



Quantitative and qualitative analysis of fecal incontinence

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Contributions: (I) Conception and design: Both authors; (II) Administrative support: Both authors; (III) Provision of study materials or patients: Both authors; (IV) Collection and assembly of data: Both authors; (V) Data analysis and interpretation: Both authors; (VI) Manuscript writing: Both authors; (VII) Final approval of manuscript: Both authors.

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Abstract: Fecal incontinence (FI), a condition characterised by the involuntary passage of flatus or fecal matter, has significant impacts on individuals it afflicts. Despite the availability of a myriad of treatments, it remains a difficult condition to treat. Valid and reliable measures for this condition are important to evaluate its severity at baseline, assess treatment response, and compare various treatment options and innovations. Various tools have been described to assess FI, but few are widely adopted. These tools can assess the degree of incontinence, qualify and characterise it further, or assess its impact on quality of life—respectively categorized as grading scales, severity scores and impact measures. Grading scales use ordinal scales to describe various types of incontinence (for example incontinence to solid stool, liquid stool or flatus). While easy to use, they lack important details and cannot detect the subtle effects of treatments on incontinence. Summary scores address some of the limitations of grading scales by incorporating both quantifying and qualifying values to describe and grade the incontinence. While less straightforward to use than the available grading scales, they represent a more accurate reflection of the patient's incontinence. In addition, summary scores are more likely to reflect the effects of treatment interventions. As such, they have emerged as the preferred way of measuring FI and of comparing different interventions. Impact measures aim to qualify the effect of FI on various spheres of life such as the emotional, social or physical spheres. However, they can be arduous to administer, and their use has largely been limited to research settings. This article will review and summarize the various tools available to measure FI.

Keywords: Fecal incontinence (FI); quality of life (QoL); measurement instruments

Received: 23 January 2022; Accepted: 29 April 2022; Published: 30 April 2022.

doi: 10.21037/ales-22-1

View this article at: <https://dx.doi.org/10.21037/ales-22-1>

Introduction

Fecal incontinence (FI), the involuntary passage of fecal matter and/or flatus from the anus, is a debilitating problem that can be difficult to treat. Symptom severity and its effect on quality of life (QoL) may vary from one individual to another (1). Moreover, the magnitude of symptoms does not always correlate with an anatomic or physiologic abnormality. This contributes to the difficulties in standardizing tools that can be used to accurately measure FI. Qualifying the type of incontinence and quantifying its

severity is important. It allows us to have a reproducible measure of the degree of incontinence, evaluate treatment response, compare outcomes for different interventions, and assess this condition's impact on QoL. Clinical tests such as anal manometry, defecography and electromyography can sometimes better delineate the mechanism for the FI. However, given the subjective nature of this symptom, these tests are not enough to accurately and consistently reflect the degree of incontinence experienced by the patient and its subjective impact on their QoL, nor can these tests determine the outcome of an intervention for FI.

Thus, reliable and valid symptom assessment tools are needed to evaluate FI for clinical and research use. While various tools have been described to measure FI, few are widely used. This article will review the various instruments available to measure FI, categorized as grading scales, severity scores, and impact measures (2,3).

Thresholds, validity, and reliability

Prior to describing the available tools to measure and report FI, one must understand how these tools should be assessed for suitability of use in clinical and research settings. Certain measures are necessary to evaluate the accuracy of newly developed tools, how they compare to existing tools, and how they perform in various settings (4,5). Reliability refers to the ability of the assessment tool to capture the true phenomenon and not be the result of random error (4,6). As such, a reliable instrument has reproducible consistent result for the same patient in similar contexts. The test-retest reliability is the test of choice to assess instrument reliability (7). Internal consistency, whereby a tool is tested for its ability to be consistent with measuring similar facets of a variable is also an important indicator. Validity, in general, refers to whether the instrument accurately measures what it was intended to measure. Content validity, or the ability of the test to assess elements that are important for the instrument to capture, should be determined both by patients and healthcare providers. Criterion validity is the comparison of the new tool to the gold standard. As mentioned earlier, one of the important distinguishing factors for instruments are their ability to detect clinically important changes, as assessed by sensitivity or responsiveness studies (8).

In addition to these measures to assess the adequacy of a tool, establishing thresholds for each tool can be important. These thresholds identify the point at which patients may benefit from various interventions, and allows standardization of treatment indications.

Grading scales for FI

Grading scales are descriptive systems that assign an ordinal (categorical) value to different types of incontinence (3). One of the earliest and simplest grading scales for FI is a category scale described by Parks in 1975 (9). It consists of four categories ranging from normal continence (A) to incontinence to both liquid/solid stool and gas (D). Similarly, others have described grading scales that also

qualify continence into broad categories that range from perfect to poor continence. Another example is the grading scale for FI described by Womack *et al.* categorizing incontinence into continence to solid/liquid stool and flatus (Grade A), continence to solid and liquid stool but not to flatus (Grade B), continence to solid stool but not to liquid or flatus (Grade C), and finally incontinence to solid/liquid stool and flatus (Grade D) (10). A summary of the most commonly reported grading scales is presented in *Table 1* (9-17). The majority of these scales were used in original research papers to report on outcomes of specific treatments for FI and lack validation. These scales all attribute an ordinal description to the symptoms of FI, without significant details and lack important information. Some of these grading scales incorporate frequency, while others rely solely on the type of incontinence (to solid/liquid stool or flatus). As such, despite their ease of use, these tools are unable to detect subtle changes in outcomes and are thus not often used in colorectal pelvic health assessment and research.

Summary scores for FI

Summary scores address some of the limitations of grading scales by including the type of incontinence and incorporating qualifying values like frequency of the incontinent episodes. A variety of summary scores exist, and they each differ by the use of diverse categories [summarized in *Table 2* (8,18-20,23)]. These questionnaires can be weighted whereby each category of the assessment tool is assigned a weight (2). The weights assigned to each category can be patient-assigned or pre-determined by the authors (4). When different weights are assigned in the summary scores, an assumption is made on the bigger/smaller importance of that category compared to another. Given the significant subjective component of FI, questionnaires that incorporate patient perspective may be more reflective of the condition. However, the increased subjectivity that patient-driven weights adds may make comparison and evaluation of treatment effects difficult across populations seeking treatment. Another way to include patient's experience of the symptoms without weighting is to include impact or bother measures like the use of pads or medication within the score. With the inclusion of these impact measures, some scoring systems share similarities with QoL questionnaires, and the separation between the two types of tools is blurred.

While the increased items and increasing categories

Table 1 Summary of commonly used grading scales

Author(s)	Year	Grades
Parks (9)	1975	(A) Continent to stool and liquid stool and flatus; (B) continent to solid and liquid stool but not flatus; (C) continent to solid but not liquid stool or flatus; (D) incontinent to solid and liquid stool and to flatus
Rudd (11)	1979	Grade I: perfect continence; Grade II: minor defects like flatus incontinence; Grade III: still acceptable but presence of minor fecal leakage and patient must wear a pad; Grade IV: unsatisfactory with major incontinence; Grade V: totally unsatisfactory, necessitating a colostomy
Keighley and Fielding (12)	1983	Minor incontinence usually to diarrhea (no more than once a month); moderate incontinence to solid stool at least once a week; severe incontinence on most days
Corman (13)	1985	Excellent: continence all the time with no pad use; good: totally continent, may require suppositories/enemas or dilation, no pad use; fair: continent to solid stool but not liquid stool, may wear a pad and have difficulty regulating bowel action; poor: incontinent to formed stool, obstructed or required colostomy
Hiltunen <i>et al.</i> (14)	1986	Totally continent; partially incontinent: incontinence to liquid stools, daily mucous discharge, fecal soiling, inability to control flatus, urgency or both; totally incontinent: gross fecal incontinence
Broden <i>et al.</i> (15)	1988	1: None, no episodes of incontinence; 2: medium, episodes of incontinence to solid stool, incontinence to gas, incontinence to liquid stool only or soiling; 3: severe, incontinence to solid stool at all times
Womack <i>et al.</i> (10)	1988	Grade A: continence to solid/liquid stool and flatus; Grade B: continence to solid and liquid stool but not to flatus; Grade C: continence to solid stool but not to liquid or flatus; Grade D: incontinence to solid/liquid stool and flatus
Rainey <i>et al.</i> (16)	1990	Continence to solid \pm flatus to incontinent to all
Williams <i>et al.</i> (17)	1991	1: Continent to solids, liquids and flatus; 2: continent to solid and liquid stool but not flatus; 3: continent to solids but occasional liquid incontinence; 4: occasional episodes of incontinence of solids and frequent episodes of incontinence to liquids; 5: frequent episodes of incontinence of solids and liquids

make summary scores less straightforward to use than the available grading scales, they represent a more accurate reflection of the patient's incontinence, and are more likely to reflect the effects of treatment interventions on incontinence. For these reasons, they have emerged as the preferred way of measuring FI and comparing different treatment interventions.

Scores that are the most widely used include the Wexner/Cleveland Clinic Florida Incontinence Score (CCFIS), the Vaizey/St. Mark's score and the FI Severity Index (FISI). The Wexner/CCFIS is the most-cited and most-translated FI score, and consists of a five item score, with each item graded on a scale from 0 to 4, with a total score of 20 (19). This score is validated and has been widely adopted because of its ease of use and reproducibility. The Wexner score can be utilized in clinical practice and for research purposes by patients throughout their treatment journey in order

to assess the response to various interventions at different timepoints. The Vaizey/St. Mark's Fecal Incontinence Score (FIS) is very similar to the Wexner score but also includes anti-diarrheal medication use and fecal urgency (21). The FISI was developed with input from colorectal surgeons and patients as an initiative from the American Society of Colon and Rectal Surgeons (24). It is a score that qualifies the type of incontinence, the quantity of incontinence with regards to number of episodes and generates a summary score in combination. Symptom severity is highly correlated with FISI scores, and correlates well with Fecal Incontinence Quality of Life (FIQL) scales (24).

Another available scoring system is the American Medical Systems score (AMS score) which was initially developed to assess outcomes of the artificial bowel sphincter (25). It comprises more than 30 questions and needs a retrospective evaluation of the 4 weeks preceding the assessment. Given

Table 2 Summary of commonly used severity scores

Severity score	Pescatori Incontinence score	Wexner/CCFIS	FISI	Vaizey/SMIS	RAFIS
Reference	Pescatori <i>et al.</i> , 1992 (18)	Jorge and Wexner, 1993 (19)	Rockwood <i>et al.</i> , 1999 (20)	Vaizey <i>et al.</i> , 1999 (21)	de la Portilla, 2021 (22)
Validity	Yes	Yes	Yes	Yes	Yes
Reliability	Yes	Yes	Yes	Yes	Yes
Items	3 items (degree of incontinence): A: incontinence to flatus/mucous; B: incontinence to liquid stool; C: incontinence to solid stool	5 items: incontinence to solid stool; incontinence to liquid stool; flatus incontinence; wears pad; lifestyle alteration	4 items: flatus incontinence; mucous incontinence; liquid incontinence; solid stool incontinence	7 items: incontinence to solid stool; incontinence to liquid stool; incontinence to flatus; alteration of lifestyle (yes/no); needs to wear a pad/plug; takes constipating medicines; inability to defer defecation for 15 min	3 items: severity (S); type of incontinence (T); perception (P)
Frequency category scores	1: less than once a week; 2: at least once a week; 3: every day	0: never; 1: rarely (<1/month); 2: sometimes (more than 1/week, not more than 1/month); 3: usually (more than 1/day, not more than 1/week); 4: always (at least 1/day)	At least 2 times a day; once a day; at least 2 times a week; once a week; up to 3 times a month; never; separate severity weighting systems developed for patients and surgeons	0: never (no episodes in the past 4 weeks); 1: rarely (1 episode in the past 4 weeks); 2: sometimes (>1 episode in the past 4 weeks but <1 a day); 3: weekly (1 or more episodes/week but <1 a day); 4: daily (1 or more episodes a day); Pad/plug use: no [0]; yes [2]; constipating agents: no [0]; yes [2]; urgency: no [0]; yes [2]	Severity: 5: at least 1 episode of incontinence daily ± without toilet proximity → always incontinent episodes; 4: several incontinent episodes each week, but not daily; 3: several leaks per month, but some weeks without incontinence; 2: occasional incontinence episodes; 1: rarely have incontinence; 0: no incontinence Type (T): 3: would have leaks of solid/liquid stool if toilet not close; 2: incontinence of solid or liquid stool (no spotting of the underwear); 1: staining of underwear; 0: no incontinence Perception (P): 3: patient feels terrible incontinence; 2: patient feels bad for incontinence; 1: does not feel well because of incontinence; 0: feels good despite incontinence
Weighted	Yes	No	Yes	Yes	Yes

Table 2 (continued)

Table 2 (continued)

Severity score	Pescatori Incontinence score	Wexner/CCFIS	FISI	Vaizey/SMIS	RAFIS
Scoring	Score = FI degree (A = 1, B = 2 or C = 3) + FI frequency	Score = sum of each item's frequency score Range: 0 (perfect continence) → 20 (worst continence)	Patient-derived score = sum of each item x patient-derived weight for the item Range 0 (perfect continence) to 61 (worst continence) Surgeon derived score = sum of each item x surgeon-derived weight for the item Range 0 (least severe) → 58 (most severe)	Score = sum of each item's frequency score Range 0 (perfect continence) → 24 (worst continence)	Score = sum of severity score+ type score + perception score Range: 0 (perfect continence) → 11 (worst continence)

CCFIS, Cleveland Clinic Florida Incontinence Score; FISI, Fecal Incontinence Severity Index; SMIS, St. Mark's Incontinence Score; RAFIS, Rapid Assessment Fecal Incontinence Score; FI, fecal incontinence.

its complexity and the lack of evidence of superiority to the commonly used scoring systems, its use has been largely limited to industry-sponsored research.

The Rapid Assessment Fecal Incontinence Score (RAFIS) was first published in 2015 and recently updated and validated (8,22). Compared to other tools, it allows for the inclusion of some bother indicators such as the importance of being close to a toilet, and the severity of the incontinence by reporting the frequency of stool loss. This tool has a qualitative component (type of incontinence), a quantitative component (frequency of incontinence episodes), as well as the inclusion of impact on QoL. The older version of this score included a visual analogue scale, while the new version includes Likert scales to ease understanding. A multicenter validation study showed that the RAFIS had good internal consistency, good test-retest reliability and a good correlation with the Wexner score (8). Furthermore, the RAFIS appears to be sensitive at identifying changes brought forth by FI interventions, and was better than the FIQL score in this regard. Further research is needed to assess the external validity of this novel tool as well as its uptake and use.

Assessment of the Impact of FI on QoL

QoL instruments measure the subjective effect of a given patient's health state on different facets of their life (emotional, behavioral, physical, social and cognitive) (6). There exists FI specific QoL tools as well as generic tools that also assess QoL related to FI (26). The FIQL scale is a well-known validated and reliable tool developed by the American Society of Colon and Rectal Surgeons in 2000 (20). It includes four domains (lifestyle, behavior, depression/self-perception and embarrassment) each containing up to 10 questions. Each domain's score is calculated by the mean of the included questions (lower score indicating a lower QoL). The FIQL score has shown good correlation with the SF-36 (a generic validated health-related QoL measurement tool) and the Wexner score. Disease specific quality-of-life scales like the FIQL score are important as they were developed with that specific problem in mind, and may be a better reflection of the impact of the condition on the patient's QoL (27). Gastrointestinal specific QoL scales are also commonly used to measure the impact of FI within specific gastrointestinal disease states. They include amongst others the Memorial Sloan Kettering Cancer Center (MSKCC) Bowel Function Instrument, Modified Manchester Health Questionnaire,

and the Gastrointestinal Quality of Life Index (GIQL) and the Low Anterior Resection Syndrome (LARS) score (6). Generic QoL questionnaires such as the SF-36 have the advantage of being a leveling ground that allows for easier comparison across different populations in different settings (27). Attention should be drawn to the variety of impact measures that are specific for certain populations and may be better suited to assess patients in specific clinical settings (such as the use of the LARS score for patients after rectal surgery or specific scales developed for patients with anorectal malformations if that is the cause of FI) (28). Thus, special care should be paid when selecting a QoL questionnaire as not all condition-specific tools provide an equal qualitative evaluation of FI (27). Lastly, despite their importance in the assessment of symptomatology, the use of these questionnaires is mostly limited to research.

Conclusions

While not straightforward, quantitative and qualitative evaluation of FI is important to stratify patients, initiate and assess treatment response, and compare interventions. The ideal tool to evaluate FI is a validated, reliable tool, with thresholds to categorize severity and guide treatment. It is also a tool that is easy to administer, incorporates the important impact of the condition on QoL and can reflect treatment response. While no one such perfect tool exists for FI, a variety of tools are available to guide physicians and patients alike. This chapter summarized the most commonly used scales, scores and questionnaires.

Acknowledgments

Funding: None.

Footnote

Provenance and Peer Review: This article was commissioned by the Guest Editors (Lucia Oliveira, Steven D. Wexner and Sarah A. Vogler) for the series “The Pelvic Floor and Anorectal Disorders” published in *Annals of Laparoscopic and Endoscopic Surgery*. The article has undergone external peer review.

Conflicts of Interest: Both authors have completed the ICMJE uniform disclosure form (available at <https://ales.amegroups.com/article/view/10.21037/ales-22-1/coif>). The series “The Pelvic Floor and Anorectal Disorders” was

commissioned by the editorial office without any funding or sponsorship. MB received teaching honorarium from Minogue, Johnson & Johnson, and Stryker—none of which affect the content of this review. The authors have no other conflicts of interest to declare.

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

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doi: 10.21037/ales-22-1

Cite this article as: Abou Khalil M, Boutros M. Quantitative and qualitative analysis of fecal incontinence. *Ann Laparosc Endosc Surg* 2022;7:19.