



Provided by the author(s) and University of Galway in accordance with publisher policies. Please cite the published version when available.

Title	The assessment and treatment of toileting difficulties in individuals with autism spectrum disorder and other developmental disabilities
Author(s)	Francis, Kady; Mannion, Arlene; Leader, Geraldine
Publication Date	2017-06-01
Publication Information	Francis, Kady, Mannion, Arlene, & Leader, Geraldine. (2017). The Assessment and Treatment of Toileting Difficulties in Individuals with Autism Spectrum Disorder and Other Developmental Disabilities. <i>Review Journal of Autism and Developmental Disorders</i> , 4(3), 190-204. doi: 10.1007/s40489-017-0107-3
Publisher	Springer Verlag
Link to publisher's version	https://dx.doi.org/10.1007/s40489-017-0107-3
Item record	http://hdl.handle.net/10379/7406
DOI	http://dx.doi.org/10.1007/s40489-017-0107-3

Downloaded 2024-05-14T08:20:40Z

Some rights reserved. For more information, please see the item record link above.



The assessment and treatment of toileting difficulties in individuals with autism spectrum disorder and other developmental disabilities.

Kady Francis

Geraldine Leader

Arlene Mannion

National University of Ireland, Galway

Corresponding author: Geraldine Leader, Ph.D., Irish Centre for Autism and Neurodevelopmental Research, School of Psychology, National University of Ireland, Galway, Ireland. Tel: 00353 91 493434, Fax: 00353 91 521355.

Abstract

In 2009, Kroeger and Sorensen-Burnworth published a comprehensive review of the literature on toilet training individuals with Autism Spectrum Disorder and other developmental disabilities. Their review highlighted that the majority of toilet training programs were modelled after Azrin and Foxx's Rapid Toilet Training method. The current study will update the toilet training literature since 2009. Behaviorally-based components of these programs will be described and their contribution to toilet training discussed. This study will also review the range of assessment tools available to measure toileting difficulties and will discuss their contribution to toilet training programs.

Keywords: Toilet training, Toileting assessment, Continence, Autism spectrum disorder, Developmental disabilities, Review.

1. Introduction

Toileting refers to the accomplishment of various unprompted behaviors, including recognising the need to go to the toilet, and waiting before eliminating (Keen, Brannigan, & Kuskelly, 2007). Therefore, there are two fundamental goals in toilet training; to recognise the need to go to the toilet and the ability to independently complete the sequence of behaviors necessary for successful healthy toileting (Lott & Kroeger, 2004). In the typically developing population, these skills are usually acquired by the age of four (Schum et al., 2002; Chang, Lee, Chou, Chen, & Chen, 2011). However, individuals with developmental disabilities such as Autism Spectrum Disorder (ASD) are more likely to experience toileting problems such as enuresis, encopresis, soiling and other toileting problems more so than the general population (Matson & Lovullo, 2009). Szyndler (1996) reported that 82% of children with ASD experienced toileting difficulties, as identified through parent reports. Dalrymple and Ruble (1992) identified the most common toileting difficulties in a survey of 100 parents of children with ASD. Forty-three percent of their sample urinated in places other than the toilet post-training, and 26% had bowel movements in places other than the toilet post-training. The most commonly reported location for out-of-toilet urinations and bowel movements was outdoors. In addition, Matson, Horovitz and Sipes (2011) investigated the prevalence and frequency of toileting difficulties in 153 adults with intellectual disabilities using the Profile of Toileting Issues (POTI; Matson, Dempsey, & Fodstad, 2010) questionnaire. The results revealed that five toileting problems were endorsed as being a problem in over 50% of participants. The most commonly reported problems were: “has a toileting accident during the day”, “has toileting accidents during the night”, “has had wet underwear in the past month”, “requires the use of fiber supplements/laxatives to defecate”, and “is on a medication with a known side effect of constipation”. The findings also suggested that toileting difficulties differ across level of intellectual disability. The

percentage of toileting difficulties among individuals with a profound, severe, moderate and mild intellectual disability were 10.60%, 6.39%, 6.47% and 3.54% respectively. This is an important finding as intellectual disability is the most common co-occurring disorder with ASD (Matson & Shoemaker, 2011) with prevalence rates reporting that up to 75% of individuals with ASD show some level of ID (Croen, Grether, & Selvin, 2002).

Competent toileting is a critical life skill necessary for independent living, and incontinence is a significant quality of life barrier for individuals with and without developmental disabilities (Kroeger & Sorensen-Burnworth, 2009; Vermandel, Van Kampen, Van Gorp, & Wyndaele, 2007). Research on typically-developing children conducted by Joinson et al. (2007) found that children who experienced toileting difficulties (i.e. soiled themselves) were more likely to be victims of bullying, subject to both verbal and physical aggression, compared to children who did not experience any toileting difficulties. This is an important finding as such victimisation may exacerbate challenging and self-injurious behaviors which are common in children with intellectual disability and ASD (Oliver & Richards, 2010). Independent toileting can improve an individual's quality of life through improved hygiene and improved self-confidence, as well as reduced stigmatism and reduced physical discomfort that comes from soiled clothes and bed linen (Cicero & Pfadt, 2002, Lott & Kroeger, 2004). Furthermore, research suggests that individuals who have not been successfully toilet trained as children are increasingly more difficult to toilet train as adults (Smith & Smith, 1977; Lohmann, Eyman, & Lask, 1967), meaning they are likely to continue to face significant quality of life barriers throughout their lives. Belva, Matson, Barker, Shoemaker, and Mahan (2011) investigated the relationship between adaptive functioning and toileting difficulties in a sample of 80 individuals with intellectual disabilities, ranging from mild to profound. As hypothesised, the results demonstrated that individuals with lower adaptive functioning experienced increased toileting difficulties. In particular, those who

scored lower on adaptive functioning experienced increased physical problems related to toileting deficits such as urinary tract infections, pelvic aches, and pain while toileting.

Despite the negative impact of toileting difficulties on an individual's quality of life, there has been surprisingly little research conducted in the area. In fact, toileting difficulties in individuals with developmental disabilities has frequently been identified as an area in need of further exploration (Mannion & Leader, 2013; Matson & Lovullo, 2009). Of particular importance is the lack of formal and comprehensive measures available to assess toileting problems in this population. For example, toilet training interventions most often employ observational measures of toileting difficulties such as frequency of toilet accidents, number of wet diapers, or number of times the individual wets the bed per week (Le Blanc, Carr, Crossett, Bennett, & Detweiler, 2005; Henriksen & Peterson, 2013). Furthermore, while many researchers have reported the prevalence of toileting difficulties in individuals with intellectual disabilities, ASD and other developmental disabilities, this is often assessed using a single question (e.g., Maskey, Warnell, Parr, Le Couteur, & McConachie, 2013; Ando, Yoshimura, & Wakabayashi, 1980) or subscales of larger tools that measure challenging behaviors or adaptive skill deficits on a broader scale. For example, the Vineland Adaptive Behavior Scales – II (Sparrow, Cichetti, & Balla, 2005) is comprised of four domains, communication, daily living skills, socialisation, and motor skills domain. Within the daily living skills domain, there are three subdomains, personal, academic and school community. The personal subdomain assess skills such as feeding, dressing, toileting and bathing. However, due to the limited number of items which directly measure toileting skills, this measure does not provide adequate information on an individual's toileting behaviors. In particular, these measures lack the ability to inform and drive treatment. As behaviorally-based treatment programs have been chosen as the interventions of choice for toilet training individuals with developmental disabilities, the function of toileting behaviors needs to be

identified to target in treatment programs. As an important element of developing toilet training interventions relies heavily upon the ability to comprehensively assess the most common toileting problems and the possible functions of these problems, and to identify the greatest barriers experienced by parents/caregivers when toilet training their children with developmental disabilities, the questionnaire measures used to assess toileting difficulties will be reviewed in this study.

The most widely cited and comprehensive toilet training protocol was published in 1971 by Azrin and Foxx who developed the Rapid Toilet Training (RTT) method. This procedure was developed in order to rapidly toilet train individuals with learning disabilities, along with motivating them to remain continent during the day (Azrin & Foxx, 1971). The rationale for the development of this method was that normal toilet training is not simply a matter of responding to sensations in the bowel and bladder. Instead, it is a complex operant and social learning process that can be severely impeded by the reduced learning capacities of those with intellectual disabilities (Azrin & Foxx, 1971). Therefore, the RTT method and more current approaches to toilet training individuals with developmental disabilities have drawn heavily upon operant conditioning techniques. The RTT procedure includes many different components, including positive reinforcement for successful in-toilet eliminations, positive punishment following out-of-toilet urinations, increased fluid intake to increase opportunity for urination, along with scheduled times to visit the bathroom to ensure frequent toilet sittings and to promote independence (Thomson, Walters, Martin, & Yu, 2011). The RTT method has demonstrated success in toilet training individuals with a wide range of developmental disabilities (Foxx & Azrin, 1973; Butler, 1976) and modified and shortened versions of this method have also shown to be effective (Chung, 2007; Didden, Sikkema, Bosman, Duker, & Curfs, 2001; Williams & Sloop, 1978).

Kroeger and Sorensen-Burnworth (2009) reviewed the literature on toileting training programs and found that the majority of toileting programs were derivatives of Azrin & Foxx's RTT method. They reported that the most common component of toilet training programs was graduated guidance and the least frequently used strategy was priming and video modeling. A number of other training components were identified and discussed, including reinforcement-based training, scheduled sittings, elimination schedules, punishment procedures, hydration, manipulation of stimulus control and night-time training for diurnal continence. Since their review, there has also been some novel and incremental advances in toilet training programs, for example, video modeling techniques have been frequently used in more recent years to toilet train individuals with developmental disabilities. Different types of video modeling, such as video-hero modelling (VHM), point-of-view modeling (PVM) and video self-modeling (VSM) have proven successful in achieving continence in individuals with ASD. Therefore, advances in the toilet training literature since 2009 will be discussed in this review.

2. Assessment of Toileting Problems

2.1 Method

To identify the questionnaire measures used to assess toileting difficulties, a comprehensive literature review was conducted. The major Psychology (PsycInfo), educational (ERIC) and medical (Medline) search engines were queried for toileting articles using a combination of search terms: "toileting, toilet, (in) continence" and "autism, developmental disability and disorder, intellectual disability and mental retardation". The years searched began with July 2016 and a lower limit was not set. Three hundred and seventy-six papers were returned in the initial search. All returned documents were reviewed for pertinence and divided into two categories: theoretical or statement papers (including

book chapters) and data-based or single-case design, peer-reviewed journal submissions. A total of 20 papers were included and reviewed herein based on the presence of a questionnaire measure of toileting.

3. Results

3.1 Observational Measures

The majority of the articles that were returned in the search measured toileting difficulties or successes through observations, as opposed to questionnaires. For example, toileting difficulties were most often measured as frequency of toileting accidents, that is, eliminating in any place other than the toilet (Cicero & Pfadt, 2002). Toileting accidents were phrased in a variety of ways including non-toilet eliminations (e.g., Rinald & Mirenda, 2012) incontinence (e.g., Luiselli, 1997), in-pants or in-diaper urinations/soiling (e.g., Luiselli, 2007) and bedwetting (e.g., Henriksen & Peterson, 2013). In some cases, accidents were divided into large and small accidents (Lancioni & Markus, 1999; Lancioni, O' Reilly, Serenelli, & Campodonico, 2000). Large accidents were defined as wetting/soiling underwear and pants, and small accidents were defined as wetting small areas of the underpants such as only the disposable tissue inside the underwear.

Similarly, toileting independence or successes were frequently measured as percentage or number of times the individual urinated or voided in the toilet appropriately, often during scheduled bathroom visits. This refers to times where urine or faeces were directly deposited into the toilet (Kroeger & Sorensen, 2010). In some cases, these successful in-toilet eliminations were further coded as either prompted or self-initiated (e.g., Le Blanc et al., 2005). Prompted refers to the toileting being initiated by the parent/caregiver whereas self-initiations or spontaneous requests can be defined as a request by the participant to use the bathroom using spoken requests, sign language, picture icons, or by walking to the toilet

and initiating the process without prompting (Le Blanc et al., 2005). Other forms of toileting successes included absence of accidents such as number of dry diapers at scheduled bathroom visits (e.g., Bainbridge & Myles, 1999) and morning dryness in the case of bedwetting (e.g., Van Laecke, Raes, Van de Walle, & Hoebeke, 2008).

Observational measures of toileting are an effective way of gathering information on the success of a toilet training intervention through comparing pre- and post-intervention data. However, observational measures lack the ability to inform and drive treatment programs. Therefore the questionnaire measures of toileting difficulties which have been employed in research with participants with developmental disabilities will be reviewed and discussed herein. This includes (1) single-item measures (2) subscale measures and (3) full scale measures, of toileting.

3.2 Single-Item Measures

Maskey et al. (2013) created the “Ten Common Problems Questionnaire” to determine the frequency of the most common emotional and behavioral problems in a sample of children with ASD. The 10 most common comorbid problems included habit disorders, such as eating, sleeping and toileting, and other emotional and behavioral problems, such as anxiety, aggression, and severely overactive periods. Each item is answered as either “*Frequent*”, i.e. the behavior is apparent several times a week (3 or more), “*Sometimes*”, i.e. the behavior occurs once or twice a week, “*Never or Rare*” or “*In Past Only*”. The toileting component consists of a single-item, as follows: “Toileting problems, including constipation, retaining faeces, smearing faeces, diarrhea, wetting self after it is usual for his/her age group”.

Strauss and Zigman (1996) explored the adaptive skills including toileting, eating and ambulation on a sample of adults above the age of 40 with developmental disabilities. The toileting component consisted of a single item measured on a 3-point scale: high, medium or

low. Operational definitions were, “*high*” -goes to toilet by self, completes by self; “*low*”- not toilet trained or habit trained.

Duker and Dekkers (1992) assessed bladder control in a sample of children and adults with MR using a 10-point rating scale, completed independently by two direct-care staff members. A rating of (0) was assigned to individuals who wore diapers during the day and were dry between zero and three times a week. Individuals who did not wear diapers during the day and had an average of less than one daytime urinary accident a week were assigned a score of (10). For example, a rating of (7) was assigned to the individual if they did not wear diapers during the day and had an average of four to six daytime urinary accidents per week.

Ando et al. (1980) measured the effect of age on adaptive behavior, including toileting, and academic skills in children aged between 6-14years with ASD and MR. Teachers were asked to rate the children’s level of toileting on a four point scale. The possible responses were as follows; 1 = *Independent use of toilet*, 2 = *Makes toileting needs known but needs some assistance*, 3 = *Partially trained* (responds if taken to the toilet at scheduled intervals, but some untidiness), 4 = *Not trained at all*.

--Insert Table 1 here--

3.3 Subscales

Bailey, Raspa, Holiday, Bishop, and Olmsted (2009) constructed a 37-item survey where parents of 1,298 children with Fragile X Syndrome (including adult children) rated their functional skills, including current eating, dressing, toileting, bathing and hygiene, communication, articulation, and reading skills. They assigned one of four ability levels to each of the items (*Does not perform this task*, *Does this task but not well*, *Does this task fairly well*, or, *Does this task very well*). The toileting subscale contained five toileting skills (1) asks to use the toilet (2) uses toilet independently (3) wipes independently (4) washes hands

after toileting (5) cares for toileting needs without being reminded. The authors generated the survey items following a review of the literature and other measures of functional skills, with a goal of identifying major functional skills that would represent important indicators of independent functioning (e.g., dresses independently) or major progress toward the accomplishment of those indicators (e.g., buttons clothes). However, a formal validation of the items or the data was not conducted.

Dykens, Hodopp, and Leckman (1989) used the Vineland Adaptive Behavior Scales (VABS; Sparrow, Balla, & Cicchetti, 1984) to establish the profile of adaptive strengths and weaknesses of a sample of Fragile X Males. Currently, the VABS-II (Sparrow, Cicchetti, & Balla, 2005) is the most up-to-date and widely used measure of adaptive functioning. The VABS-II is an informant based measure designed to evaluate adaptive functioning from birth throughout adulthood. It consists of four subdomains including communication (receptive, expressive, and written), daily living skills (personal, domestic, and community), socialisation (interpersonal relationships, play and leisure time, and coping skills) and motor skills (gross, fine). Respondents answer each questions on a Likert-type 3-point scale (0 = *Never*, 1 = *Sometimes/Partially*, 2 = *Usually*). The personal daily living skills subdomain contains a limited number of questions on toileting difficulties.

Several studies (Cooper, Smiley, Morrison, Williamson & Allan, 2007; Smiley et al., 2007; Mantry et al. 2008; Cooper et al., 2009) have employed the C21st Health Check (Glasgow UCEDD, 2001) to assess problem behaviors, development, disabilities and physical health in individuals with intellectual disabilities. This instrument has a number of questions throughout which relate to urinary and bowel continence. For example, a question on the individuals' urinary continence levels include "How continent is the person with her / his urine?" and is responded to as either "*Fully continent*", "*Occasional accidents/continent with toileting programme*", "*Incontinent at night only*", or, "*Incontinent*". The measure also

gathers information on the urinary system, such as whether or not the individual experiences pain when passing water, and bowel problems, such as whether or not the individual experiences constipation or diarrhea.

The Scales of Independent Behavior (SIB-R; Bruininks, Bradley, Weatherman, & Woodcock, 1996) was employed by Keen et al. (2007) to assess adaptive functioning and the frequency and severity of problem behaviors in a sample of 5 boys aged between 4-6 years with autism prior to a toilet training video modelling intervention. The SIB-R has been normed for use with individuals from the age of 3 months to over 80 years. It contains 259 items that are separated into 14 subscales that are grouped into four adaptive behavior clusters: Social Interaction and Communication, Personal Living, Community Living, and Motor Skills. Toileting falls under the Personal Living cluster along with eating and meal preparation, dressing, personal self-care and domestic skills. The SIB-R is reported to have high split-half and test-retest reliabilities (Sattler, 2002; Wells, Condillac, Perry, & Factor, 2009).

--Insert Table 2 here--

3.4 Full-Scale Measures

The Survey of Toilet Habits (STH; Dalrymple & Ruble, 1992) was employed to assess parent's views on toilet training of children with Autism. The measure was developed through extended interviews with 10 parents of children with Autism aged between 12 and 24 years. The STH consisted of 21 open-ended questions involving (a) developmental milestones in toileting development, (b) difficulties in urine and bowel training, (c) post toilet training difficulties, and (d) methods implemented in toilet training. Feedback from parents was used to design the final questionnaire consisting of 22 primary questions with some

divided for specificity. The STH was shown to have good internal consistency (alpha coefficient = .82)

The Parental Questionnaire: Enuresis/Encopresis Incontinence (Beetz, von Gontard, & Lettgen, 1994) has been used in a number of studies (von Gontard, Didden, Sinnema, & Curfs, 2010; Giesbers et al., 2012; Radstaake et al., 2013; Equit, Piro-Hussong, Niemczyki, Curfs, & von Gontard, 2013) involving individuals with Prader-Willi Syndrome, Rett Syndrome, Angelman Syndrome, and Fragile-X Syndrome. It is a clinical non-validated questionnaire (von Gontard et al., 2010) that consists of 57 items referring to daytime and nighttime wetting (e.g., 'How many days a week does your child wet his/her clothes or diaper'), toileting (e.g., Does your child go to the toilet him/herself if he/she needs to or does he/she express that he/she wants to go to the toilet), observable voiding behaviors and reactions (e.g., 'When your child needs to void, does he/she have to rush to the toilet immediately), urinary tract function (e.g., 'Has your child/client ever had a UTI'), stool habits (e.g., 'Does your child have daily bowel movements') and behavioral symptoms (e.g., 'Does your child wet more often in stressful times'). The questions are responded to by a yes/no by the individual's primary caregiver. Additional data such as voiding and defecation frequency are noted numerically. The questionnaire is suitable for children who are at least 5 years of age.

Matson et al. (2010) developed the Profile of Toileting Issues (POTI) questionnaire for individuals with intellectual disabilities between the ages of four throughout adulthood and since then it has been used in several studies involving individuals with intellectual disabilities (Belva et al., 2011; Matson et al., 2011a; Matson, Neal, Hess & Kozlowski, 2011). The POTI is a paper-based 56-item checklist that is designed to screen for diagnostic criteria for enuresis and encopresis as well as potential functions, including avoidance, pain, social difficulties, noncompliance, internal cues, peer rejection, aversive parenting,

shame/deception and medical conditions. The scale is completed by clinicians with an individual's primary caregiver with items rated as "No Problem Present" (0), "Problem Present" (1), or "Does Not Apply" (X). A total score is derived by summing the responses for each item, with higher scores indicating more significant toileting difficulties. Good internal consistency ($\alpha=.83$) and interrater reliability have been established for the measure (Matson et al., 2011b).

--Insert Table 3 here--

4. Conclusion

The majority of toileting papers returned in the search employed observational measures of toileting difficulties. While observations are an effective way of measuring participants' progress in toileting interventions, they do not provide any information on why the individual may be experiencing toileting difficulties (e.g., due to stress or pain), which could inform treatment and contribute to the long-term maintenance of appropriate and healthy toileting. A significantly smaller number of papers employed paper-based measures of toileting difficulties. Single-item measures may be considered convenient in providing an overall prevalence rate of toileting difficulties in a given population which in turn may highlight the need for toilet training programs, however, they do not provide enough information to inform and drive these programs. Where possible it is recommended to employ subscale measures which include several toileting questions or full scale measures of toileting skills. The full scale measures mentioned (the STH, POTI and The Parental Questionnaire: Enuresis/Encopresis Incontinence) help parents and practitioners to gain a comprehensive insight into the individual's toilet difficulties. For example, the POTI identifies possible functions of toileting difficulties such as pain and medical conditions,

which may be a barrier to successful toilet training that will need to be addressed prior to a program being introduced.

5. Toilet Training

5.1 Method

To identify toilet training programs, a comprehensive literature review was conducted where the major psychology (PsycInfo) educational (ERIC) and medical (Medline) search engines were queried for toileting articles using a combination of the following search words “toileting, toilet, (in) continence” and “autism, developmental disability and disorder, intellectual disability and mental retardation”. The years searched were between 2009 and July 2016 to identify the growth in toilet training programs since Kroeger and Sorensen-Burnsworth’s 2009 review. One hundred and nine papers were returned in the initial search. All returned documents were reviewed for pertinence and divided into two categories: theoretical or statement papers (e.g., book chapters, review articles) and data-based studies or single-case design, peer-reviewed journal submissions only. A total of fifteen data-based studies were included and are summarised in Table 4. The growth in toilet training interventions since Kroeger and Sorensen’s 2009 review will be described. This includes (1) enuresis alarm (2) scheduled chair sittings (3) video modelling (4) diaper/pad removal (5) communication training and (6) dry checks.

6. Results

6.1 Enuresis alarm

Kroeger and Sorensen-Burnsworth (2009) referred to the use of urine/enuresis alarms in identifying an individuals’ elimination schedule which helps to inform a more individualised treatment protocol and the most effective times to intervene. Since then, the enuresis alarm has been employed as a primary treatment component to treat both nocturnal

(bedwetting) and diurnal enuresis. An enuresis alarm (or bell and pad) emits a loud sound and/or vibration when the sensor attached to the person's undergarments or to a pad on the bed detects moisture. This in turn alerts the parent/caregiver when a diaper is wet. There has been considerable debate surrounding the theoretical rationale by which enuresis alarms produce their effect. Originally, Mowrer and Mowrer (1938) postulated that the technique works through the process of classical conditioning. In this theory, bladder distention cues (the conditioned stimulus) gradually gains the ability to produce the awakening response (the conditioned response) through repeated pairings with the alarm sound (the unconditioned stimulus) (Matson, 1988). However, this theory does not explain why children learn to sleep throughout the night without wetting, as opposed to learning to get up during the night, as would be expected if they were learning to associate bladder distinction cues with wakefulness. Another explanation of the alarm's mechanism is based on operant conditioning, whereby the sound of the alarm followed by the subsequent abrupt wakening functions as a negative consequence that can be avoided by learning not to wet during the night (Matson, 1988).

The urine alarm was originally designed to be worn at night, to treat nocturnal enuresis. Henriksen and Peterson (2013) outline the procedure they employed to treat night-time bedwetting using the enuresis alarm as follows: (1) attach the urine alarm to the participant's pyjama top and the moisture sensor to their training pants before putting them to bed (2) listen for the alarm sounding during the night (3) upon hearing the alarm, immediately go to the participant and wake them if not already awoken, and turn the alarm off (4) have them finish urinating in the toilet; (5) provide little attention after bedwetting but praise use of the toilet (6) have them place any wet laundry in the hamper and put on clean clothes and bed sheets if needed (7) reattach the alarm before returning to bed. This is a relatively non-invasive intervention which has several advantages over other behavioral and

medical approaches. Several advantages include the relatively low expense of the urine alarm and the minimal adverse effects compared to the effects of medication for nocturnal enuresis such as oxybutynin which can cause problems such as stomach discomfort, dry mouth and headaches (e.g., Lovering et al., 1988). Furthermore, Henriksen and Peterson noted that the response effort and intrusiveness for the family involved in their study was relatively low, compared to more complex training programs which involve many behavioral components. New technology has created a mobile wireless alert systems for toilet training, where teachers in schools are sent a message to their phone (Chang et al., 2011) when their students undergarments are wet. The idea here is to alert caregivers immediately when a diaper or pad is wet and help the child become more aware of urination. As soon as the alarm goes off the child is encouraged to go to the toilet. This helps the children to learn to associate the sensation of a full bladder with the toileting routine (Vermandel et al., 2009). This wireless technology means that the urine alarm can be successfully utilised to treat diurnal enuresis in addition to nocturnal enuresis, and can be employed across a variety of settings. Both Chang et al. (2011) and Henriksen and Peterson (2013) note the usefulness of feedback to the user for example vibrations or acoustics when the moisture sensor becomes wet.

6.2 Video Modeling

Video Modelling (VM) involves the individual observing a video of a model engaging in the target behavior and subsequently imitating it. Kroeger and Sorensen-Burnworth (2009) identified only two papers which reported using Video Modeling to toilet train children with Autism (Bainbridge & Myles, 1999; Keen et al., 2007). Since their review, four studies have employed various types of Video Modeling to teach independent toileting skills to children with ASD. It is important to note that certain pre-requisite skills should be present in the individual's repertoire before choosing VM as the toilet training intervention of choice. It is

essential to ensure that participants have sufficient imitation and visual discrimination skills to ensure they will learn from the VM intervention. Lee, Anderson & Moore (2014) used both Video Self Modeling (VSM) and Point-of-view Video Modeling (PVM) to toilet train a 4 year old boy with Autism. VSM involves the participant watching video recordings of themselves successfully performing the target behaviors. PVM involves the use of video footage filmed from the participant's perspective. It can involve close-up shots, such as hands performing a fine motor task, for example flushing a toilet, or it can involve a broader scene shot from the participant's eye level. The results of Lee et al.'s study showed that the intervention package was effective in teaching the toileting skills of dressing, sitting on the toilet, and flushing. However, it did not result in the acquisition of in-toilet voiding. The authors attributed this to the fact that the participant never saw the model void in the toilet due to privacy issues and current social expectations regarding the explicit depiction of genitalia and excretion. Taking this into account, animation has since been incorporated into VM to successfully teach independent toileting skills, including in-toilet voiding, while simultaneously overcoming the practical limitations in depicting a sensitive private event such as toileting (Drysdale, Lee, Anderson, & Moore, 2015; McLay, Carnett, van der Meer, & Lang, 2015). Additionally, animations involving characters that the subjects are pre-occupied with has since been employed to teach toileting skills to children with ASD (Ohtake, Takahashi & Watanabe, 2015), known as Video Hero Modeling (VHM). VHM involves showing a video in which a character with which the participant is pre-occupied engages in the target behavior immediately before the participant has to exhibit the behavior. The term "pre-occupied" means that the student interacts with a given character very intensely and for a significant proportion of time, for example, talking about the character or pretending he/she is the character. Ohtake et al. (2015) note that attempts to engage individuals with ASD in self-care skills such as toileting can be met with a number of

obstacles such as escape, avoidance and aggressive or self-injurious behaviors. Therefore it is imperative to make the target activities interesting and enjoyable, which can be achieved using animation and video heroes as models.

6.3 Scheduled Chair Sitings

Kroeger and Sorensworth (2009) identified scheduled toilet sitings as a common component of many toilet training programs, which was taken from Azrin and Foxx's RTT method. Scheduled toilet sitting involves individuals sitting on or on front of the toilet (depending on sex and training protocol) at regular intervals (for example every 90 minutes) for a set period of time (for example 30 seconds), and is still employed in as part of multi-component toileting programs today (Van Oorsouw, Duker, Melein, & Avernik 2010; Brown & Peace, 2011; Cocchiola, Martino, Dwyer, & Demezzo, 2012; Suppo & Mayton, 2012; Rinald & Mirenda, 2012; Kroeger & Sorensen-Burnworth, 2010; Lee et al., 2014; Drysdale et al., 2015; McLay et al., 2015; Axelrod et al., 2016). However, if an individual is demonstrating difficulty initiating trips to the toilet, that is, if the individual has not already started to approach the toilet independently for elimination, a new method, which involves scheduled chair sitings has been demonstrated to be successful to initiate this step which is vital to the maintenance of toileting success (Rinald & Mirenda, 2012; Kroeger & Sorensen-Burnworth, 2010). This technique involves placing a chair near the toilet (e.g., 2 feet away) and seating the child on the chair, using the same schedule of intervals as in scheduled toilet sitings. If the child does not move from the chair to the toilet when he or she begins to eliminate, the parent prompts the child to do so using the least intrusive, minimal, physical prompt possible. Once the child moves from the chair to the toilet and eliminates completely without prompts on one occasion, the chair is moved 2 feet further away from the toilet. After each child-initiated success, the chair is moved 2 feet further from the toilet until it is 20 feet away, at which time the chair is removed completely. Kroeger and Sorensen-

Burnworth (2010) also used this approach to teach self-initiation, however they employed a more conservative approach which required the child to independently move from the chair to the toilet to void three consecutive times before the chair was moved further away.

6.4 Diaper/Pad Removal

It is common for carers to use pads and diapers to manage incontinence in people with learning disabilities, even though there is evidence that this can interfere with the acquisition of continence skills. Some studies have therefore employed the technique of removing the individual's pad or diaper as part of a multi-component toilet training program. (Cocchiola et al., 2011; Brown & Peace, 2011; Rinald & Mirenda; Drysdale et al., 2015; McLay et al., 2015; Van Oorsouw et al., 2009). Underlying this technique is the idea that removing pads or diapers may have negative reinforcing effects (Cocchiola et al., 2011; Brown & Peace, 2011). That is, avoidance of the discomfort associated with being wet may act as a negative reinforcer that increases continence levels. In contrast, wearing a pad or diaper removes this wet feeling, and it's negative reinforcing properties. However, it should be noted that in order for wetness to have a motivating function, the individual must be observed to be particularly aware of, or become upset by being wet (Brown & Peace, 2011). There are also some ethical issues to be aware of and careful consideration of the short-term and long-term effects of such a strategy should be employed. The short-term benefits associated with wearing a pad such as the reduced feeling of discomfort associated with wetness should be carefully weighed up against the long-term benefits of helping the individual to become continent (Brown & Peace, 2011). For example, in Van Oorouw et al.'s study, caretakers of participants who were wearing a diaper again post-intervention were requested to remove the diaper for one or more days to record the participants' number or accidents. However, due to both practical and hygienic reasons, all caretakers refused this request.

6.5 Communication Training/Visual Aids

Communication Training and Visual Aids can become an important component of toilet training programs for individuals who experience communication or language deficits. Picture Exchange Communication System (PECS) is commonly used for children with developmental disabilities who have limited language ability. For example, the participant is given a toilet PECS card, and prompted to give it back to their parent/caregiver when they need to use the bathroom in order to teach self-initiation of toileting (Brown & Peace, 2011; Lee et al., 2014). Cue cards have also been employed to inform participants when it is time for them to visit the toilet (Drysdale et al., 2015). For individuals who do not have spoken language and use a speech-generating device (SGD) to communicate, a toileting symbol can be added to the home screen of the SGD to allow the participant to request the toilet. In McLay et al.'s study participants SGD's were programmed to produce the synthetically generated word "toilet" when the toilet symbol was selected. Additionally, visual aids in the form of pictures has been employed in conjunction with other behavioral techniques. For example, a visual schedule of the toileting procedure (Suppo & Mayton, 2012) can be used to show the step-by-step details of the toileting process such as (1) pull down pants (2) sit on potty (3) void in potty (4) wipe (5) flush (6) and wash hands. Each step can be paired with high-interest pictures to gain the individual's attention (such as favourite cartoon characters).

6.6 Dry Checks

Dry checks are often carried out during scheduled bathroom visits. However, in some studies dry checks are carried out independent of scheduled bathroom visits and can be completed by either the parent/caregiver (e.g., Ardic & Cavyaktar, 2014) or by the participant themselves (e.g., McLay et al., 2015), but are initiated by the parent/caregiver. Ardic &

Cavkaytar (2014) incorporated dry checks into their multicomponent toilet training program by checking dryness every 10 minutes during 30 minute toilet training sessions. The verbal expression “Let’s see, are you dry?” was used to initiate the dry check. McLay et al. (2015) incorporated dry checks into their toileting routine in an attempt to decrease the frequency of accidents by creating an incompatible behavior (e.g., being dry). For each dry check the parent approached their child, gained their attention, and said, “Are you dry?” The child was then prompted to touch the area to feel wet or dry. In both cases, if the participant was dry they were provided with positive reinforcement in the form of praise, edibles or tangibles.

--Insert Table 4 here--

7. Conclusion

As identified in Kroeger and Sorensen-Burnworth’s 2009 review, Azrin and Foxx’s RTT method continues to be widely used in toilet training programs for individuals with ASD and other developmental disabilities. Since their review, there has been some novel advances in toilet training programs which have been discussed. One particularly interesting advance is the increase in the use Video Modeling interventions in toilet training programs. VM provides not only an effective way of teaching toileting skills to individuals with developmental disabilities (Drysdales et al., 2015; Lee et al., 2014) but also provides an engaging way to learn important independent living skills. A number of other advances in toilet training programs were also discussed, including the use of enuresis alarms, scheduled chair sittings, diaper/pad removal, communication training and dry checks. These techniques should be considered alongside those identified by Kroeger and Sorensen-Burnworth (2009) when designing multicomponent toilet training programs for the development and maintenance of healthy toileting.

Compliance with Ethical Standards**Disclosure of potential conflicts of interest:**

The authors declare that they have no conflict of interest.

Research involving Human Participants and/or Animals:

This article does not contain any studies with human participants or animals performed by any of the authors.

References:

- Axelrod, M. I., Tornehl, M., & Fontanini-Axelrod, A. (2016). Co-occurring autism and intellectual disability: A treatment for encopresis using a behavioral intervention plus laxative across settings. *Clinical Practice in Pediatric Psychology, 4*(1), 1.
- Ando, H., Yoshimura, I., & Wakabayashi, S. (1980). Effects of age on adaptive behavior levels and academic skill levels in autistic and mentally retarded children. *Journal of Autism and Developmental Disorders, 10*(2), 173-184.
- Ardıç, A., & Cavkaytar, A. (2014). Effectiveness of the modified intensive toilet training method on teaching toilet skills to children with autism. *Education and Training in Autism and Developmental Disabilities, 49*(2), 263.
- Azrin, N. H., & Foxx, R. M. (1971). A rapid method of toilet training the institutionalized retarded. *Journal of Applied Behavior Analysis, 4*(2), 89-99.
- Bailey Jr, D. B., Raspa, M., Holiday, D., Bishop, E., & Olmsted, M. (2009). Functional skills of individuals with fragile X syndrome: A lifespan cross-sectional analysis. *American Journal of Intellectual and Developmental Disabilities, 114*(4), 289-303.
- Bainbridge, N., & Myles, B. S. (1999). The use of priming to introduce toilet training to a child with autism. *Focus on Autism and Other Developmental Disabilities, 14*(2), 106-109.
- Beetz, R., Von Gontard, A., & Lettgen, B. (1994). Anamnese-Fragebogen: Einnässen/Harninkontinenz und Erläuterungen zum Anamnese-Fragebogen. *Bad Homburg: Enuresis Informationszentrum.*
- Belva, B., Matson, J. L., Barker, A., Shoemaker, M. E., & Mahan, S. (2011). The relationship between adaptive behavior and specific toileting problems according to the profile on toileting issues (POTI). *Journal of Developmental and Physical Disabilities, 23*(6), 535-542.

- Brown, F. J., & Peace, N. (2011). Teaching a child with challenging behaviour to use the toilet: a clinical case study. *British Journal of Learning Disabilities*, 39(4), 321-326.
- Bruininks, R. H., Bradley, H. K., Weatherman, R. F., & Woodcock, R. W. (1996). *SIB-R*. Riverside publishing Company.
- Butler, J. F. (1976). The toilet training success of parents after reading toilet training in less than a day. *Behavior Therapy*, 7(2), 185-191.
- Chang, Y. J., Lee, M. Y., Chou, L. D., Chen, S. F., & Chen, Y. C. (2011). A mobile wetness detection system enabling teachers to toilet train children with intellectual disabilities in a public school setting. *Journal of Developmental and Physical Disabilities*, 23(6), 527-533.
- Chung, K. M. (2007). Modified version of Azrin and Foxx's rapid toilet training. *Journal of Developmental and Physical Disabilities*, 19(5), 449-455.
- Cicero, F. R., & Pfadt, A. (2002). Investigation of a reinforcement-based toilet training procedure for children with autism. *Research in Developmental Disabilities*, 23(5), 319-331.
- Cocchiola Jr, M. A., Martino, G. M., Dwyer, L. J., & Demezzo, K. (2012). Toilet training children with autism and developmental delays: An effective program for school settings. *Behavior Analysis in Practice*, 5(2), 60.
- Cooper, S. A., Smiley, E., Jackson, A., Finlayson, J., Allan, L., Mantry, D., & Morrison, J. (2009). Adults with intellectual disabilities: prevalence, incidence and remission of aggressive behaviour and related factors. *Journal of Intellectual Disability Research*, 53(3), 217-232.
- Cooper, S. A., Smiley, E., Morrison, J., Williamson, A., & Allan, L. (2007). Mental ill-health in adults with intellectual disabilities: prevalence and associated factors. *The British Journal of Psychiatry*, 190(1), 27-35.

- Croen, L. A., Grether, J. K., Hoogstrate, J., & Selvin, S. (2002). The changing prevalence of autism in California. *Journal of Autism and Developmental Disorders*, 32(3), 207-215.
- Dalrymple, N. J., & Ruble, L. A. (1992). Toilet training and behaviors of people with autism: Parent views. *Journal of Autism and Developmental Disorders*, 22(2), 265-275.
- Didden, R., Sikkema, S. P., Bosman, I., Duker, P. C., & Curfs, L. M. (2001). Use of a modified Azrin–Foxx toilet training procedure with individuals with Angelman syndrome. *Journal of Applied Research in Intellectual Disabilities*, 14(1), 64-70.
- Drysdale, B., Lee, C. Y. Q., Anderson, A., & Moore, D. W. (2015). Using video modeling incorporating animation to teach toileting to two children with autism spectrum disorder. *Journal of Developmental and Physical Disabilities*, 27(2), 149-165.
- Duker, P. C., & Dekkers, M. (1992). Development of diurnal bladder control in severely and profoundly mentally handicapped residents. *Journal of Intellectual Disability Research*, 36(2), 177-181.
- Dykens, E. M., Hodapp, R. M., & Leckman, J. F. (1989). Adaptive and maladaptive functioning of institutionalized and noninstitutionalized fragile X males. *Journal of the American Academy of Child & Adolescent Psychiatry*, 28(3), 427-430
- Equit, M., Piro-Hussong, A., Niemczyk, J., Curfs, L., & von Gontard, A. (2013). Elimination disorders in persons with Prader–Willi and Fragile-X syndromes. *Neurourology and Urodynamics*, 32(7), 986-992.
- Giesbers, S., Didden, R., Radstaake, M., Korzilius, H., von Gontard, A., Lang, R., ... & Curfs, L. M. (2012). Incontinence in individuals with Rett syndrome: A comparative study. *Journal of Developmental and Physical Disabilities*, 24(3), 287-300.

Henriksen, N., & Peterson, S. (2013). Behavioral treatment of bedwetting in an adolescent with autism. *Journal of Developmental and Physical Disabilities, 25*(3), 313-323.

Joinson, C., Heron, J., Butler, R., Von Gontard, A., Butler, U., Emond, A., & Golding, J. (2007). A United Kingdom population-based study of intellectual capacities in children with and without soiling, daytime wetting, and bed-wetting. *Pediatrics, 120*(2), 308-316.

Keen, D., Brannigan, K. L., & Cuskelly, M. (2007). Toilet training for children with autism: The effects of video modeling. *Journal of Developmental and Physical Disabilities, 19*(4), 291-303.

Kroeger, K. A., & Sorensen-Burnworth, R. (2009). Toilet training individuals with autism and other developmental disabilities: A critical review. *Research in Autism Spectrum Disorders, 3*(3), 607-618.

Kroeger, K., & Sorensen, R. (2010). A parent training model for toilet training children with autism. *Journal of Intellectual Disability Research, 54*(6), 556-567.

Lancioni, G. E., O'Reilly, M. F., Serenelli, S., & Campodonico, F. (2000). Alarm signals and prompts to eliminate large urinary accidents in a woman with multiple disabilities. *Scandinavian Journal of Behaviour Therapy, 29*(3-4), 152-155.

Lancioni, G. E., & Markus, S. (1999). Urine-triggered alarm signals and prompts to promote daytime urinary continence in a boy with severe intellectual disability. *Behavioural and Cognitive Psychotherapy, 27*(03), 261-265.

LeBlanc, L. A., Carr, J. E., Crossett, S. E., Bennett, C. M., & Detweiler, D. D. (2005). Intensive outpatient behavioral treatment of primary urinary incontinence of children with autism. *Focus on Autism and Other Developmental Disabilities, 20*(2), 98-105.

- Lee, C. Y. Q., Anderson, A., & Moore, D. W. (2014). Using video modeling to toilet train a child with autism. *Journal of Developmental and Physical Disabilities, 26*(2), 123-134.
- Lohmann, W., Eyman, R. K., & Lask, E. (1967). Toilet training. *American journal of mental deficiency, 71*(4), 551.
- Lott, J. D., & Kroeger, K. A. (2004). Self-help skills in persons with mental retardation. In Matson, J. L., Laud, R. B., & Matson, M. L. (Eds.), *Behavior modification for persons with developmental disabilities: Treatment and supports* (Vol II). New York: National Association for the Dually Diagnosed.
- Luiselli, J. K. (1997). Teaching toilet skills in a public school setting to a child with pervasive developmental disorder. *Journal of Behavior Therapy and Experimental Psychiatry, 28*(2), 163-168.
- Luiselli, J. K. (2007). Single-case evaluation of a negative reinforcement toilet training intervention. *Child & Family Behavior Therapy, 29*(1), 59-69.
- Mannion, A., & Leader, G. (2013). Comorbidity in autism spectrum disorder: A literature review. *Research in Autism Spectrum Disorders, 7*(12), 1595-1616.
- Mantry, D., Cooper, S. A., Smiley, E., Morrison, J., Allan, L., Williamson, A., ... & Jackson, A. (2008). The prevalence and incidence of mental ill-health in adults with Down syndrome. *Journal of Intellectual Disability Research, 52*(2), 141-155.
- Maskey, M., Warnell, F., Parr, J. R., Le Couteur, A., & McConachie, H. (2013). Emotional and behavioural problems in children with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 43*(4), 851-859.

- Matson, J. L., & LoVullo, S. V. (2009). Encopresis, soiling and constipation in children and adults with developmental disability. *Research in Developmental Disabilities, 30*(4), 799-807.
- Matson, J. L., Dempsey, T., & Fodstad, J. C. (2010). The profile of toileting issues (POTI). *Baton Rouge, LA: Disability Consultants, LLC.*
- Matson, J. L., & Shoemaker, M. E. (2011). Psychopathology and intellectual disability. *Current Opinion in Psychiatry, 24*(5), 367-371.
- Matson, J. L., Horovitz, M., & Sipes, M. (2011a). Characteristics of individuals with toileting problems and intellectual disability using the Profile of Toileting Issues (POTI). *Journal of Mental Health Research in Intellectual Disabilities, 4*(1), 53-63.
- Matson, J. L., Neal, D., Hess, J. A., & Kozlowski, A. M. (2011b). Assessment of toileting difficulties in adults with intellectual disabilities: An examination using the profile of toileting issues (POTI). *Research in Developmental Disabilities, 32*(1), 176-179.
- McLay, L., Carnett, A., van der Meer, L., & Lang, R. (2015). Using a video modeling-based intervention package to toilet train two children with autism. *Journal of Developmental and Physical Disabilities, 1-21.*
- Mowrer, O. H., & Mowrer, W. M. (1938). Enuresis—a method for its study and treatment. *American journal of Orthopsychiatry, 8*(3), 436.
- Ohtake, Y., Takahashi, A., & Watanabe, K. (2015). Using an animated cartoon hero in video instruction to improve bathroom-related skills of a student with autism spectrum disorder. *Education and Training in Autism and Developmental Disabilities, 50*(3), 343-355.

- Oliver, C., & Richards, C. (2010). Self-injurious behaviour in people with intellectual disability. *Current Opinion in Psychiatry*, 23(5), 412-416.
- Ozcan, N., & Cavkaytar, A. (2009). Parents as teachers: Teaching parents how to teach toilet skills to their children with autism and mental retardation. *Education and Training in Developmental Disabilities*, 237-243.
- Radstaake, M., Didden, R., Giesbers, S., Korzilius, H., Peters-Scheffer, N., Lang, R., ... & Curfs, L. M. (2013). Incontinence in individuals with Angelman syndrome: A comparative study. *Research in Developmental Disabilities*, 34(11), 4184-4193.
- Rinald, K., & Mirenda, P. (2012). Effectiveness of a modified rapid toilet training workshop for parents of children with developmental disabilities. *Research in Developmental Disabilities*, 33(3), 933-943.
- Schum, T. R., Kolb, T. M., McAuliffe, T. L., Simms, M. D., Underhill, R. L., & Lewis, M. (2002). Sequential acquisition of toilet-training skills: a descriptive study of gender and age differences in normal children. *Pediatrics*, 109(3), 48.
- Smiley, E., Cooper, S. A., Finlayson, J., Jackson, A., Allan, L., Mantry, D., ... & Morrisson, J. (2007). Incidence and predictors of mental ill-health in adults with intellectual disabilities. *The British Journal of Psychiatry*, 191(4), 313-319.
- Smith, P. S., & Smith, L. J. (1977). Chronological age and social age as factors in intensive daytime toilet training of institutionalized mentally retarded individuals. *Journal of Behavior Therapy and Experimental Psychiatry*, 8(3), 269-273.
- Sparrow, S. S., Balla, D. A., Cicchetti, D. V., & Doll, E. A. (1984). Vineland adaptive behavior scales: Survey form manual. American Guidance Service.

- Sparrow, S. S., Cicchetti, D. V., & Balla, D. A. (2005). *Vineland Adaptive Behavior Scales (2nd ed.)*. Circle Pines, MN: American Guidance Service.
- Strauss, D., & Zigman, W. B. (1996). Behavioral capabilities and mortality risk in adults with and without down syndrome. *American Journal on Mental Retardation*, *101*(3), 269-281.
- Suppo, J. L., & Mayton, M. R. (2012). A portable potty plan for children with autism. *Young Exceptional Children*, 1096250612451758.
- Szyndler, J. (1996). Toileting problems in a group of children with autism. *Child Psychology and Psychiatry Review*, *1*(1), 19-25.
- Tarbox, R. S., Williams, W. L., & Friman, P. C. (2004). Extended diaper wearing: Effects on continence in and out of the diaper. *Journal of Applied Behavior Analysis*, *37*(1), 97-100.
- Thomson, K., Walters, K., Martin, G. L., & Yu, C. T. (2011). Teaching adaptive and social skills to individuals with Autism Spectrum Disorders. In *International Handbook of Autism and Pervasive Developmental Disorders*(pp. 339-354). Springer New York.
- Van Laecke, E., Hoebeke, P., Raes, A., Klockaerts, K., & Walle, J. V. (2008). Adequate fluid intake, an important factor in the treatment of urinary incontinence in children suffering mental and/or motor disability. *Journal of Pediatric Urology*, *4*, S37.
- Van Oorsouw, W. M., Duker, P. C., Melein, L., & Averink, M. (2009). Long-term effectiveness of the response restriction method for establishing diurnal bladder control. *Research in Developmental Disabilities*, *30*(6), 1388-1393.
- Vermandel, A., Van Kampen, M., Van Gorp, C., & Wyndaele, J. (2007). How to toilet train healthy children? A review of the literature. *Neurology and Urodynamics*, *27*, 162–166
- Von Gontard, A., Didden, R., Sinnema, M., & Curfs, L. (2010). Urinary incontinence in persons with Prader-Willi Syndrome. *BJU international*, *106*(11), 1758-1762.

Williams, F. E., & Sloop, E. W. (1978). Success with a shortened Foxx-Azrin toilet training program. *Education and Training of the Mentally Retarded*, 399-402.

UCEDD, G. (2001). The C21st Health Check. *University of Glasgow, Glasgow*.