



Erika Boman, PhD, RNT Malin Nylander, BSc, RN Josefine Oja, BSc, RN Birgitta Olofsson, PhD, RN

Transanal Irrigation for People With Neurogenic Bowel Dysfunction

An Integrative Literature Review

ABSTRACT

Transanal irrigation has been introduced as a complement to standard bowel care for people with neurogenic bowel dysfunction. There is no contemporary integrative review of the effectiveness and feasibility of transanal irrigation from a holistic nursing perspective, only fragments of evidence to date. The aim was to investigate the effectiveness and feasibility of transanal irrigation for people with neurogenic bowel dysfunction. An integrative literature review was conducted. Nineteen studies were included. According to the results, transanal irrigation can reduce difficulties associated with defecation, episodes of incontinence, and the time needed for evacuation and bowel care. Transanal irrigation can increase general satisfaction with bowel habits and quality of life and decrease level of dependency. However, there are practical problems to overcome and adverse effects to manage. Discontinuation is relatively common. The results support the effectiveness of transanal irrigation, but feasibility is inconclusive. Users, including caregivers, report practical problems, and compliance was not always easy to achieve. It is important that users, including caregivers, are well informed and supported during transanal irrigation treatment, especially during introduction. The quality of the studies found was generally weak; therefore, high-quality quantitative and qualitative studies are needed on the topic.

he majority of people with neurological disorders experience bowel problems, leading to what is called neurogenic bowel dysfunction
(NBD) (Emmanuel, Collins, Henderson,

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About the authors: Erika Boman, PhD, RNT, is Lecturer, Department of Nursing, Umeå University, Umeå, Sweden; Department of Nursing, Åland University of Applied Sciences, Mariehamn, Finland.

Malin Nylander, BSc, RN, is a former RN student at Umeå University, Umeå, Sweden.

Josefine Oja, BSc, RN, is a former RN student at Umeå University, Umeå, Sweden.

Birgitta Olofsson, PhD, RN, is Professor, Department of Nursing, Umeå University, Umeå, Sweden; Department of Surgical and Perioperative Sciences, Umeå University, Umeå, Sweden.

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Correspondence to: Erika Boman, PhD, RNT, Department of Nursing, Åland University of Applied Sciences, Neptunigatan 17, Mariehamn, Finland (Erika.Boman@ha.ax).

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Lewis, & Stackhouse, 2019). Reduced function and sensation are common, resulting in prolonged bowel transit time and impairment or loss of sphincter control. The severity of dysfunction depends on the location and extent of neurological disorder (Krogh & Christensen, 2009).

The physical consequences of NBD are extensive and can include constipation, fecal incontinence, and/ or other potential problems such as hemorrhoids, abdominal pain, fecaloma, anal bleeding, rectal prolapse, anal fissures, bloating, and/or nausea (Adriaansen, van Asbeck, van Kuppevelt, Snoek, & Post, 2015; Coggrave, Norton, & Cody, 2014). There is also an increased risk of autonomic dysreflexia (i.e., an abnormal surge of the sympathetic nervous system as a response to painful stimuli below injury level). Problems with emptying the bladder can occur alongside NBD, and people with severe NBD often have problems with urinary incontinence and/or urinary tract infections (Cameron et al., 2015).

In addition to physical problems, NBD can have a negative impact on quality of life. People with NBD may fear having an accident in public or needing to

spend hours on the toilet, which can have a major impact on quality of life and social integration. Problems associated with NBD tend to be unpredictable and may cause limitations in daily life: at work, in school, and/or participation in social contexts (Dibley, Coggrave, McClurg, Woodward, & Norton, 2017; Emmanuel, 2010a; Emmanuel et al., 2019; Nevedal, Kratz, & Tate, 2016). People with NBD often make involuntary changes based on what they perceive has a positive impact on their bowel function (Burns et al., 2015; Dibley et al., 2017). Furthermore, many with NBD need assistance with emptying the bowel, which can impact independence and lead to loss of dignity (Dibley et al., 2017; Emmanuel, 2010a; Emmanuel et al., 2019; Nevedal et al., 2016). It is important that healthcare staff understand that people with NBD do not suffer from a single occasion of constipation or fecal incontinence, but instead a life long problem that greatly impacts experienced quality of life (Coggrave, Norton, & Wilson-Barnett, 2009; Shaw, 2018).

The goal of NBD treatment is to experience control over bowel emptying. This includes for defecation becoming predictable and regular (Pardee, Bricker, Rundquist, MacRae, & Tebben, 2012), and regardless of injury level or underlying disease the treatment is the same (Krogh & Christensen, 2009). First-line treatment includes diet and fluid, lifestyle alterations, and laxatives or constipating drugs. The next step includes digital stimulation and suppositories, and biofeedback is recommended. The third step in the treatment pyramid is transanal irrigation (TAI) (Emmanuel et al., 2013).

TAI is a method of flushing out the lower part of the bowel using tap water and a closed system. A waterfilled container is connected to a tubing system with a pump and a disposable rectal catheter (a review of different current systems can be found in Bardsley, 2020). TAI is performed while sitting on a toilet. A rectal catheter is inserted into the anus and a balloon inflated, which prevents the catheter from slipping out. Through the tubing system, water is flushed from the control unit/container into the colon. This flushes stool from the rectum, sigmoid colon, and parts of the descending colon. After completed irrigation, the container and tubing system are emptied of water and the rectal catheter is disposed of alongside other household waste (Emmanuel, 2010a).

There are previous reviews on the use of TAI for people with NBD. The focus of these reviews differs. Some include a focus on different treatment options, such as the comparison of TAI with surgical or pharmacological management (Gor, Katorski, & Elliott, 2016; Krassioukov, Eng, Claxton, Sakakibara, & Shum, 2010) or other enemas (Kelly, 2019). In others there is a focus on a specific medical condition, such as multiple sclerosis (Preziosi, Gordon-Dixon, & Emmanuel, 2018), or a specific age group, such as children and young people (Bray & Sanders, 2013). There are also some earlier reviews on the economics and feasibility of TAI (Christensen, Andreasen, & Ehlers, 2009; Emmanuel, 2010b). In a Cochrane review on the management of fecal incontinence and constipation in adults with NBD, evidence from one trial indicated positive results from TAI (Coggrave et al., 2014). Practical guidance for physicians has been presented in a consensus review, with a focus on a stepwise approach to assessments, interventions, and the monitoring of people with NBD (Emmanuel, 2019). There are even some commentary and discussion articles from a nursing perspective (e.g., Holroyd, 2017; Shaw, 2018; Wilson, 2017; Woodward, 2017; Yates, 2019). However, an overall systematic approach to the topic is lacking. To the best of our knowledge, there is no contemporary integrative review of the effectiveness and feasibility of TAI from a holistic nursing perspective—only fragments of evidence have been seen to date.

Aim

The aim of this review was to investigate the effectiveness and feasibility of TAI for people with NBD.

Methods

This is an integrative literature review (Whittemore & Knafl, 2005), a method which allows the simultaneous inclusion of studies with different research designs and was chosen to understand the phenomenon of concern more fully (Whittemore & Knafl, 2005). This review is reported in accordance with Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) (Moher et al., 2009).

Search Strategy

The search strategy was designed in collaboration with a team of information specialists to find the optimal search strategies, including relevant databases and search terms. After discussion, the following databases were used: PubMed (Public/Publisher MEDLINE), CINAHL (the Cumulative Index to Nursing and Allied Health Literature), APA PsycInfo (American Psychological Association's Psychological Information Database), Scopus, and Web of Science Core Collection. Language was restricted to English, and year of publication from 2005 to 2020.

An initial search was undertaken in PubMed, using the terms "neurogenic bowel" and "transanal irrigation." We observed that the term "neurogenic bowel" was not entered into the database until 2009 and not all studies related to neurogenic bowel were indexed under the term, even after 2009. Therefore, a broader

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search was undertaken. This included synonyms/terms related to bowel dysfunction and diseases or injuries that may cause NBD and synonyms/terms related to the term "transanal irrigation."

In CINAHL, searches related to exact subject headings, title, and abstract were performed. In APA PsycInfo, titles and abstracts were searched. In Scopus, title, abstract, and keywords were searched. In Web of Science Core Collection, topic was searched.

The final search was performed at the beginning of December 2020 and resulted in 14,066 hits. The exact search queries are presented in Supplemental Digital Content Table A1 (available at: http://links.lww.com/GNJ/A69).

Selection of Studies

All studies were imported into Endnote. Duplicates were excluded, resulting in 9,966 studies (a flowchart of the study selection process is presented in Figure 1). All titles were screened for relevance to the aim, resulting in 150 relevant titles. The abstracts of those studies were read and judged based on the inclusion criteria: (1) original research; (2) published in English; (3) published between 2005 and 2020; (4) includes people



FIGURE 1. Flowchart over study selection process.

with NBD; and (5) TAI was implemented. Exclusion criteria were: (1) studies focusing on participants with nonneurogenic disorders, such as malformations, constipation, or fecal incontinence not related to NBD; (2) studies not specifically evaluating the effectiveness and feasibility of TAI; and (3) reviews, book chapters, editorial comments, and conference abstracts.

The 33 remaining studies were read in full. In some, people with other diagnoses alongside NBD were included. In others, treatment with TAI was used together with or compared with other treatment options. Studies were excluded if the results from TAI treatment could not be distinguished from other types of NBD treatment (n = 9). A cross-sectional study in which TAI was compared with another method was also excluded, because the effectiveness of TAI was considered unassessable due to the cross-sectional design.

Whittemore and Knafl (2005) emphasize that the evaluation of source quality in integrated reviews should be addressed in a meaningful way; traditional quality assessment methods may not be viable, because of the diversity of the primary sources. As a minimum criterion, we decided that all included studies must include a description of the design/method that made the study replicable. Four studies were excluded due to vague methodological descriptions. In total, 19 studies were included in this review.

Data Analysis

The first step in the analysis process was to classify included studies (Whittemore & Knafl, 2005). The characteristics of the included studies were analyzed: population (participant age and diagnosis), continent of origin, research design, study site (single or multisite), TAI system, and instruments/scales used for evaluation (Table 1).

The next step included coding, extracting, and displaying data (Whittemore & Knafl, 2005). The included studies were read thoroughly and data relevant to the aim were coded and extracted. In line with Whittemore and Knafl (2005), results from each primary source were reduced to a single page. One of the study authors extracted the data, whereas the others reviewed the correctness of the extracted data. To gain an overview of the data, a template was developed: first author, year of publication, country of origin; the participant age and diagnosis; study design and number of participants; TAI system and preparatory training; main findings; and strengths and limitations (Table 2).

The subsequent step included data comparison to identify patterns and, in the final phase, to draw conclusions (Whittemore & Knafl, 2005). Similar variables were grouped and sorted to provide a

TABLE 1. Characteristics of the Included Studies (n = 19)

Characteristics	п
Participant age	
\leq 18 years	7
≥18 years	8
Mixed ages	4
Participant diagnosis	
Multiple sclerosis	2
Myelomeningocele	3
Spina bifida	4
Spinal cord injury	5
Mixed diagnosis	5
Continent of origin	
Europe	14
Asia	2
North America	2
Australia	1
Research design	
Quantitative	
Randomized controlled trial	1
Before–after study	11
Follow-up study	6
Qualitative	
Interview study	1
Study site	
Single	15
Multisite	4
Transanal irrigation system	
Peristeen	18
Colotip or Peristeen	1
Instruments/scales used for evaluation	
Bristol scale	2
Child Health Questionnaire (CHQ-PF50)	2
Cleveland Clinic Constipation Scoring System (CCCSS)	5
EuroQol five-dimensional questionnaire (EQ-5D)	1
Fecal Incontinence Quality of Life (FIQOL)	1
Fecal Incontinence and Constipation Quality of Life scale (FICQOL)	1
Modified American Society of Colon and Rectal Surgeons' fecal incontinence score	2
Neurogenic Bowel Dysfunction Score (NBD score)	6
Neurogenic Bowel Dysfunction Score (NBoDS)	1
St. Marks Fecal Incontinence Grading System (FIGS)	4
The 36-Item Short Form Health Survey (SF-36)	2
Wexner Constipation score	1
Wexner Incontinence score	1

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Author Country	Participant Age (M) and Diagnosis	Study Design and Number of Participants	Transanal Irrigation System and Preparatory Training	Main Findings	Strengths (+) and Limitations (–)
Ausili et al., 2010 Italy	Aged 8–17 (12.5) years with MMC	Prospective, before-after study, 3 months Questionnaire Two points of measure: T0 = before, $n = 62^{a}$ T1 = 3 months, $n = 60^{a}$	Peristeen ^b A specialized physician trained the participants	Constipation and fecal incontinence were improved. Frequency of evacuation was increased. Use of laxatives, manual extraction and frequency of UTIs decreased. General satisfaction with bowel habit and QoL associated to bowel dysfunction (NBD score) was improved. Some symptoms during evacua- tion were reported, but no serious adverse events	 + Prospective + Standard scoring system/scales (partly) - Noncomparative
Ausili et al., 2018 Italy	Aged 6–17 (12.7) years with SB or ARM ^c	Prospective, before-after study, up to 32 months Questionnaire Three points of measure (n = participants with SB): T0 = baseline, n = 38 T1 = 3 months, n = 37 T2 = 24-32 months, n = 37 n = 36	Peristeen ^b Specialist nurses and medical physician trained the participants	Constipation, fecal and flatus incon- tinence, and fecal consistency (Bristol scale) were improved. Percentage of participants with no symptoms of evacuation increased and time for evacuation decreased. Both children and car- egivers reported an improvement in QoL (CHQ-PF50 and SF-36, respectively). A majority reported need of assis- tance. Some practical problems in performance were reported, but no serious adverse events.	 + Prospective + Long duration + Multicenter + Standard scoring system/scales (partly) - Noncomparative
Choi et al., 2015 South Korea	Aged 3–18 years (mean unknown) with SB	Prospective, before-after study, 3 years Questionnaire Three points of measure: To = baseline, $n = 47$ T1 = 3 months, $n = 44$ (of which six were nonus- ers)	Peristeen or Colotip ^b (65.9% and 34.1%, respectively). Treatment period was 3 months. A special- ized physician trained the participants	Fecal continence was improved and frequency of bowel move- ments was increased. Time for bowel care and number of diaper changes were reduced. QoL was improved (parts of FICQOL) Mean grade of satisfaction was 8/10. A majority reported ab- dominal discomfort. Disliking the treatment was the most common reason for withdrawal	+ Prospective + Long duration - Noncomparative
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	Strengths (+) and Limitations (–)	 + Prospective + RCT + Multicenter + Standard scoring system/scales 	 + Prospective + Multicenter + Standard scoring system/scales - Noncomparative 	 + Prospective - Noncomparative - Short duration - Nonvalidated questionnaire
	Main Findings	Reduced symptoms of constipa- tion (CCCSS), fecal incontinence (FIGS), and NBD (NBD score). Improved QoL (Modified American Society of Colon and Rectal Sur- geons' fecal incontinence score). Reduced time spent on bowel management, improved intestinal functionality, and reduced UTIs. A higher proportion of TAI users were independent. Some practi- cal problems in performance were reported and some symptoms during evacuation, but no serious adverse events	Findings from RCT, related to ef- fectiveness, were confirmed (see above) Some practical problems in per- formance were reported, but no serious adverse events	Number of participants reporting fecal and flatus incontinence decreased. Time for evacuation decreased and more participants never or rarely had symptoms during evacuation. Satisfac- tion with bowel habit and QoL increased Some practical problems in per- formance were reported, but no serious adverse events
	Transanal Irrigation System and Preparatory Training	Peristeen ^b Specialist nurses trained the participants. Participants were en- couraged to contact the specialist nurse for advice	Peristeen ^b Specialist nurses trained the participants. Participants were en- couraged to contact the specialist nurse for advice	Peristeen ^b Specialized nurses trained the participants
	Study Design and Number of Participants	RCT, 10 weeks Participants were randomly assigned to TAI or CBM Questionnaire Two points of measure: T0 = baseline, $n = 42$ (control, $n = 45$) T1 = 10 weeks, $n = 37$ (control, $n = 44$)	Prospective, before-after study, 10 weeks Extension to RCT; partici- pants in conservative arm offered crossover to Peristeen Questionnaire Two points of measure: T0 = baseline, $n = 55$ T1 = 10 weeks, $n = 45^d$	Prospective, before-after study, 3 weeks Questionnaire Two points of measure: T0 = baseline, $n = 33$ T1 = 3 weeks, $n = 32^d$
(Participant Age (<i>M</i>) and Diagnosis	18 years and older (intervention: 47.5; control: 50.6) with SCI	18 years and older (47.5) with SCI	18 years and older (31.6) with SCL
	Author Country	Christensen et al., 2006 Denmark, the United Kingdom, Germany, Italy, and Sweden	Christensen et al., 2008 Denmark, the United Kingdom, Germany, Italy, and Sweden	Del Popolo et al., 2008 Italy

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Limitations (Cor	ntinued)				
Author Country	Participant Age (<i>M</i>) and Diagnosis	Study Design and Number of Participants	Transanal Irrigation System and Preparatory Training	Main Findings	Strengths (+) and Limitations (-)
Faaborg et al., 2009 Denmark	Aged 7–61 (<i>Mdn</i> = 49) with mixed NBD: Traumatic SCI and SB most common	Follow-up, mean 19 months Questionnaire and chart review <i>n</i> = 211	Participants used rectal balloon catheter (48%), cone-shaped colostomy tip (32%) or other systems (20%) A specialist nurse trained the par- ticipants. Participants were encouraged to keep frequent tel- ephone contact with the nurse	Successful outcome was achieved in 46% at mean follow-up, and in 35% after 3 years. Male gender, mixed symptoms, and prolonged colorectal transit time were asso- ciated with successful outcome One nonlethal bowel perforation oc- curred (0.002%), whereas minor side effects were observed in 48%.	 + Large sample - Noncomparative - Nonvalidated questionnaire
Hamonet-Torny et al., 2013 France	Adults (49.0) with mixed NBD: SCI and MS most common	Follow-up, mean 2.6 years Structured telephone interview <i>n</i> = 16	Peristeen ^b Participants were given an informal education. Participants and car- egivers had possibility to call the department if needed	Successful outcome was 62.5% at mean follow-up. Fecal continence was assessed to be practically normal (CCCSS). NBD score in- dicated minor severity of bowel dysfunction Mean grade of satisfaction was high. Technical problems were found among 77.8% of the partic- ipants. In total, 37.5% ceased TAI. One participant had a subocclu- sive episode, requiring emergency consultation	 + Long follow-up + Standard scoring system/scales (partly) - Noncomparative - Small sample
Kelly et al., 2017 The United States	Aged 3–21 (10.5) years with SB	Prospective, before-after study, 6 months Questionnaire Four points of measure: T0 = baseline, $n = 24$ T1 = 2 weeks, $n = 24$ T2 = 2 months, $n = 10$ T3 = 6 months, $n = 12$	Peristeen ^b Preparatory training — unknown	There was a significant improve- ment in QoL associated to bowel dysfunction (NBoDS)	 + Prospective + Standard scoring system/scale - Noncomparative - Small sample

(continues)

TABLE 2. Overview of Included Studies: Characteristics, Study Design, Transanal Irrigation System, Main Findings, Strengths, and

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Author Country	Participant Age (<i>M</i>) and Diagnosis	Study Design and Number of Participants	Transanal Irrigation System and Preparatory Training	Main Findings	Strengths (+) and Limitations (–)
Kim et al., 2013 South Korea	Adults (44.5 years) with SCI	Prospective, before-after study, 6 months Questionnaire Four points of measure: To = baseline, $n = 52$ T1 = after 1 month, n = 31 T2 = after 3 months, n = 25 T3 = after 6 months, n = 18	Peristeen ^b Participants and car- egivers were in- structed by a trained investigator. Partici- pants were encour- aged to seek advice by phone	Defecation time decreased and QoL (modified scale) increased. One-third used TAI at 6 months. The noncompliant contained higher proportion of tetraplegia than paraplegia, and higher propor- tion dependent on assistance. Two-thirds complained of practi- cal problems. One-third reported adverse events	 + Prospective Noncomparative - Nonvalidated questionnaire
King et al., 2017 Australia	Pediatric popula- tion (14.5 years) with SB	Follow-up, mean 4.1 years Structured telephone interview <i>n</i> = 20	Peristeen ^b Preparatory training — unknown	There was no difference in constipa- tion (CCCSS), fecal incontinence (FIGS; FIQOL), and QoL associ- ated to bowel dysfunction (NBD score) among those using and those no longer using TAI A high rate of cessation was ob- served (55%), which could be explained by the lack of ongoing outpatient support for the children and their families	+ Standard scoring system/scale - Noncomparative - Small sample
Loftus et al., 2012 Ireland	Adults (44 years) with SCI or SB	Follow-up, 3-28 months Questionnaire $n = 11$	Peristeen ^b A specialist nurse trained the par- ticipants and had telephone contact with the participants	The participants suffered from fewer bowel symptoms. There was a reduction in fecal incontinence (CCCSS; FIGS), abdominal pain, and lifestyle alterations secondary to bowel management No serious adverse events occurred during the study	 + Standard scoring system/scale (partly) - Noncomparative - Small sample

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TABLE 2. Overview of Included Studies: Characteristics, Study Design, Transanal Irrigation System, Main Findings, Strengths, and

ry(M) and DiagnosisNumber of ParticipantsPreparatory TrainingMain FindingsLimitations (-)r PereiraAged 6-25 (12.5)Follow-up, meanPeristeen ^b Bowel dysfunction symptoms, including fecal incontinence, improved significantly.Noncomparative - Noncomparative egivers were trained by specialized nursesNoncomparative - Noncomparative - Noncomparative - Noncomparative egivers were trained by specialized nursesNain FindingsLimitations (-)	r Participant Age Study Design and System and Main Findings Limitations (–)	Findings Strengths (+) and Limitations (-) Ion symptoms, ion symptoms, all incontinence, inficantly. + Prospective - Noncomparative - Noncomparative - Noncomparative - Small sample + X-ray to study intestin transfer time - Small sample - Small sample - Small sample system/scales (partly) - Noncomparative - Small sample system/scales (partly) - Noncomparative - Small sample - Small sample - Small sample - Small sample - Small sample - Standard scoring fecal incontinence, articipants with ring evacuation, es, and manual s reduced. Both caregivers reported ent in QoL (CHQ- -36, respectively).	Main Bowel dysfuncti including feca improved sigr Participants s evacuation The participants s fied with TAL. problems with but no serious progression o progression o pro	System and System and Peristeen ^b Participants and/or car- egivers were trained by specialized nurses egivers were trained by specialized nurses Peristeen ^d Peristeen ^d Participants were trained by a specialist nurse and a physician	Study Design and Follow-up, mean 12 months Questionnaire Two points of measure: Two points of measure: Two points of measure: Two points of measure: Two points of measure: To = baseline, $n = 35$ To = baseline, $n = 25$ Prospective, before-after study, 72 hours, three markers were taken every 24 hours, three times To = baseline, $n = 16$ To = baseline, $n = 16$ Prospective, before-after study, 3 months Questionnaire Two points of measure: To = baseline, $n = 78$ T1 = 3 months, $n = 78$	Participant Age (M) and Diagnosis Aged 6–25 (12.5) years with MMC mean unknown) with MMC with MMC and ARM ^e Years with SCL	r r r Pereira and relli, 2013 6 et al.,
and and bill, 2013Aged 4-17 years with MMCProspective, before-after reary 22 hours with MMCProspective, before-after reparatory training- rankers were taken markers were taken every 24 hours, three markers were taken every 24 hours, three timesPresteriory training- significant improvement of the significant improvement of the progression of the intestinal bolus progression of the intestinal bolus - Small sample - Small sampleatt al.Aged 6-17 (14.2) years with SCL 1 = 72 bounts of measure: 1 = 72 bounts of measure: 1 = 3 months. n = 78 years were 1 = 3 months. n = 78 years were 1 = 3 months. n = 78 years were years w	PereiraAged37 (12.5) years with MICFollow-up, mean to mostion rate Partioparts and/or care Partioparts and Partioparts and care Partioparts and Partioparts and care Partioparts and		problems duri				

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TABLE 2. Overview of Included Studies: Characteristics, Study Design, Transanal Irrigation System, Main Findings, Strengths, and Limitations (Continued)

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Parti (<i>M</i>) an	cipant Age d Diagnosis	Study Design and Number of Participants	Transanal Irrigation System and Preparatory Training	Main Findings	Strengths (+) and Limitations (–)
Adults with	(51 years) MS	Follow-up, mean 3.3 years Structured telephone interview <i>n</i> = 49	Peristeen ^d Participants were trained by the same clinical nurse specialist	Episodes of incontinence, number of treated UTIs, and number of hospitalizations were reduced. QoL associated to bowel dysfunc- tion (NBD score) was improved. General health-related QoL (EQ- 5D) declined, both among users and nonusers 55% continued with TAI. Most com- mon reasons for interruption were disliking treatment and inefficient effect. Some practical problems were reported	+ Standard scoring system/scale - Noncomparative
Agec	a 2–21 (8.9) ars with NBD, RM°, or RC°	Follow-up, mean 4.6 months Review of medical charts <i>n</i> = 114	Peristeen ^d Participants and/or car- egivers were trained by a nurse specialist. The nurse specialist remained available via telephone	Number of participants with constipation, fecal incontinence, and abdominal pain was reduced. Satisfaction with TAI was high. Approximately half of the participants were fully dependent on caregiver assistance Some side effects were mentioned (in ≤2%), no serious adverse events were identified. Different reasons for discontinuation were mentioned	 Noncomparative Nonvalidated questionnaire Short duration
Adul wi	ts (49 years) th MS	Prospective, before-after study, 6 weeks Questionnaire Two points of measure: T0 = baseline $(n = 30)$ T1 = 6 weeks $(n = 16^{d})$	Peristeen ^b Participants or caregivers were trained by a nurse specialist	Constipation (Wexner Constipation score) and incontinence (Wexner Incontinence score) improved. There was no significant change in QoL Two participants stopped using TAI, due to no more response and severe deterioration of MS, respectively	+ Standard scoring system/scale - Noncomparative - Short duration

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TABLE 2. Over Limitations (<i>Col</i>	view of Included 5 <i>ntinued</i>)	Studies: Characteristics	, Study Design, Trans	anal Irrigation System, Main Fin	lings, Strengths, and
Author Country	Participant Age (<i>M</i>) and Diagnosis	Study Design and Number of Participants	Transanal Irrigation System and Preparatory Training	Main Findings	Strengths (+) and Limitations ()
Sanders et al., 2014 The United Kingdom	Caregivers of children aged 3–16 years, mixed diagnosis: SB and no underlying condition most common	Interview study n = 18 participants	Peristeen ^b Preparatory training – unknown	Two themes occur: "Parents in- vestment in their child's bowel management," and "Supporting their child's independence." The parents negotiated getting started and using TAI with their child. A sense of success derived from confidence in using and master- ing irrigation. Challenges included minimizing their child's distress and how they negotiated and moved toward their child becom- ing independent	+ Multicenter
<i>Note.</i> ARM = anorect EQ-5D = EuroQoL Fix Fecal Incontinence Qu Score; QoL = quality Form Health Survey; "	ve-Dimensional Instrume ve-Dimensional Instrume Jality of Life; Mdn = medi of life; RC = refractory TAI = transanal irrigation	 = conservative bowel management; FICQOL = Fecal Incontinencian; MMC = myelomeningocele; constipation; RCT= randomize c; UTI = urinary tract infection. 	ent; CCCSS = Cleveland Clin ce and Constipation Quality of MS = multiple sclerosis; NBD d controlled trial; SB = spina	c Constipation Scoring System; CHQ-PF50 Life scale; FIGS = St. Marks Fecal Incontine = neurogenic bowel dysfunction; NBoDS = I bifida; SCI = spinal cord injury; SCL = spir	 Child Health Questionnaire; Ice Grading System; FIQOL = leurogenic Bowel Dysfunction al cord lesion; SF-36 = Short

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^dData were analyzed on an intention-to-treat basis (i.e. participants lost to follow-up were accounted for in the analysis). ^oThe results are presented so that the results linked to participants with NBD can be separated from other group(s). ^pPeristeen Anal Irrigation System (Coloplast A/S Kikkedal, Denmark); Colotip (Coloplast, Humlebak, Denmark).

^aPer-protocol analysis.

TABLE 3. Categorization of the Results

Effectiveness	
Difficulties associated with defecation	Constipation Fecal consistency Intestinal transfer time Frequency of bowel movement Frequency of evacuation Use of laxatives and/or other enemas Digital stimulation, evacuation of anorectum, and/or abdominal massage Symptoms during evacuation
Episodes of incontinence	Fecal incontinence Flatus incontinence
Impact on other health concerns and healthcare needs	Abdominal pain and bloating Perianal skin problems Urinary tract infections Healthcare utilization
Time needed for evacuation and bowel care, general satisfaction with bowel habits	Time for evacuation Bowel care time General satisfaction with bowel habit
Quality of life	Quality of life associated with bowel dysfunction General quality of life Lifestyle alterations related to bowel management
Feasibility	
Dependency	
Practical problems with the irrigation procedure	Difficulties with and/or pain during catheter insertion Leakage of irrigation fluid/fecal leakage Balloon/catheter expulsion Technical problems with the equipment
Adverse effects	
Continuation and reasons for discontinuation	Frequency of continuation/discontinuation Reasons for discontinuation
Overall satisfaction with bowel regimen/usefulness	
Experiences	

categorization of the results (Table 3). Lastly, the results were abstracted and summarized.

Results

Study Characteristics

Study characteristics are summarized in Table 1. Eleven studies included young participants (≤ 18 years) whereas eight included adult participants (≥ 18 years). In those studies including young participants, caregivers were also included as participants. The studies included people with multiple sclerosis, myelomeningocele, spina bifida, or spinal cord injury. Five studies included people with mixed diagnoses.

The studies were mainly performed in Europe (Denmark, England, Germany, Italy, Sweden, or the United Kingdom). There were also studies from Asia (South Korea), North America (the United States [U.S.]), and Australia. The majority of studies were quantitative with varying designs: a randomized controlled trial, before–after studies (comparing outcomes before and after implementation of TAI at fixed point of time(s)), or follow-up studies (following users being introduced to TAI over time without fixed points of measure). In the quantitative studies, questionnaires, structured interviews, and/or review of medical records were used to collect data. Validated and nonvalidated scales were used to assess outcomes. Radiographic method (x-ray) was used in one study. Only one study had a qualitative design, and semistructured interviews were used to collect data.

Peristeen (Coloplast) was the most commonly used TAI system. Colotip (Coloplast) was used in one study. In most studies (n = 15), any eventual TAI preparatory

training and/or support available for users, including caregivers, were described. The duration for which a TAI intervention was studied varied from 3 weeks to 4.1 years across the studies, with the exception of the radiographic method study, where the test period was 72 hours (Table 2).

Effectiveness

To investigate the effectiveness of TAI, the following were assessed: difficulties associated with defecation; episodes of incontinence; and impact on other health concerns and healthcare needs. Also, time needed for evacuation and bowel care and general satisfaction with bowel habits and quality of life were studied. The measurements of effectiveness of TAI are presented in Supplemental Digital Content Table A2 (available at: http://links.lww.com/GNJ/A70).

Difficulties Associated With Defecation

Constipation was assessed in 10 studies. In eight, reduced constipation was seen (Ausili et al., 2010, 2018; Christensen et al., 2006, 2008; Loftus, Wallace, McCaughey, & Smith, 2012; Midrio et al., 2016; Patel, Hopson, Bornstein & Safder, 2020; Preziosi et al., 2012). In one, no difference was seen between users and those no longer using TAI (King et al., 2017) and in another, no comparison was made (Hamonet-Torny et al., 2013). In two studies, significantly fewer participants had a feeling of incomplete evacuation after implementation of TAI (Del Popolo et al., 2008; López Pereira et al., 2010). In two, a positive impact on fecal consistency was seen; that is, a larger number of people reported softer stool after the intervention (Ausili et al., 2018; Midrio et al., 2016).

In one study, a radiographic method (x-ray) was used to study intestinal transfer time, and significant improvement of the progression of intestinal bolus was found (Marte & Borrelli, 2013). In another, frequency of bowel movements was assessed, and a significant increase of movements was seen (Choi et al., 2015). In two, improvement in frequency (i.e., more regular defecation) was seen (Ausili et al., 2010; Midrio et al., 2016)

Laxatives and/or other enemas were assessed in four studies. In one, a significant reduction in laxatives was reported (Ausili et al., 2010), but Hamonet-Torny et al. (2013) found no significant difference in laxative consumption. In Midrio et al. (2016), a reduction in laxatives and enemas was indicated, but significance of the tests is not confirmed (Midrio et al., 2016).

Digital stimulation, evacuation of anorectum, and/ or abdominal massage were investigated in four studies. Ausili et al. (2010) reported a significant decrease in digital stimulation or evacuation of anorectum. Midrio et al. (2016) indicated a reduction in manual extraction. Faaborg et al. (2009) found that 23% still required manual evacuation, and Hamonet-Torny et al. (2013) reported that two out of 10 required manual evacuation, with a similar percentage needing abdominal massages.

Episodes of Incontinence

Fecal incontinence was assessed in 14 studies. In 12, fecal incontinence was significantly reduced (Ausili et al., 2010, 2018; Christensen et al., 2006, 2008; Del Popolo et al., 2008; Loftus et al., 2012; López Pereira et al., 2010; Passananti, Wilton, Preziosi, Storrie, & Emmanuel, 2016; Patel et al., 2020; Preziosi et al., 2012). Results from two other studies also indicated improvement (Choi et al., 2015; Midrio et al., 2016). In one, no significant difference was found between users and those no longer using TAI (King et al., 2017). In another, fecal continence was assessed as being nearly normal (Hamonet-Torny et al., 2013).

Flatus incontinence was evaluated in five studies. In two, flatus incontinence was significantly reduced (Del Popolo et al., 2008, Loftus et al., 2012), and in another two studies improvement was indicated (Ausili et al., 2018; Midrio et al., 2016), whereas in one no difference was found (Ausili et al., 2010).

Impact on Other Health Concerns and Healthcare Needs

Abdominal pain and bloating were studied in four studies. A significant reduction of pain (Del Popolo et al., 2008, Loftus et al., 2012; López Pereira et al., 2010; Patel et al., 2020) and bloating (Loftus et al., 2012) was shown. In a study on perianal skin problems, no difference was seen (Ausili et al., 2010).

Urinary tract infections were investigated in four studies. One showed a significant decrease in infections (Ausili et al., 2010), with improvement indicated in the other three (Christiansen et al. 2006; Del Popolo et al., 2008; Passananti et al., 2016). Passananti et al. (2016) indicated that the annual number of hospitalizations was reduced, and the proportion visiting a general practitioner, specialist, and/or dietician was reduced.

Time Needed for Evacuation and Bowel Care, General Satisfaction With Bowel Habits

Time needed for evacuation was evaluated in seven studies. In three, a significant decrease was seen (Ausili et al., 2018; Del Popolo et al., 2008; Kim, Lee, Lee, & Shin, 2013), and in two a reduction of time was indicated (López Pereira et al., 2010; Midrio et al., 2016). Ausili et al. (2010) reported no significant change, and Christiansen (2006) saw no significant difference in time spent sitting on the toilet when compared with conventional bowel management.

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Choi et al. (2015) showed that the time needed for bowel care decreased significantly. Christensen et al. (2006) showed significantly less time when compared with conventional bowel management. Hamonet-Torny et al. (2013) reported a more than 30-minute decrease for the majority (60%) of participants.

General satisfaction with bowel habits was assessed in four studies. In three, a significant increase in degree of general satisfaction was seen (Ausili et al., 2010; Del Popolo et al., 2008; López Pereira et al., 2010). Hamonet-Torny et al. (2013) saw a high level of satisfaction (a mean score 9.1 out of 10).

Quality of Life

Quality of life, associated with bowel dysfunction, was evaluated in 12 studies. In eight, enhanced quality of life was seen (significant results) (Ausili et al., 2010; Choi et al., 2015; Christensen et al., 2006, 2008; Del Popolo et al., 2008; Kelly, Dorgalli, McLorie, & Khoury, 2017; Kim et al., 2013; Loftus et al., 2012). However, King et al. (2017) reported no significant difference among users when compared with those no longer using TAI. Hamonet-Torny et al. (2013) and Passananti et al. (2016) presented no comparative (baseline) values but found that those still using TAI at follow-up experienced minor bowel dysfunction and found higher numbers of participants reporting mild or no problem, respectively.

General quality of life was assessed in four studies. In two, significantly higher overall quality of life was shown (Ausili et al., 2018; Midrio et al., 2016). In two studies, including participants with multiple sclerosis, no difference or even a decreased quality of life was seen (Passananti et al., 2016; Preziosi et al., 2012).

Lifestyle alterations related to bowel management were assessed in one study. Loftus et al. (2012) reported a significant decrease in the frequency of lifestyle alterations after the introduction of TAI.

Feasibility

To investigate the feasibility of TAI, the following were assessed: dependency, practical problems with the irrigation procedure, adverse effects, continuation and reasons for discontinuation, overall satisfaction with bowel regime/usefulness, and experiences.

Dependency

Dependency was investigated in 12 studies, with change in dependency assessed in six studies. In five, a decrease was seen in the need for caregiver assistance (Ausili et al., 2018; Christensen et al., 2006; López Pereira et al., 2010; Midrio et al., 2016; Passananti et al., 2016). Del Popolo et al. (2008) investigated dependence on caregiver and/or family and saw that the majority of study participants could be considered less dependent, two considered more dependent, and six saw no change.

Frequency of dependence was reported in four studies (Christensen et al., 2008; Faaborg et al., 2009; Hamonet-Torny et al., 2013; Patel et al., 2020). In a review of all included studies reporting numbers on dependency (needing practical help to carry out TAI), the frequency of dependency was seen to vary from 23% to 76%. Also, Kim et al. (2013) showed that a significantly higher proportion of noncompliant users needed assistance during bowel management when compared with compliant users.

Practical Problems With the Irrigation Procedure

Difficulties with catheter insertion was seen in five studies, with prevalence from 2% to 33.3% (Christensen et al., 2008; Del Popolo et al., 2008; Kim et al., 2013; King et al., 2017; Patel et al., 2020). Pain during catheter insertion was noted in two studies. Faaborg et al. (2009) found that 29% experienced pain, whereas Kim et al. saw that 1.9% experienced pain. Kim et al. also reported that 3.8% complained about the catheter being long and thick.

Technical problems with the equipment were reported in five studies (Ausili et al., 2018; Christiansen et al., 2006, 2008; Hamonet-Torny et al., 2013; Midrio et al., 2016). The frequency of technical problems varied between 5% (Ausili et al., 2018; Midrio et al., 2016) and almost 86% (Hamonet-Torny et al., 2013).

Leakage of irrigation fluid/fecal leakage was seen in seven studies, with prevalence from 3% to 64% (Ausili et al., 2018; Christensen et al., 2008; Del Popolo et al., 2008; Faaborg et al., 2009; Kim et al., 2013; López Pereira et al., 2010; Midrio et al., 2016). Balloon/catheter expulsion was reported in eight studies (Ausili et al., 2018; Christensen et al., 2006, 2008; Del Popolo et al., 2008; Faaborg et al., 2009; Kim et al., 2013; López Pereira et al., 2010; Midrio et al., 2016, Patel et al., 2020). Kim et al. (2013) saw that up to 48.1% experienced balloon or catheter expulsion. Other studies reported lower frequencies. In Ausili et al. (2018), balloon expulsion had decreased to 3% at the end of the study.

Adverse Effects

The most commonly reported adverse effect when using TAI was abdominal pain/discomfort, seen in eight studies (Ausili et al., 2010; Choi et al., 2015; Christensen et al., 2006; Faaborg et al., 2009; Kim et al., 2013; King et al., 2017; López Pereira et al., 2010; Patel et al., 2020). Other more common adverse effects were anorectal/perianal irritation/discomfort (Ausili et al., 2010; Christensen et al., 2006; Kim et al., 2013; Passananti et al., 2016; Patel et al., 2020), minor

anal/rectal bleeding (Choi et al., 2015; Faaborg et al., 2009; Kim et al., 2013; Passananti et al., 2016), sweating (Ausili et al., 2010; Christiansen et al., 2006; Faaborg et al., 2009; López Pereira et al., 2010), fatigue (Faaborg et al., 2009; Kim et al., 2013), and/or general discomfort (Ausili et al., 2010; Christensen et al., 2006; Faaborg et al., 2009).

Adverse events that required further care were reported in three studies. Christensen et al. (2006) reported four adverse events, but only two were related to TAI. Two participants experienced severe abdominal pain leading to hospitalization, but no serious conditions were found and they improved after the removal of constipated stool. Hamonet-Torny et al. (2013) also reported a subocclusive episode that required emergency consultation. Faaborg et al. (2009) reported a nonlethal bowel perforation (0.002% risk). No adverse events were reported in six studies (Ausili et al., 2010, 2018; Choi et al., 2015; Del Popolo et al., 2008; Loftus et al., 2012; López Pereira et al., 2010).

Continuation and Reasons for Discontinuation

Frequency of continuation was investigated in three studies. Faaborg et al. (2009) found that 46% experienced a successful outcome at mean follow-up, decreasing to 35% after 3 years of using TAI. In that study, male gender, mixed symptoms, and prolonged colorectal transit time were associated with successful outcome, and a 20% dropout rate was seen in the first 3 months. Hamonet-Torny et al. (2013) reported that six out of 16 participants discontinued treatment (two thirds over 1 month). Passananti et al. (2016) reported a 55% rate of continuation at mean follow-up.

Reasons for discontinuation reported by users were addressed in nine studies (Table 4). In a comparison of compliant and noncompliant users, Kim et al. (2013) saw that the noncompliant group had a higher proportion of tetraplegia than paraplegia.

Overall Satisfaction With Bowel Regimen/ Usefulness

Satisfaction was assessed on a 10-graded scale (10 = perfect satisfaction) in four studies (Choi et al., 2015; Kim et al., 2013; López Pereira et al., 2010; Patel et al., 2020). The mean grade of satisfaction varied from 7.3 to 8.75. Ineffectiveness was assessed in three studies and found to vary from about 3% (Ausili et al., 2018; Midrio et al., 2016) to 19.2% (Kim et al., 2013).

Experiences

Only one qualitative study exploring experiences was found (Sanders, Bray, Driver, & Harris, 2014). The study was based on the experiences of caregivers (17 parents and one grandmother) to children aged 3–16 years. Before being introduced to TAI, the caregivers had struggled to find an optimal bowel regimen for their children, which they described as being emotionally draining. They had tried multiple different interventions. Although each new intervention offered hope for improvement, failures had a negative impact on their confidence to try new approaches. Confidence in the options professionals offered, such as TAI, was low.

The caregivers mentioned peer support systems, intended to build confidence, and that they were more confident about trying TAI if they considered the physicians and nurses to be competent. The caregivers also stated that receiving training for the home environment and support over time was empowering. After training, some even reported being proud of their new skills, linked to their child no longer being incontinent. Being continent was considered important, especially once a child started school. "Soiling in the classroom" and "still wearing nappy" were associated with social difficulty in a school environment. Being continent opened possibilities for participating in new activities, like swimming.

However, the caregivers struggled with the TAI bowel procedure. Some had to hold their child during irrigation, because the child found the procedure so distressing. Such challenges were perceived to be upsetting and could even strain the interparental relationship; parents could disagree on whether the treatment should be continued. The caregivers regularly reevaluated the effectiveness of the treatment against the impact it had on their child, themselves and the rest of their family's busy social life.

Most were motivated to continue using TAI. Supporting their child in becoming independent was a strong driving force, in addition to "taking control" over bowel emptying. The achieved and prospective levels of independence were related to physical and cognitive disability. Some predicted that their child would never become fully independent.

Discussion

TAI appears to be an effective method for people with NBD. TAI may have a positive effect on constipation and incontinence; reduces the time needed for evacuation and bowel management; and results in more regular defecation, less symptoms during evacuation, and a reduction in the use of other methods to support evacuation. Furthermore, other health concerns related to NBD may be eased, the need for healthcare services reduced, and quality of life enhanced. Regarding feasibility, the results are inconclusive. Users may become independent, but not all will. Practical problems were typical and a common reason for discontinuation, together with unsatisfactory effect, disliking treatment

TABLE 4. Rea	son for Dis	continuation	-						-	
Reason	Choi et al., 2015	Christensen et al., 2006	Christensen et al., 2008	Faaborg et al., 2009	Hamonet-Torny et al., 2013	Kim et al., 2013	King et al., 2017	Passananti et al., 2016	Patel et al., 2020	Preziosi et al., 2012
Unsatisfactory effect	×	×	×	×	×		×	×		×
Time- consuming/ heavy administration				×	×	×	×			
Disliked treatment	×	×	×	×				×		
Practical problems	×	×	×	×		×	×	×	×	
Costs/insurance issues	×								×	
Side effects/ adverse event		×	×	×	×	×	×	×	×	
Lack of compliance		×								
Normal defecation/ surgical intervention	×								×	
Pathology preventing irrigation								×		×
No reason/ personal decision	×								×	

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and side/adverse effects. Compliance was not always easy to achieve.

The results indicate that for people with neurogenic bowel TAI dysfunction might reduce difficulties associated with defecation, making it easier to empty the bowel more regularly and controlled. This is in line with previous reviews (Coggrave et al., 2014; Dale, Morgan, Carter, White, & Carolan-Rees, 2019) and a well-functioning bowel regimen (Pardee et al., 2012). Reducing constipation (including softening of stool, reducing intestinal transfer times and the need for laxatives and/or other support for emptying the bowel, and decreasing frequency of bowel movements and frequency of evacuation) is most relevant for people with NBD. In general, constipation can result in pain, loss of appetite, and lethargy (Cameron et al., 2015; Emmanuel, 2010b) and negatively affect quality of life (Belsey, Greenfield, Candy, & Geraint, 2010). For people with spastic tendencies, constipation even may aggravate spasticity or limit the person's mobility (Kheder & Nair, 2012). The results further suggested that TAI might reduce the time needed for evacuation. Reducing the time spent on the toilet is important, as prolonged toilet visits significantly increase the risk of pressure ulcers and also take time away from other, more enjoyable activities (Cameron et al., 2015).

The results even indicate that use of TAI can reduce fecal and flatus incontinence, which is in line with the results seen in other reviews (Bray & Sanders, 2013; Coggrave et al., 2014; Dale et al., 2019). Reducing incontinence is important, because incontinence is associated with negative self-affirmation, guilt, shame, and life limitations (Dibley et al., 2017; Olsson & Berterö, 2015). Not only the person with incontinence is affected, but also significant others. For example, parents worry about their child growing older, because soiling and nappies are socially unacceptable (Sanders et al., 2014).

NBD and its symptoms majorly impact the life of people with the condition and their significant others. People with NBD even perceive that their bowel is controlling them (Dibley et al., 2017; Nevedal et al., 2016). As seen in this review, TAI appears to be a means whereby control can be regained. Not only can TAI provide control over bowel emptying, it also has a positive impact on dependency, and both children and adults appear to become less dependent. However, level of dependency appears to be linked to overall functional and cognitive ability; severer degree of disability may hamper total independence. According to Wide, Mattsson, Drott, and Mattsson (2014), those who are independent in toilet procedures rate quality of life significantly higher than those who are fully dependent. From the results, TAI in general seems to have a positive impact on quality of life.

TAI appears to be effective and may increase independence, but the results are inconclusive regarding feasibility. Practical problems and adverse effects affect feasibility negatively. Yet severe adverse events such as bowel perforations were rare, which increase the benefit-risk ratio in support of the further use of TAI (Christensen et al., 2016). Practical problems were one of the most commonly reported reasons for discontinuation, mainly at the beginning of the treatment period. According to Bildstein et al. (2017), people who continue to use TAI seem to tolerate possible practical problems as their bowel function improves (Bildstein et al., 2017). TAI can be a well-functioning treatment for people with NBD (Dale et al., 2019), if users can persist through an initial period of practical problems, which according to Christensen et al. (2009) can be solved with adjustments.

To ensure compliance, training led by competent instructors alongside structured user support is essential (Adriaansen et al., 2015; Bildstein et al., 2017; Dale et al., 2019; Lallemant-Dudek et al., 2020; Sanders et al., 2014). The further development and use of new equipment is also needed. Passananti et al. (2016) found that problems with balloon bursts were reduced after catheter design was altered. Further, electronic systems with digital functions for TAI that improves user-friendliness (Passananti et al., 2016) and pumps that can increase feasibility (Charvier, Bonniaud, Waz, Desprez, & Leroi, 2020) have been developed none of the participants in the studies included in this review had access to such equipment.

One tendency that could be discerned was a difference in compliance between children and adolescents, and adults. Children and adolescents in general reported a high degree of compliance. This might be explained by the fact that many children and adolescents are supported by their parents. It has been suggested that parents of children with NBD often are driving forces in terms of improvement methods (Sanders et al., 2014), whereas an adult with NBD is more often "left on his/her own" (Burns et al., 2015). Children and their parents often receive information about TAI at an early stage, because it is an accepted treatment for those born with spinal cord injury. Adults who suffer from neurological diseases/injuries later in life tend to receive less information about TAI (Coggrave et al., 2009).

Cultural differences and differences in socioeconomic support systems also seem to affect level of compliance. In one of the included studies from Korea, parents were seen to take full responsibility for their child's care because there is a limited availability of support programs for children with chronic conditions (Choi et al., 2015). In the only study from Australia, there was a high rate of cessation with TAI, explained

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by a lack of outpatient support (King et al., 2017). In two studies, from Korea and the U.S., economic restrictions and/or insurance issues were reported as a reason for discontinuation (Choi et al., 2015; Patel et al., 2020). This indicates that TAI is not accessible for all, even if it is a cost-effective method in comparison to standard bowel care (Christensen et al., 2009; Emmanuel et al., 2016; Sengoku et al., 2018).

Implications for Nursing

For patients with NBD, the process of defecation is challenging causing symptoms of fecal incontinence and/or constipation known to be associated with a poorer quality of life. The results of this study show that TAI effectively reduces symptoms of NBD and thus nurses in clinical practice should inform potential uses on the method. However, it is important that nurses, as well as other healthcare staff, can offer a proper introduction Nurses guide and support the users and caregivers to pass the challenges that may follow the treatment of TAI. This is important for the treatment to be successful.

Limitations

The aim of this integrative review was to investigate the effectiveness and feasibility of TAI for people with NBD. During quality appraisal it became clear that only one randomized control trial had been performed on the topic and several other studies had small participant numbers and/or were otherwise weak in quality (e.g., used nonstandardized measures, noncomparative, and/or short duration of treatment). This may affect reliability of the study. Also, the integrative design was chosen so that both quantitative and qualitative designs could be integrated. Yet only one qualitative study matched the inclusion criteria. Still, by summarizing the results from several studies tendencies can be found, and the results in this review are supported by previous, dated reviews.

When performing an integrative review, a broad approach should be used. To ensure high-quality search strategies, we consulted a team of information specialists who assisted with the searches. This led to a rich number of studies. Only one of the authors reviewed all of the included studies and withdrew data, which can be understood as a weakness. Nevertheless, the entire research team discussed any unclear cases and reviewed the correctness of the extracted data.

Conclusion

After completing this integrative review, we conclude that TAI seems to be an effective method for people with NBD. Regarding feasibility, the results are inconclusive but suggest that TAI can reduce dependency in bowel habits. However, users, including caregivers, report practical problems, and compliance was not always easy to achieve. It is important that users, including caregivers, are well informed and supported throughout treatment, especially by way of introduction. Also, there is a need for high-quality quantitative and qualitative studies on the topic to support our findings. •

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