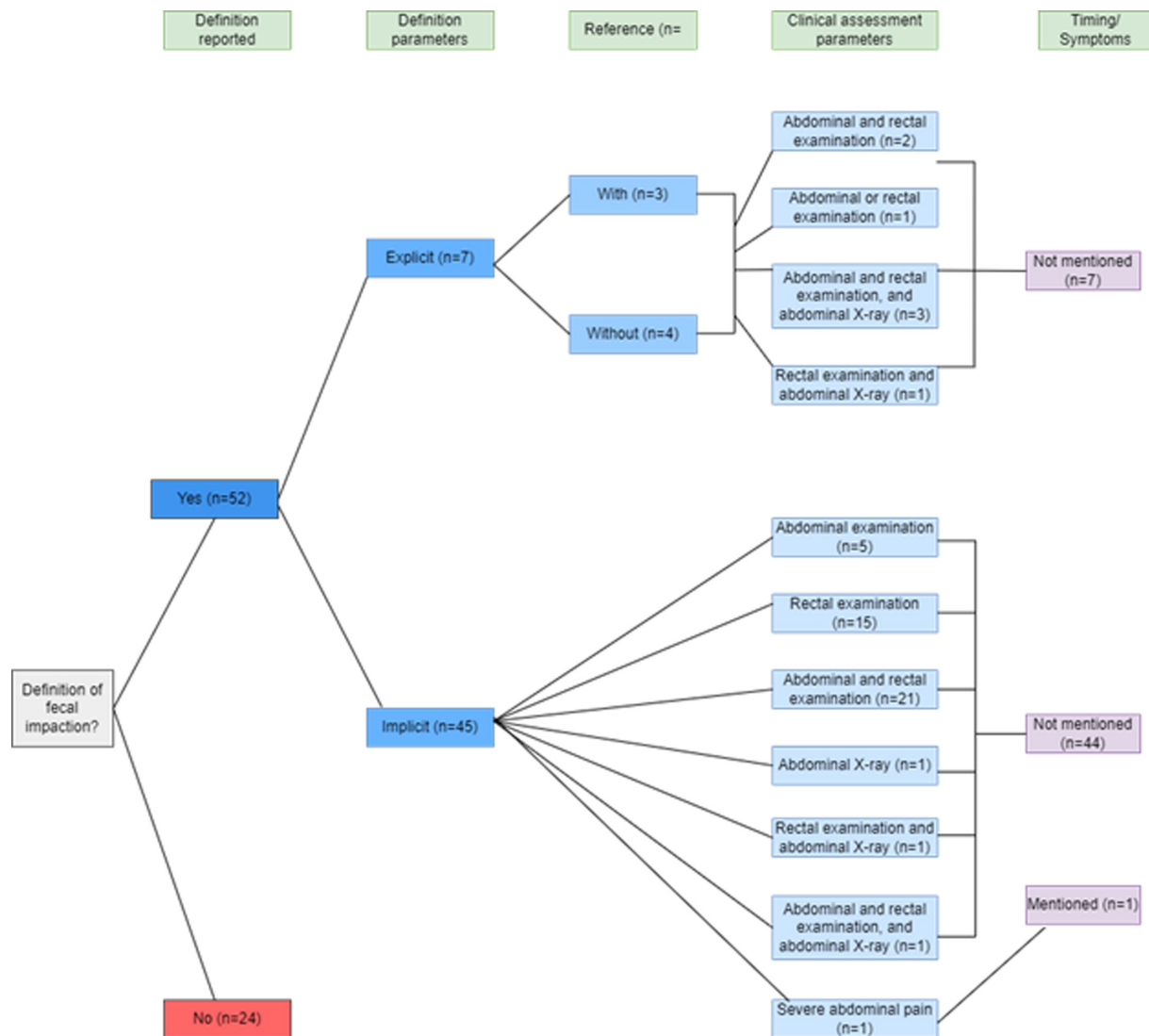


Figure 2 Visual summary of the contents of definitions for the included studies in the analysis for faecal impaction in children. Explicit definition;^{6 16–21} implicit definition;^{22–27 29–34 36–39 41 44–49 51 53 54 56–59 61–67 70 72 73 76–78 80 81} and no definition.^{12 28 35 40 42 43 50 52 55 60 68 69 71 74 75 79 82–89}

in the rectum. 24 studies included both abdominal and rectal examination.

It is quite surprising to see such frequent reports of rectal examination in children. Notably, just one study avoided this examination to prevent exacerbating the fear associated with defecation. The common use of rectal examination is well recognised historically, and its role in these more recent studies could^{92 93} be related to its importance in infants or newborns not passing faeces, where most guidelines support such an examination in order to demonstrate anatomical anomalies^{94 95} or in Hirschsprung's disease. Paradoxically, recent guidance⁹⁴ suggests that in older children, this examination is usually reserved for experts and is not routinely used to assess faecal impaction. However, some reports still highlight its importance in a few cases where other methods are ineffective.⁹⁶ Thus, the question of digital rectal examination in the diagnosis of faecal impaction is perhaps the element that is the most controversial, and any definition

needs to carefully consider whether to include it. Given the lack of a consensus on whether the entity should even be recognised as a stand-alone clinical paradigm, this would seem to be a further barrier to proposing the use of rectal examination outside of the specific contexts noted.

Finally, x-rays were mentioned in seven studies in varying combinations with clinical assessment. Abdominal X-ray alone was mentioned by one study, rectal examination and abdominal X-ray by two studies and both abdominal and rectal examination with abdominal X-ray by four studies. This finding is interesting as the broader field of disorders of gut–brain interaction has very much moved away from radiographs to diagnose constipation, but exceptions are often made in chronic or difficult cases, such as intractable constipation.⁹⁷ Given that so few studies mentioned this, the use of radiograph appears to not be based on a consensus in the context of faecal impaction, and it is worth noting that where a role may

exist, other imaging means such as transabdominal ultrasound may have a role.⁹⁸ It is once again worth reflecting that perhaps the lack of a clear definition or even the clear statement that such a clinical paradigm should not be recognised is allowing a gap in which radiographs are finding a role in practice when this should not be the case. As such, clarifying this definition issue may be key to addressing their role or lack thereof.

This review has several strengths. It involved a meticulous search across numerous databases to gather pertinent literature, encompassing every available paper and abstract addressing faecal impaction in children. The articles selected provided both explicit and implicit definitions, enabling us to thoroughly dissect the components necessary to craft a scientific definition of faecal impaction. The decision not to filter out articles based on the quality of their assessment was made as it was believed it did not influence the definition of faecal impaction, but this may be considered a methodological weakness. A final key limitation is the focus on randomised controlled trials. Searching more broadly could have included more definitions, but when a pilot search was performed using key terms without filtering for trials, very few reports that mentioned the condition gave any form of reference or definition, and so these were not considered.

It is important to establish consensus on a definition for this clinical paradigm. As many aspects of the different definitions given in the literature directly inform the choice of therapeutic goals for patients, professionals and researchers, clarity on these definitions will directly inform such practice. It appears that the use of the term is associated with a lack of consensus on clinical presentations and perhaps more importantly, it uses methods that are not acceptable or even common in current paediatric practice. We believe a single consensus definition is needed to clarify the scope of this paradigm, set realistic goals for disimpaction prior to the maintenance of therapy for constipation and ensure understanding in the context of the broader clinical paradigms of constipation and treatment-resistant constipation.

The author team, having worked with the literature during this review, considered devising a definition to form the basis of further discussions. The team's initial consensus proposal was:

Faecal impaction in childhood is defined as a prolonged period of passing no stool per rectum, associated with previously hard and difficult to pass stools (with a scale of Bristol 1 or 2) and clinical evidence of hard faeces (eg, palpable abdominal mass).

However, the process of considering this definition has raised a number of issues of concern and consternation. This does not give a specific length of time for symptoms, which is similar to most current publications. However, this risks considering cases of intractable or even untreated constipation that align with the ROME IV criteria as being impacted. It also may have some practical limitations without being

explicit on the length of symptoms. There was also discussion regarding how clinical evidence is gathered and whether this should be specified at all in the definition. The role of rectal examination, as an invasive intervention that is clearly controversial as discussed above, was also of concern.

This process highlighted the need for a formal study to reach multistakeholder and multinational agreement on any such definition to ensure clinical validity and utility. It is entirely possible that the outcome of such a process may be to actively discourage the recognition of impaction as a stand-alone clinical entity and in doing so allow clarity on some of the diagnostic aspects of concern. It is therefore suggested that such a process should be as clinically and globally inclusive as possible to clarify this situation.

CONCLUSION

There is a clear lack of consensus for defining faecal impaction in children with FC. The reports focused on abdominal, rectal or X-ray examination, but with little consensus. Definitions did not consider the duration of impaction symptoms or the presence of other indicator symptoms such as incontinence. Despite the clinical, diagnostic and prognostic importance of having a unified definition of faecal impaction, currently, there is no universally accepted definition, and future work is needed to reach a consensus on this or whether this clinical paradigm should not be recognised as a stand-alone entity but rather as a part of wider constipation.

X Morris Gordon @drmorrisgordon

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ORCID iDs

Morris Gordon <http://orcid.org/0000-0002-1216-5158>

Vassiliki Sinopoulou <http://orcid.org/0000-0002-2831-9406>

REFERENCES

- Hyams JS, Di Lorenzo C, Saps M, et al. Functional Disorders: Children and Adolescents. *Gastroenterology* 2016.
- Vriesman MH, Rajindrajith S, Koppen IJN, et al. Quality of Life in Children with Functional Constipation: A Systematic Review and Meta-Analysis. *J Pediatr* 2019;214:141–50.
- Koppen IJN, Vriesman MH, Saps M, et al. Prevalence of Functional Defecation Disorders in Children: A Systematic Review and Meta-Analysis. *J Pediatr* 2018;198:121–30.
- Liem O, Harman J, Benninga M, et al. Health utilization and cost impact of childhood constipation in the United States. *J Pediatr* 2009;154:258–62.
- van Ginkel R, Reitsma JB, Büller HA, et al. Childhood constipation: longitudinal follow-up beyond puberty. *Gastroenterology* 2003;125:357–63.
- Bekkali N-L-H, van den Berg M-M, Dijkgraaf MGW, et al. Rectal fecal impaction treatment in childhood constipation: enemas versus high doses oral PEG. *Pediatrics* 2009;124:e1108–15.
- Hussain ZH, Whitehead DA, Lacy BE. Fecal impaction. *Curr Gastroenterol Rep* 2014;16:404.
- Elkaraghy ES, Shamsya MM, Metwally RH, et al. Efficacy of lubiprostone for functional constipation treatment in adolescents and children: Randomized controlled trial. *J Pediatr Gastroenterol Nutr* 2024;78:800–9.
- Benninga MA, Hussain SZ, Sood MR, et al. Lubiprostone for Pediatric Functional Constipation: Randomized, Controlled, Double-Blind Study With Long-term Extension. *Clin Gastroenterol Hepatol* 2022;20:602–10.
- Hyman PE, Di Lorenzo C, Prestridge LL, et al. Lubiprostone for the treatment of functional constipation in children. *J Pediatr Gastroenterol Nutr* 2014;58:283–91.
- Worona-Dibner L, Vázquez-Frias R, Valdez-Chávez L, et al. Efficacy, safety, and acceptability of polyethylene glycol 3350 without electrolytes vs magnesium hydroxide in functional constipation in children from six months to eighteen years of age: A controlled clinical trial. *Rev Gastroenterol Mex (Engl Ed)* 2023;88:107–17.
- Mugie SM, Korczowski B, Bodi P, et al. Prucalopride is no more effective than placebo for children with functional constipation. *Gastroenterology* 2014;147:1285–95.
- Benninga M, Candy DCA, Catto-Smith AG, et al. The Paris Consensus on Childhood Constipation Terminology (PACCT) Group. *J Pediatr Gastroenterol Nutr* 2005;40:273–5.
- Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ* 2021;372:n71.
- Wong G, Greenhalgh T, Westhorp G, et al. RAMESES publication standards: meta-narrative reviews. *BMC Med* 2013;11:20.
- Bellomo-Brandão MA, Collares EF, da-Costa-Pinto EAL. Use of erythromycin for the treatment of severe chronic constipation in children. *Braz J Med Biol Res* 2003;36:1391–6.
- Miller MK, Dowd MD, Friesen CA, et al. A randomized trial of enema versus polyethylene glycol 3350 for fecal disimpaction in children presenting to an emergency department. *Pediatr Emerg Care* 2012;28:115–9.
- Shatnawi MS, Alrwalah MM, Ghanma AM, et al. Lactulose versus polyethylene glycol for disimpaction therapy in constipated children, a randomized controlled study. *Sudan J Paediatr* 2019;19:31–6.
- Vadlapudi SPU, Sen Sarma M. Home-based disimpaction with polyethylene glycol (PEG) in children with functional constipation: is it the way forward? A randomised control trial. *J Gastroenterol Nutr* 2022;2:464–5.
- van der Plas RN, Benninga MA, Büller HA, et al. Biofeedback training in treatment of childhood constipation: a randomised controlled study. *Lancet* 1996;348:776–80.
- Youssef NN, Peters JM, Henderson W, et al. Dose response of PEG 3350 for the treatment of childhood fecal impaction. *J Pediatr* 2002;141:410–4.
- Abi Nader E, Roche O, Jais J-P, et al. The use of biofeedback for children with fecal incontinence secondary to retentive constipation: Experience of a French Pediatric Center. *Clin Res Hepatol Gastroenterol* 2021;45:101550.
- Acharyya BC, Bhattacharyya C, Mukhopadhyay M, et al. Polyethylene Glycol Plus Electrolytes with Stimulant Laxative in Paediatric Faecal Disimpaction: A Randomised Controlled Study. *Pediatr Gastroenterol Hepatol Nutr* 2021;24:230–7.
- Ala S, Haghighat M, Dehghani SM, et al. Response and Recurrence Rate After Treatment With Polyethylene Glycol Versus Polyethylene Glycol Plus Lactulose in Children With Chronic Functional Constipation: A Randomized Controlled Trial. *J Compr Ped* 2015;6.
- Amendola S, De Angelis P, Dall'oglio L, et al. Combined approach to functional constipation in children. *J Pediatr Surg* 2003;38:819–23.
- Banaszkiewicz A, Szajewska H. Ineffectiveness of Lactobacillus GG as an adjunct to lactulose for the treatment of constipation in children: a double-blind, placebo-controlled randomized trial. *J Pediatr* 2005;146:364–9.
- Bastürk A, Artan R, Atalay A, et al. Investigation of the efficacy of synbiotics in the treatment of functional constipation in children: a randomized double-blind placebo-controlled study. *Turk J Gastroenterol* 2017;28:388–93.
- Bekkali NLH, Hoekman DR, Liem O, et al. Polyethylene Glycol 3350 With Electrolytes Versus Polyethylene Glycol 4000 for Constipation: A Randomized, Controlled Trial. *J Pediatr Gastroenterol Nutr* 2018;66:10–5.
- Blanco Díaz M, Bousoño García C, Segura Ramírez DK, et al. Manual Physical Therapy in the Treatment of Functional Constipation in Children: A Pilot Randomized Controlled Trial. *J Altern Complement Med* 2020;26:620–7.
- Bongers MEJ, de Looij R, Reitsma JB, et al. The clinical effect of a new infant formula in term infants with constipation: a double-blind, randomized cross-over trial. *Nutr J* 2007;6:8.
- Bongers MEJ, van den Berg MM, Reitsma JB, et al. A randomized controlled trial of enemas in combination with oral laxative therapy for children with chronic constipation. *Clin Gastroenterol Hepatol* 2009;7:1069–74.
- Bu LN, Chang MH, Ni YH, et al. Lactobacillus casei rhamnosus Lcr35 in children with chronic constipation. *Pediatr Int* 2007;49:485–90.
- Candy DCA, Edwards D, Geraint M. Treatment of faecal impaction with polyethylene glycol plus electrolytes (PEG + E) followed by a double-blind comparison of PEG + E versus lactulose as maintenance therapy. *J Pediatr Gastroenterol Nutr* 2006;43:65–70.
- Cao Y, Liu S. Lactulose for the treatment of Chinese children with chronic constipation. *Medicine (Baltimore)* 2018;97:e13794.
- Cassetari VMG, Machado NC, Lourenço P de A, et al. Combinations of laxatives and green banana biomass on the treatment of functional constipation in children and adolescents: a randomized study. *J Pediatr (Rio J)* 2019;95:27–33.
- Chmielewska A, Horvath A, Dziechciarz P, et al. Glucosaminan is not effective for the treatment of functional constipation in children: a double-blind, placebo-controlled, randomized trial. *Clin Nutr* 2011;30:462–8.
- Coccorullo P, Strisciuglio C, Martinelli M, et al. Lactobacillus reuteri (DSM 17938) in infants with functional chronic constipation: a double-blind, randomized, placebo-controlled study. *J Pediatr* 2010;157:598–602.
- Dehghani SM, Bahrololomifard MS, Yousefi G, et al. A randomized controlled double blinded trial to evaluate efficacy of oral administration of black strap molasses (sugarcane extract) in comparison with polyethylene glycol on pediatric functional constipation. *J Ethnopharmacol* 2019;238:111845.
- Dupont C, Leluyer B, Maamri N, et al. Double-blind randomized evaluation of clinical and biological tolerance of polyethylene glycol 4000 versus lactulose in constipated children. *J Pediatr Gastroenterol Nutr* 2005;41:625–33.
- Dziechciarz P, Horvath A, Szajewska H. Polyethylene Glycol 4000 for Treatment of Functional Constipation in Children. *J pediatr gastroenterol nutr* 2015;60:65–8.

- 41 van Engelenburg-van Lonkhuyzen ML, Bols EMJ, Benninga MA, *et al.* Effectiveness of Pelvic Physiotherapy in Children With Functional Constipation Compared With Standard Medical Care. *Gastroenterology* 2017;152:82–91.
- 42 Esmaeilidooki MR, Mozaffarpur SA, Mirzapour M, *et al.* Comparison Between the Cassia Fistula's Emulsion With Polyethylene Glycol (PEG4000) in the Pediatric Functional Constipation: A Randomized Clinical Trial. *Iran Red Crescent Med J* 2016;18:e33998.
- 43 Farahmand F. A randomized trial of liquid paraffin versus lactulose in the treatment of chronic functional constipation in children. *Acta Med Iran* 2007;45.
- 44 Farahmand F, Eftekhari K, Modarresi V, *et al.* Comparing Oral Route Paraffin Oil versus Rectal Route for Disimpaction in Children with Chronic Constipation; a Randomized Control Trial. *Iran J Pediatr* 2010;20:291–6.
- 45 Gilger MA, Wagner ML, Barrish JO, *et al.* New treatment for rectal impaction in children: an efficacy, comfort, and safety trial of the pulsed-irrigation enhanced-evacuation procedure. *J Pediatr Gastroenterol Nutr* 1994;18:92–5.
- 46 Hakimzadeh M, Mottaghi S, Ahmadi M, *et al.* Effect of polyethylene glycol versus lactulose on abdominal pain in children occult constipation: a randomized controlled study. *Rev Gastroenterol Peru* 2019;39:323–8.
- 47 Jarzebicka D, Sieczkowska-Golub J, Kierkus J, *et al.* PEG 3350 Versus Lactulose for Treatment of Functional Constipation in Children: Randomized Study. *J Pediatr Gastroenterol Nutr* 2019;68:318–24.
- 48 Karami H, Khademloo M, Parisa N. Polyethylene glycol versus paraffin for the treatment of childhood functional constipation. *Iran J Pediatr* 2009;19.
- 49 Keshtgar AS, Ward HC, Clayden GS, *et al.* Role of anal dilatation in treatment of idiopathic constipation in children: long-term follow-up of a double-blind randomized controlled study. *Pediatr Surg Int* 2005;21:100–5.
- 50 Khodadad A, Sabbaghian M. Role of synbiotics in the treatment of childhood constipation: a double-blind randomized placebo controlled trial. *Iran J Pediatr* 2010;20:387–92.
- 51 Kokke FTM, Scholtens PAMJ, Alles MS, *et al.* A dietary fiber mixture versus lactulose in the treatment of childhood constipation: a double-blind randomized controlled trial. *J Pediatr Gastroenterol Nutr* 2008;47:592–7.
- 52 Lee KJ, Ryoo E, Lee YM, *et al.* *Saccharomyces boulardii* and Lactulose for Childhood Functional Constipation: A Multicenter Randomized Controlled Trial. *J Neurogastroenterol Motil* 2022;28:454–62.
- 53 Loening-Baucke V, Pashankar DS. A randomized, prospective, comparison study of polyethylene glycol 3350 without electrolytes and milk of magnesia for children with constipation and fecal incontinence. *Pediatrics* 2006;118:528–35.
- 54 Loening-Baucke V. Modulation of abnormal defecation dynamics by biofeedback treatment in chronically constipated children with encopresis. *J Pediatr* 1990;116:214–22.
- 55 Loening-Baucke V, Miele E, Staiano A. Fiber (glucomannan) is beneficial in the treatment of childhood constipation. *Pediatrics* 2004;113:e259–64.
- 56 Lojanatorn P, Phrommas J, Tanpowpong P, *et al.* Efficacy of *Bacillus clausii* in Pediatric Functional Constipation: A Pilot of a Randomized, Double-Blind, Placebo-Controlled Trial. *Indian Pediatr* 2023;60:453–8.
- 57 Modin L, Walsted AM, Dalby K, *et al.* Polyethylene Glycol Maintenance Treatment for Childhood Functional Constipation: A Randomized, Placebo-controlled Trial. *J Pediatr Gastroenterol Nutr* 2018;67:732–7.
- 58 Mozaffarpur SA, Naseri M, Esmaeilidooki MR, *et al.* The effect of cassia fistula emulsion on pediatric functional constipation in comparison with mineral oil: a randomized, clinical trial. *Daru* 2012;20:83.
- 59 Asburçe M, Olgaç B, Sezer OB, *et al.* Comparison of probiotic and lactulose treatments in children with functional constipation and determination of the effects of constipation treatment on quality of life. *Cocuk Sagligi ve Hastaliklari Dergisi* 2013;56:1–7.
- 60 Olgaç A, Balci Sezer O, Ozbay Hosnut F, *et al.* Lactobacillus reuteri DSM 17938 and quality of life associated with functional constipation. *ZdravVestn* 2020;89:347–56.
- 61 Quitadamo P, Coccorullo P, Giannetti E, *et al.* A randomized, prospective, comparison study of a mixture of acacia fiber, psyllium fiber, and fructose vs polyethylene glycol 3350 with electrolytes for the treatment of chronic functional constipation in childhood. *J Pediatr* 2012;161:710–5.
- 62 Rafati M, Karami H, Salehifar E, *et al.* Clinical efficacy and safety of polyethylene glycol 3350 versus liquid paraffin in the treatment of pediatric functional constipation. *Daru* 2011;19:154–8.
- 63 Ratanamongkol P, Lertmeharit S, Jongpiputvanich S. Polyethylene glycol 4000 without electrolytes versus milk of magnesia for the treatment of functional constipation in infants and young children: a randomized controlled trial. *Asian Biomed* 2010;3.
- 64 Russo M, Giugliano FP, Quitadamo P, *et al.* Efficacy of a mixture of probiotic agents as complementary therapy for chronic functional constipation in childhood. *Ital J Pediatr* 2017;43:24.
- 65 Saneian H, Mostofizadeh N. Comparing the efficacy of polyethylene glycol (PEG), magnesium hydroxide and lactulose in treatment of functional constipation in children. *J Res Med Sci* 2012;17:S145–9.
- 66 Savino F, Viola S, Erasmo M, *et al.* Efficacy and tolerability of peg-only laxative on faecal impaction and chronic constipation in children. A controlled double blind randomized study vs a standard peg-electrolyte laxative. *BMC Pediatr* 2012;12:178.
- 67 Sevilla DAC, Hofman D, Madero SD, *et al.* The use of two Comfort Young Child Formulas in the dietary management of toddlers with functional constipation: a randomized controlled trial. *BMC Pediatr* 2022;22:672.
- 68 Shahamat M, Daneshfard B, Najib K-S, *et al.* DRY CUPPING IN CHILDREN WITH FUNCTIONAL CONSTIPATION: A RANDOMIZED OPEN LABEL CLINICAL TRIAL. *Afr J Tradit Complement Altern Med* 2016;13:22–8.
- 69 Sharifi-Rad L, Ladi-Seyedian S-S, Manouchehri N, *et al.* Effects of Interferential Electrical Stimulation Plus Pelvic Floor Muscles Exercises on Functional Constipation in Children: A Randomized Clinical Trial. *Am J Gastroenterol* 2018;113:295–302.
- 70 Shinghal U, Kaundal PK, Sharma S. Comparative efficacy of polyethylene glycol 3350 and psyllium in treatment of pediatric functional constipation: A randomized and controlled trial. *Natl J Physiol Pharm Pharmacol* 2023;13:1.
- 71 Silva CAG, Motta MEFA. The use of abdominal muscle training, breathing exercises and abdominal massage to treat paediatric chronic functional constipation. *Colorectal Dis* 2013;15:e250–5.
- 72 Srihati Dyah Permatasari T, Najib A, Agus F. Effectiveness of Probiotics in the Management of Functional Constipation in Children: A Randomized, Double-Blind, Placebo-Controlled Trial. *IJPP* 2020;15:1–6.
- 73 Tolia V, Lin CH, Elitsur Y. A prospective randomized study with mineral oil and oral lavage solution for treatment of faecal impaction in children. *Aliment Pharmacol Ther* 1993;7:523–9.
- 74 Trepongkaruna S, Simakachorn N, Pienvichit P, *et al.* A randomised, double-blind study of polyethylene glycol 4000 and lactulose in the treatment of constipation in children. *BMC Pediatr* 2014;14:153.
- 75 Urganci N, Akyildiz B, Polat TB. A comparative study: the efficacy of liquid paraffin and lactulose in management of chronic functional constipation. *Pediatr Int* 2005;47:15–9.
- 76 Üstündağ G, Kuloğlu Z, Kirbaş N, *et al.* Can partially hydrolyzed guar gum be an alternative to lactulose in treatment of childhood constipation? *Turk J Gastroenterol* 2010;21:360–4.
- 77 van Dijk M, Bongers MEJ, de Vries G-J, *et al.* Behavioral Therapy for Childhood Constipation: A Randomized, Controlled Trial. *Pediatrics* 2008;121:e1334–41.
- 78 van den Berg MM, Bongers MEJ, Voskuil WP, *et al.* No role for increased rectal compliance in pediatric functional constipation. *Gastroenterology* 2009;137:1963–9.
- 79 Voskuil W, de Lorig F, Verwijs W, *et al.* PEG 3350 (Transipeg) versus lactulose in the treatment of childhood functional constipation: a double blind, randomised, controlled, multicentre trial. *Gut* 2004;53:1590–4.
- 80 Wegner A, Banaszkievicz A, Kierkus J, *et al.* The effectiveness of Lactobacillus reuteri DSM 17938 as an adjunct to macrogol in the treatment of functional constipation in children. A randomized, double-blind, placebo-controlled, multicentre trial. *Clin Res Hepatol Gastroenterol* 2018;42:494–500.
- 81 Wojtyniak K, Horvath A, Dziechciarz P, *et al.* Lactobacillus casei rhamnosus Lcr35 in the Management of Functional Constipation in Children: A Randomized Trial. *J Pediatr* 2017;184:101–5.
- 82 Mohammadi Bourkheili A, Mehrabani S, Esmaeili Dooki M, *et al.* Effect of Cow's-milk-free diet on chronic constipation in children; A randomized clinical trial. *Caspian J Intern Med* 2021;12:91–6.
- 83 Dehghani S-M, Ahmadpour B, Haghighat M, *et al.* The Role of Cow's Milk Allergy in Pediatric Chronic Constipation: A Randomized Clinical Trial. *Iran J Pediatr* 2012;22:468–74.
- 84 Dehghani SM, Askarian M, Kaffashan HA. Oral domperidone has no additional effect on chronic functional constipation in children: a randomized clinical trial. *Indian J Gastroenterol* 2014;33:125–30.
- 85 Dheivamani N, Thomas W, Bannerji R, *et al.* Efficacy of polyethylene glycol 3350 as compared to lactulose in treatment of ROME IV

- criteria-defined pediatric functional constipation: A randomized controlled trial. *Indian J Gastroenterol* 2021;40:227–33.
- 86 Di Lorenzo C, Khlevner J, Rodriguez-Araujo G, *et al.* Efficacy and safety of linaclotide in treating functional constipation in paediatric patients: a randomised, double-blind, placebo-controlled, multicentre, phase 3 trial. *Lancet Gastroenterol Hepatol* 2024;9:238–50.
 - 87 Imanieh MH, Honar N, Mohagheghzadeh A, *et al.* Rosa damascena together with brown sugar mitigate functional constipation in children over 12 months old: A double-blind randomized controlled trial. *J Ethnopharmacol* 2022;298:115582.
 - 88 Sunić-Omejc M, Mihanović M, Bilić A, *et al.* Efficiency of biofeedback therapy for chronic constipation in children. *Coll Antropol* 2002;26 Suppl:93–101.
 - 89 Tavassoli S, Eftekhari K, Karimi M, *et al.* Effectiveness of Viola Flower Syrup Compared with Polyethylene Glycol in Children with Functional Constipation: A Randomized, Active-Controlled Clinical Trial. *Evid Based Complement Alternat Med* 2021;2021:9915289.
 - 90 Makhwana VA, Acharyya K, Acharyya S. Profile of Functional Constipation in Children at a Referral Hospital. *Indian Pediatr* 2022;59:287–9.
 - 91 Sinopoulou V, Gordon M, Rajindrajith S, *et al.* How do we define therapy-resistant constipation in children aged 4–18 years old? A systematic review with meta-narrative synthesis. *BMJ Paediatr Open* 2024;8:e002380.
 - 92 Gold DM, Levine J, Weinstein TA, *et al.* Frequency of digital rectal examination in children with chronic constipation. *Arch Pediatr Adolesc Med* 1999;153:377–9.
 - 93 Orenstein SR, Wald A. Pediatric Rectal Exam: Why, When, and How. *Curr Gastroenterol Rep* 2016;18:4.
 - 94 *Constipation in children and young people: diagnosis and management of idiopathic childhood constipation in primary and secondary care.* National Institute for Health and Clinical Excellence: Guidance, 2010.
 - 95 Tabbers MM, DiLorenzo C, Berger MY, *et al.* Evaluation and treatment of functional constipation in infants and children: evidence-based recommendations from ESPGHAN and NASPGHAN. *J Pediatr Gastroenterol Nutr* 2014;58:258–74.
 - 96 Pradhan S, Jagadisan B. Yield and Examiner Dependence of Digital Rectal Examination in Detecting Impaction in Pediatric Functional Constipation. *J Pediatr Gastroenterol Nutr* 2018;67:570–5.
 - 97 *Constipation in children and young people: diagnosis and management.* National Institute for Health and Care Excellence: Guidelines, 2017.
 - 98 Burgers R, de Jong T, Benninga MA. Rectal examination in children: digital versus transabdominal ultrasound. *J Urol* 2013;190:667–72.