

## **The Effectiveness of Different Methods of Toilet Training for Bowel and Bladder Control**

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## Preface

The Agency for Healthcare Research and Quality (AHRQ), through its Evidence-based Practice Centers (EPCs), sponsors the development of evidence reports and technology assessments to assist public- and private-sector organizations in their efforts to improve the quality of health care in the United States. The reports and assessments provide organizations with comprehensive, science-based information on common, costly medical conditions and new health care technologies. The EPCs systematically review the relevant scientific literature on topics assigned to them by AHRQ and conduct additional analyses when appropriate prior to developing their reports and assessments.

To bring the broadest range of experts into the development of evidence reports and health technology assessments, AHRQ encourages the EPCs to form partnerships and enter into collaborations with other medical and research organizations. The EPCs work with these partner organizations to ensure that the evidence reports and technology assessments they produce will become building blocks for health care quality improvement projects throughout the Nation. The reports undergo peer review prior to their release.

AHRQ expects that the EPC evidence reports and technology assessments will inform individual health plans, providers, and purchasers as well as the health care system as a whole by providing important information to help improve health care quality.

We welcome comments on this evidence report. They may be sent by mail to the Task Order Officer named below at: Agency for Healthcare Research and Quality, 540 Gaither Road, Rockville, MD 20850, or by e-mail to [epc@ahrq.gov](mailto:epc@ahrq.gov).

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- Liza Bialy for implementing the quality assessment and data extraction forms within the online SRS system and for assisting with quality assessment.
- Nicola Hooton for verifying the extracted data.
- Donna Dryden for editing and providing feedback on the draft of this report.
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## Structured Abstract

**Objectives:** The objectives of this report are to determine the following: (1) the effectiveness of the toilet training methods, (2) which factors modify the effectiveness of toilet training, (3) if the toilet training methods are risk factors for adverse outcomes, and (4) the optimal toilet training method for achieving bowel and bladder control among patients with special needs.

**Data Sources:** MEDLINE<sup>®</sup>, Ovid MEDLINE<sup>®</sup> In-Process & Other Non-Indexed Citations, Ovid OLDMEDLINE<sup>®</sup>, Cochrane Central Register of Controlled Trials, EMBASE, CINAHL<sup>®</sup>, PsycINFO<sup>®</sup>, ERIC<sup>®</sup>, EBM Reviews, HealthSTAR, AMED, Web of Science<sup>®</sup>, Biological Abstracts, Sociological Abstracts, OCLC ProceedingsFirst, OCLC PapersFirst, Dissertation Abstracts, Index to Theses, National Research Register's Projects Database, and trials registers.

**Review Methods:** Two reviewers assessed the studies for inclusion. Studies were included if they met the following criteria: *Study design:* RCT, CCT, prospective or retrospective cohort, case-control, cross-sectional or case-series; *Population:* infants, toddlers, or children with or without co-morbidities, neuromuscular, cognitive, or behavioral handicaps disabilities; *Intervention:* at least one toilet training method; and *Outcome:* bladder and/or bowel control, successes, failures, adverse outcomes. Methodological quality was assessed independently by two reviewers. Data were extracted by one reviewer and a second checked for accuracy and completeness. Due to substantial heterogeneity, meta-analysis was not possible.

**Results:** Twenty-six observational studies and eight controlled trials were included. Approximately half of the studies examined healthy children while the remaining studies assessed toilet training of mentally or physically handicapped children. For healthy children, the Azrin and Foxx method performed better than the Spock method, while child-oriented combined with negative term avoidance proved better than without. For mentally handicapped children, individual training was superior to group methods; relaxation techniques proved more efficacious than standard methods; operant conditioning was better than conventional treatment, and the Azrin and Foxx and a behavior modification method fared better than no training. The child-oriented approach was not assessed among mentally handicapped children. For children with Hirschsprung's disease or anal atresia, a multi-disciplinary behavior treatment was more efficacious than no treatment.

**Conclusions:** Both the Azrin and Foxx method and the child-oriented approach resulted in quick, successful toilet training, but there was limited information about the sustainability of the training. The two methods were not directly compared; thus, it is difficult to draw definitive conclusions regarding the superiority of one method over the other. In general, both programs may be used to teach toilet training to healthy children. The Azrin and Foxx method and operant conditioning methods were consistently effective for toilet training mentally handicapped children. Programs that were adapted to physically handicapped children also resulted in successful toilet training. A lack of data precluded conclusions regarding the development of adverse outcomes.



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**Appendixes and evidence tables for this report are provided electronically at <http://www.ahrq.gov/clinic/tp/toiletrtp.htm>.**

# Executive Summary

## Introduction

Toilet training is the mastery of skills necessary for urinating and defecating in a socially acceptable time and manner. In many cultures, parents regard the achievement of independent toileting as a significant accomplishment and a step toward self-sufficiency. Bladder and bowel function is regulated by complex muscles and may be modified by physiological, psychological, social, and cultural factors. Currently, an all-encompassing definition of “toilet trained” is lacking, and there are no strict criteria stating how long a child must be bladder or bowel continent, or what components of the toileting process a child must accomplish independently, in order to be considered “toilet trained.”

Over the last 100 years, recommended toilet training methods have oscillated between rigid programs and child-oriented ones. In 1962, Brazelton developed the “child readiness” approach, which focused on gradual training. This approach described parameters of child and parent toilet training readiness. The Azrin and Foxx method emerged in 1971 as a parent-oriented method that emphasized structured behavioral endpoint training aimed at eliciting a specific chain of independent events by teaching the component skills of toilet training. These two methods differ with respect to goal development, endpoints, and emphasis on the child’s self-esteem. Other methods include variations of operant conditioning, assisted infant toilet training, and the Spock method. The toilet training methods are described in Appendix H\*.

Some factors believed to impact toilet training include sex, age at initiation, race, physical or mental handicaps, and constipation. While the majority of children are toilet trained without incident, approximately 2 to 3 percent experience an adverse outcome. Common adverse events are enuresis, encopresis, stool toileting refusal, stool withholding, and hiding while defecating. Toilet training children with special needs presents a unique set of challenges as impaired communication skills, reduced ability to process sensory information, and mobility and neurophysiological deficits add challenges to their toilet training.

Current published toilet training guidelines in North America recommend (1) a child-oriented approach, (2) not starting before 18 months because the child is not physically ready, and, (3) starting when the child displays interest.

## Objectives and Key Questions

The American Academy of Pediatrics put forth the following four questions:

1. What is the evidence for effectiveness of various toilet training methods to achieve bowel and bladder control?
2. What factors modify the effectiveness of toilet training, such as age, sex, race, ethnicity, culture, age at initiation, constipation, or stool toileting refusal?

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\* Appendixes and Evidence Tables are provided electronically at <http://www.ahrq.gov/clinic/tp/toiletrtp.htm>

3. What is the evidence for various toilet training methods as a risk factor for adverse outcomes, such as dysfunctional voiding, enuresis, encopresis, later problems, and psychological consequences?
4. What is the effectiveness of toilet training methods for achieving bowel and bladder control among patients with special needs?

## **Methods**

### **Literature Search**

Search terms were adapted for the following electronic databases: MEDLINE<sup>®</sup>, Ovid MEDLINE<sup>®</sup> In-Process & Other Non-Indexed Citations, Ovid OLDMEDLINE<sup>®</sup>, Cochrane Central Register of Controlled Trials, EMBASE, CINAHL<sup>®</sup>, PsycINFO<sup>®</sup>, ERIC<sup>®</sup>, EBM Reviews, HealthSTAR, AMED, Web of Science<sup>®</sup>, Biological Abstracts, Sociological Abstracts, OCLC ProceedingsFirst, OCLC PapersFirst, Dissertation Abstracts, Index to Theses, NLM Gateway, and the National Research Register's Projects Database. Trials registers were searched and position statements were sought. In addition, annual conference proceedings were hand searched and the reference lists were reviewed. Only studies published in English were included.

### **Study Selection**

Each title and when available, abstract was independently screened by two reviewers and assessed for inclusion using a standardized form. References identified as “potentially relevant” and “unclear” were then screened by a pediatrician and a pediatric urologist. The full texts of potentially relevant articles were retrieved.

Using a priori inclusion criteria, two reviewers independently assessed the full text articles. Studies that examined the treatment of enuresis or encopresis were excluded; however, those that measured the development of enuresis or encopresis as the result of a specific toilet training method were included. Disagreement among reviewers was resolved by discussion and consulting a third party as needed.

### **Quality Assessment**

Two reviewers independently assessed the methodological quality. The quality of observational cohort studies was assessed using Downs and Black's partially validated “Checklist of the assessment of methodological quality of both randomized and non-randomized studies of health care interventions.” The Jadad Scale and allocation concealment were used to assess the methodological quality of randomized and non-randomized controlled clinical trials.

### **Data Extraction**

Data were extracted by one reviewer and checked for accuracy and completeness by a second. Data describing study design, toilet training objective (bladder vs. bowel; daytime vs. nighttime; self-directed vs. assisted), patient demographics, source of the study population, toilet

training interventions and associated details, and outcomes were extracted. All outcomes reporting change in bladder and bowel function, number of successes and accidents, success and failure rates, time to toilet train, and the occurrence of adverse events were extracted. Whenever possible, information was extracted pertaining to effect modifiers.

## Data Analysis

Due to extreme clinical heterogeneity in study designs, interventions, populations, and outcomes, no statistical meta-analysis was performed. Studies were organized by population (healthy, mentally challenged, or physically challenged) and the toilet training programs were categorized as Azrin and Foxx, child-oriented, operant conditioning, or other. In a few instances Fisher's exact test was used to compute a p-value to compare dichotomous data between two groups.

## Results

### Direct Comparisons

There were three randomized trials involving healthy children; none compared the child-oriented approach to the Azrin and Foxx method. In healthy children the Azrin and Foxx method performed better than the Spock method (trained without force) for both day and night toilet training. Negative term avoidance using the child-oriented method significantly reduced the time of stool toileting refusal and time to toilet training compared to the child-oriented method alone.

In mentally challenged children, individual training was more effective than group methods for toilet training, although neither appeared to have long term effectiveness. Relaxation showed some effectiveness in reducing accidents over standard methods. An operant conditioning method was also found to be superior to both conventional and control groups in achieving urination and defecation in the toilet. The Azrin and Foxx method showed significant reductions in dampened pants compared to no training. Behavior modification methods improved toilet training habits over no training.

A multi-disciplinary behavior treatment was found effective in improving toileting habits of children with Hirschsprung's disease and anal atresia.

### Single Cohort

**Healthy children.** In Taubman's 1997 study, 482 children from middle- and upper-class families were toilet trained using a child-oriented approach. Twenty-two percent experienced at least one month of stool toileting refusal (STR) and 13 percent developed stool withholding during training. Twenty-nine children required an intervention. In a second study, Brazelton described toilet training results of 1170 children from upper-middle class families over ten years. All used a child-oriented approach beginning at approximately 18 months of age. Daytime continence for all was achieved by a mean age of 28.5 months and nighttime continence by 33.3 months. By five years of age, 16 children suffered from at least one of the following problems: enuresis (12),

soiling in stressful situations (4), and chronic constipation (8). Kaffman examined children living in kibbutzim in Israel who were trained using an individualized child-oriented program. The prevalence of enuresis at 3.5 years was 13.9 percent (192/1376).

Foxx and Azrin identified 34 children from the community who passed a readiness test. Post training, bladder and bowel accidents were reduced by 97 percent and success was maintained at four-month follow-up. A second study examined 49 children who were trained using Azrin and Foxx's Toilet Training in Less than a Day (TTLD) program. Ten children failed to achieve continence within the intensive training session because of the child's severe emotional reaction or the parents quitting the program. In both studies children were trained in approximately 4.5 hours.

**Mentally handicapped children.** Didden used the Azrin and Fox method in an attempt to achieve prompted bowel or bladder control in six children with Angelman Syndrome. The average frequency of correct daily toileting increased from 0.8 to 3.5 at post-treatment and to 3.1 at 2.5 years follow-up. Lancioni trained nine profoundly deaf and blind children who had never shown any signs of self-initiated toileting. The training program included positive reinforcement and punishment. At day 44, eight of the nine children exhibited self-initiated toileting. Smith retrospectively examined 13 mentally retarded children trained using the Azrin and Foxx method and a urinary training device. Frequency of wetting declined from 50 percent to 10 percent by week 5 and this result was sustained at follow-up. In the final study of nine mentally handicapped children, the Azrin and Foxx method was augmented with daily reading of a toilet training book. The number of successes increased. There was poor compliance to the book and it was deemed unnecessary.

Five studies examined variants of operant conditioning programs. Van Wagenen used a forward-moving series of actions and urine alarms to successfully train nine mentally handicapped children. Ando used operant conditioning to toilet train five institutionalized autistic boys. The program involved positive reinforcement and punishment. Four children improved self-initiating toileting, while the remaining child did not respond to any reinforcers. Giles attempted to toilet train five severely and profoundly mentally retarded children using positive reinforcement and, if it did not produce continence, punishment was used. All five were successfully toilet trained in 8 weeks. Spencer attempted to establish bowel control in 38 severely and profoundly retarded boys using a six-week program consisting of positive reinforcement for sitting on the toilet and defecating in the toilet. Spontaneous toileting increased by 9 percent and accidents decreased by 17 percent. Using operant conditioning, Colwell attempted to bring toileting behaviors under verbal control in 47 profoundly and severely mentally retarded children. Of this group, 33 children improved in skill, 3 worsened, and the remaining 8 experienced no change.

**Physically handicapped children.** Van Kuyk retrospectively assessed a multidisciplinary program for 43 children with anal atresia and for 16 with Hirschsprung's disease. The program aimed to teach adequate defecation behavior by reducing fear and anxiety, using the lower body to improve straining techniques, and adopting a regular schedule. There was a significant improvement in the Templeton continence score in children with anal atresia (from  $2.2 \pm 0.45$  to  $1.6 \pm 0.59$ ) and significantly fewer children suffered from constipation (18 vs 8). The 16 boys with Hirschsprung's disease also had a significant improvement in Templeton score (from  $2.7 \pm 0.48$  to  $1.1 \pm 0.34$  at post treatment) and there were fewer constipated boys.

Three studies developed toilet training programs for establishing bowel control in children with spina bifida. King aimed to establish neurogenic bowel habituation in 35 patients. In children  $\leq 6$  years old, continence improved from 0 (0/17) to 65 percent (11/17) and it improved further to 88 percent (8/9) among children who completed the program. Forsythe created a similar stepwise program for 47 children. A combination of regular toileting, initial enemas, and laxatives was the most effective. Sullivan-Bolyai evaluated a component-based toilet training program in 525 children with spina bifida. Of 184 children  $>4$  years of age, 141 were socially acceptably trained using suppositories, expansion enemas or timed evacuations. Regardless of age, 44 children failed to achieve bowel control. Forty-six children  $<6$  years of age achieved socially acceptable bladder control mainly with diaper or pants inserts, and clean intermittent catheterization. Of 158 children  $>6$  years of age, 107 achieved socially acceptable bladder control, primarily by ileal diversion and clean intermittent catheterization. In both age groups, 62 children did not achieve socially acceptable bladder control.

**Adverse outcomes.** Only four studies specifically addressed adverse outcomes. In a case-control study among school aged children, Bakker found that those who were trained at a later age ( $>18$  months) and by more aggressive training methods had more lower urinary tract symptoms. Kaffman reported the frequency of enuresis in 6 and 7 year-old children trained by multiple caregivers on a kibbutz to be higher than non-kibbutz raised children, but lower after 10 years of age. Taubman reported an incidence of roughly 22 percent for stool toileting refusal, 53 percent for stool withholding, and 69 percent for hiding to defecate that occurred during the training process; this was associated with the presence of younger siblings, parental difficulty in setting limits, and late ( $>42$  months) training. In contrast, Brazelton 1962 reported a 1.4 percent incidence of residual problems  $>5$  years of age following a child-oriented training approach. None of the Azrin and Foxx studies reported these outcomes.

## Discussion

### Effectiveness of Toilet Training

In general, both the child-oriented and Azrin and Foxx approaches seem able to teach toilet training to healthy children. The regimented Azrin and Foxx approach seems to result in rapid success rates at relatively young ages and results are maintained.

Based on single-arm studies, mentally handicapped children had some degree of success regardless of the toilet training method. A limited number of studies was identified with most published from 1966 to 1981. Since then, the definition of mental handicap has been revised; therefore, some of the children classified as mentally handicapped in the older studies may not meet the current definition.

One of the key questions asked to identify toilet training strategies and/or outcomes of children with behavior problems. Unfortunately no studies were identified. Children with complex medical conditions should not be expected to toilet train as healthy children, and no studies evaluating standard methods among physically handicapped children were located. The results of cohort studies confirmed that children with Hirschprung's disease or anal atresia could achieve continence with a multidisciplinary approach. Due to spinal cord neurologic impairment, children with spina bifida can suffer from constipation and/or fecal incontinence as well as

urinary symptoms such as failure to empty or incontinence. The primary means to control elimination problems are timed evacuation via clean intermittent catheterization, stool softeners, suppositories, and enemas.

## Potential Limitations

The main limitation is the lack of research conducted and reported in the area of toilet training and the heterogeneity among the populations studied, the toilet training programs evaluated, and the definitions of success. As a consequence of this heterogeneity, the pooling of results was not possible. Additional limitations include analyses conducted in the primary studies, several of which did not perform a statistical analysis of their data. Finally, a descriptive analysis has several limitations and leaves the clinical reader with less information to guide future actions.

## Future Research Opportunities

Given the findings of this systematic review, the following research priorities are recommended:

- Standardize definitions of “toilet trained,” “success,” and “failure” and adapt them to cultural differences when appropriate.
- Conduct trials that directly compare two toilet training methods, such as Azrin and Foxx and the child-oriented approach, within the same population.
- Accurately describe the populations in terms of mental and/or physical challenges, using current diagnostic standards.
- Conduct toilet training programs with children suffering from behavioral disorders such as attention-deficit disorder and oppositional defiant disorder.
- Determine if toilet training is affected by age, sex, race, culture, etc.
- Document adverse outcomes.

## Conclusions

There is a lack of high-quality research to guide clinicians in advising parents and guardians on how to toilet train their children. Based on the evidence, the following conclusions can be made:

- The strategies appear similar among healthy children, thus caregivers and health care providers can try any of the methods.
- Some mentally handicapped children can attain at least partial success with toilet training.
- Given the range of functionality among mentally handicapped children and the potential for concurrent physical and behavior problems, toilet training programs may need to be flexible.
- Toilet training physically handicapped children is enhanced by a multidisciplinary team.
- Elimination problems should be treated early to encourage normal psychosocial development.

# **Evidence Report**



# Chapter 1. Introduction

## Toilet Training

### What is Toilet Training?

Toilet training is the acquisition of skills necessary for urinating and defecating in a toilet at a socially acceptable time and age. It is a heterogeneous process influenced by many physiological, psychological, social, and cultural factors. Complex muscular physiology regulates bladder and bowel function.<sup>1</sup> Because the infant central nervous system is not completely developed, the bladder empties involuntarily as a result of spinal reflexes approximately 20 times a day.<sup>2</sup> As children develop, they gain the ability to recognize that their bladder is full and to retain urine until it is appropriate to void. Defecation occurs once the rectum contains a sufficient volume of feces. As the rectum fills with feces from the colon, the rectum expands and the internal anal sphincter relaxes; anal pressure is reduced and the desire to defecate is felt. A combination of the relaxation of the external anal sphincter, bowel contractions, and an increase in intra-abdominal pressure achieved by straining results in defecation. The external anal sphincter can be voluntarily contracted if defecation is not appropriate.

An all-encompassing definition of “toilet trained” does not exist. For instance, there are no strict criteria stating how long a child must be bladder or bowel continent to be considered toilet trained and often the definition of success is dependent on the specific toilet training approach.<sup>3</sup> In addition, it is unclear what components of the toileting process the child must accomplish independently, such as undressing and dressing, flushing the toilet, or washing hands, to be considered toilet trained.<sup>3</sup> Western culture perceives the meaning of “toilet trained” to extend beyond the absence of bladder and bowel accidents and to include toileting in socially acceptable places, toileting in a proper posture, and complete toileting in a sanitary manner.<sup>4</sup>

### Evolution of Toilet Training

In North America toilet training methods have oscillated over the last century (Table 1).<sup>3</sup> In the late 1800s and early 1900s toilet training was considered a passive and permissive process and was primarily determined by parents. During the 1920s and 1930s a new generation of behavioral scientists emerged and toilet training was regarded as a rigid habit-training process, but it was still determined by parents. The objective of toilet training was to quickly alleviate the burden of infant wetting and soiling.<sup>5</sup> In 1932 the American government published *Infant Care* and suggested that toilet training was to be completed by six to eight months of age.<sup>6</sup> Training was coercive in nature; experts recommended the use of “soap stick” rectal conditioners to assist in bowel training. The importance of regularity and the scheduling of bowel movements were also stressed.

By the 1940s it was hypothesized that rigid toilet training resulted in the failure to achieve bowel and bladder continence and that it may elicit behavioral problems.<sup>7</sup> In addition, research had shown that children do not develop voluntary bladder and bowel control until approximately 9 months of age. Toilet training reverted to a child-oriented approach and parents were advised to begin toilet training once the child displayed interest in the process. In 1962 Brazelton developed the “child readiness” approach.<sup>8</sup> This was followed by the Azrin and Foxx method that focused on structured behavioral endpoint oriented training.<sup>9</sup> As toilet training moved from rigid parent-driven methods to child-oriented ones, the age at which toilet training was initiated increased.

**Table 1. Trends in recommended infant training methods extracted from three women’s magazines from 1898-1948\***

Year	Mother-determined Readiness	Early Readiness, Rigid Environmental Scheduling	Child-oriented Readiness (2–3 years)
1890	100%	0%	0%
1900	78%	22%	0%
1910	23%	77%	0%
1920	0%	100%	0%
1930	0%	75%	25%
1940	0%	33%	66%
1948	0%	0%	100%

\*Adapted from Vincent et al.<sup>10</sup> and published in deVries 1977

## Toilet Training Methods

The two primary toilet training methods used in Western societies are the child-oriented method and the Azrin and Foxx method. Both methods suggest that toilet training commence at approximately 18 months of age and that the child should be successfully toilet trained between 2 to 3 years of age.<sup>3</sup> The two methods differ with respect to goal development, endpoints, and emphasis on the child’s self-esteem. Additional toilet training methods include variations of operant conditioning and assisted infant toilet training. The toilet training methods are described in greater detail in Appendix H\*.

**Child-oriented.** In 1962 Brazelton developed a child-oriented program that focused on gradual training.<sup>3</sup> Brazelton described how he determined child and parent(s) was ready to begin toilet training. Toilet readiness is a combination of both child and parent willingness to participate in toilet training. The parent responds to the child’s signals that the child is ready to begin toilet training. In addition, the parent must be willing to toilet train the child and be aware of training obstacles, such as the child attending daycare or any physical or mental disabilities the child may have.

The child must be physiologically and behaviorally ready to toilet train. Examples of child readiness include exhibiting some degree of bladder and bowel control, having the neurological

\* Appendixes and Evidence Tables are provided electronically at <http://www.ahrq.gov/clinic/tp/toilettrtp.htm>

maturity to co-operate, and voluntarily participate in toilet training. It is believed that these components are not developed until the child is approximately 18 months old.

To toilet train the child, the child should become familiar with his own chair and sit on it while fully clothed. Once co-operation has been established, the child may sit on the chair without a diaper. The next step is to empty the diaper contents into the chair while explaining to the child that this where eliminations go. Once the child understands the chair, the child can be encouraged to use it independently and can begin wearing training pants.

**Azrin and Foxx.** Behavioral analysis and structured behavioral training were popular in the 1960s and 1970s and were subsequently applied to toilet training. The Azrin and Foxx method emerged in 1971 as a parent-oriented method that emphasized structured behavioral endpoint training aimed at eliciting a specific chain of independent events by teaching the component skills of toilet training.<sup>9</sup> Although the Azrin and Foxx method was specifically designed for achieving bladder continence, it has been adapted successfully for bowel control.

The Azrin and Foxx method described the first set of objective criteria parents could use to determine if their child was ready for toilet training.<sup>3</sup> The component skills include both physiological readiness (having periods of dryness and being physically able to perform tasks related to toilet training) and psychological readiness (able to follow instructional skills).<sup>3</sup> Physiological readiness assesses adequate muscle tone required for independent toileting. Tasks may include walking short distances, dressing, and sitting upright. Psychological readiness establishes if the child understands the instructions and is motivated to adopt independent toilet training. Examples of psychological components are pointing to body parts and imitating a task.<sup>3</sup> By completing the majority of the pre-defined tasks, a child proves able to complete complex motor tasks beyond eliminating at the proper time.

The child participates by recognizing appropriate elimination stimulus. This is a four-step stimulus-control model that is executed by (1) increasing fluid intake, (2) scheduling toilet training time, (3) positive reinforcing correct behavior, and (4) over-correcting accidents.

The Azrin and Foxx method is rigid and intensive in nature. In a study of the Azrin and Foxx method, some children initially reacted negatively to timed toilet training by having temper tantrums when training was initiated.<sup>9</sup> The authors noted this reluctance was overcome by providing immediate graduated guidance when a child did not respond to a toilet training step.

**Operant conditioning.** While the child-oriented and Azrin and Foxx method incorporate operant conditioning, basic operant conditioning techniques have been used to toilet train.<sup>11</sup> The goal of operant conditioning is to establish habits and proper behavior through positive reinforcement with rewards.<sup>12</sup> Common rewards for successfully eliminating in the toilet include parental affection, toys, and candy. Accidents can be negatively reinforced, often through punishment or a lack of positive attention.

**Assisted infant toilet training.** This toilet training method is used in China, India, Africa, South America, Central America, and parts of Europe; however, it is poorly researched.<sup>13</sup> Assisted infant toilet training results in infants that are toilet trained at a young age. Simultaneous training of bowel and bladder control may begin between the ages of 2 and 3 weeks.<sup>5</sup> When the infant has consumed a large meal or shows signs of eliminating, the infant is placed on the toilet or in a voiding position.<sup>14</sup> The parent must learn the infant's elimination signals.<sup>13</sup> For this reason, this

method has been criticized as the “parent training” method, as the parents must be trained to recognize and understand their child’s cues to eliminate.

When the infant is likely to void, he is placed in a special position and the parent makes a noise that the infant learns to associate with voiding. When the infant voids to the specific noise, he is rewarded, often with food or affection.<sup>5</sup> As the infant is conditioned, he is expected to better communicate his need to void and to crawl on the parent to assume the voiding position. With the exception of positioning, the same process is used for bowel training. During the first year of life, infants are not punished for having an accident.

A second method used to train infants is a three-phase approach that establishes a relationship with the infant and the potty.<sup>15</sup> During the first phase, the parent identifies the child’s body signals associated with eliminating. When the infant is expected to eliminate, the parent directs the infant’s attention towards the potty and the infant is placed on the potty. Eliminations within three minutes of being placed on the potty are positively reinforced. In the second phase the infants try to reach or grab the potty prior to being seated on it. The third phase establishes unprompted reaching for the potty prior to elimination.

**Elimination communication.** Recently, Western countries have witnessed an increased enthusiasm regarding toilet training infants. While similar to the assisted infant toilet training method used in Africa, elimination communication requires parents to learn to recognize their infant’s body language, noises, and bowel and bladder rhythms to determine when the infant is about to eliminate. The infant is then placed over the sink, toilet, or a specially designed miniature potty and the parent makes sound similar to that of running water. It is recommended this method be started at birth.

Since 2005, many prominent North American newspapers and magazines have published articles describing and promoting elimination communication. The main cited benefits of this method are reduced diaper expenses, fewer disposable diapers polluting the environment, strengthened infant-parent bonds, and increased infant comfort. In addition to articles in the New York Times, Boston Globe, National Post, and People magazine, there are also a number of Web sites and internet message boards promoting elimination communication ([www.diaperfreebaby.org](http://www.diaperfreebaby.org); <http://www.timl.com/ipt/>; <http://www.theecstore.com>; <http://www.natural-wisdom.com>). The articles are anecdotal and feature testimonials by parents; they are not supported by references to research assessing the effectiveness of the methods described.

## Current Recommendations

The American Academy of Pediatrics and the Canadian Paediatric Society have published similar toilet training guidelines. Despite the lack of empirical evidences supporting the toilet training approach, both guidelines recommend: 1) a child-oriented approach; 2) that children are not physically ready to begin toilet training until 18 months of age; and 3) that the child displays interest in the process. They also promote the use of a potty chair. Potty chairs can either be inserted into the toilet to create a smaller seat or be a small toilet for the child; they may help curb the fear of falling into the toilet. The Canadian Paediatric Society also recommends using a footstool to make toilet training more comfortable and make the child feel more secure and stable. Both guidelines state that toilet training is not a cookie-cutter process and must be adapted to the specific child.

**American Academy of Pediatrics (AAP).** The AAP guidelines strongly suggest a child-oriented approach to toilet training and that parents do not pursue toilet training until the child is behaviorally, developmentally, and emotionally ready to begin.<sup>16</sup> The guidelines recommend that parents and pediatricians discuss toilet training methods and expectations at the child's 12- to 18-month visits. At the 2-year visit, the pediatrician is able to assess the readiness of the child and parents.

The first step of toilet training is to introduce the potty chair and allow the child to sit on it while fully dressed. The parents should make the potty chair constantly available, but not pressure the child into acknowledging or using it. Parents can also explain the purpose of the potty chair by placing stool in the potty. It is then recommended that the child be placed on the potty chair during the specific times when voiding is expected and the parent explains what is happening. Positive reinforcement should be delivered after successful use of the potty chair. If the child is not successful at toilet training and if the parent-child relationship is not secure, the guidelines recommend temporarily abandoning toilet training and focusing on repairing the parent-child relationship by partaking in enjoyable activities and re-establishing trust and cooperation. It may take several months or years to develop nighttime bladder and bowel control. If the child is school-aged and regularly wets the bed, professional assistance should be sought.

**Canadian Pediatric Society (CPS).** The CPS guidelines recommend a child-oriented toilet training method where the parents and caregivers set time aside for the process.<sup>17</sup> The guidelines emphasize that there is no correct chronological age when toilet training should begin and that it may take several months or years to establish nocturnal continence.

At the child's 1-year visit, the physician should begin to educate the parent about the toilet training process and readiness should be assessed at approximately 18 months of age. Signs of readiness include: walking to the toilet, sitting stably on the toilet, remaining dry for several hours, following simple instructions, communicating the need to void, wanting to please parents or caregivers, and wanting to be toilet trained. After the child has expressed signs of toilet training readiness, the child should be placed on the potty chair while fully clothed. The child is then placed on the potty after voiding, followed by sitting on the potty for several minutes throughout the course of the day. Next, the child is put on the potty at specific times, such as upon waking, after meals, and before sleeping. At each stage, the child should be positively reinforced with encouragement and support as opposed to material rewards. Accidents should be handled in a supportive and patient manner.

If toilet training fails, it is most likely due to the child not being psychologically ready for training. The child should be returned to diapers for 1 to 3 months before toilet training is re-initiated. It is suggested that parents seek assistance from a general or developmental pediatrician if repeated attempts have failed or the child continues to resist training by age 4.

## **Factors Related to Toilet Training**

A variety of factors may effect a child's training. Current clinical practice guidelines stress that children can be trained differently and that training methods should be adapted to each child. Some of the factors that impact toilet training include sex, age at initiation, culture, race, physical or mental handicaps, and previous toilet training attempts.

**Sex.** While boys and girls often show toilet readiness behavior at a similar age, it has been shown that girls begin and complete toilet training earlier than boys.<sup>18 19</sup> Schum et al. examined 267 children and found that girls and boys mastered toileting skills in a similar sequence; however, girls routinely mastered toilet training skills at a younger age.<sup>20</sup> It has been hypothesized that girls accomplish this task sooner because of reasons related to socialization and a desire to please parents. Also, girls are physically more mature than boys and have more advanced language skills, skills that ease toilet training.<sup>20</sup> Furthermore, boys may have the additional obstacle of learning to adopt separate postures for voiding and defecating.

**Age at initiation.** Parents are often unsure of what age to begin toilet training. Parents may over or underestimate the skill required to successfully complete toilet training; this may result in early or delayed toilet training and associated problems.

Over the last 30 to 60 years, the average age of initiating and completing toilet training has risen.<sup>1 21</sup> Schum et al. conducted a literature review and found that children toilet trained in the late 1990s achieved bowel and bladder control approximately 12 to 15 months later than children trained in the 1950s (36 to 39 months versus 24 months, respectively).<sup>20</sup> An increased understanding of pediatric physiological development may partially account for this trend. Other hypothesized explanations include an increased reliance on diapers and the parents' perception that their child is too young to train, especially as the child-oriented approach is promoted.<sup>18</sup> Delays in toilet training can result in an increased risk of infectious diseases spread by diarrhea and fecal contact among childcare facilities,<sup>22</sup> and family stress, particularly as the child approaches kindergarten.

Recommendations suggest that a child be at least 18 months old before commencing toilet training.<sup>3</sup> However, Schum et al. have suggested that toilet training readiness skills are not obtained until after the child's second birthday.<sup>20</sup> The authors determined that of 267 children, girls mastered only 2 of 11 toilet readiness skills by 24 months and boys were not proficient at any of the 11 skills until after their second birthday. Schum et al. found the median age for girls to commence toilet training was 25.5 months and for boys 30.5 months.<sup>18</sup> They recommend that toilet training commence when a child is 22 to 30 months old.<sup>18</sup>

In a cohort of 378 children, Blum et al. found that toilet training was completed at a mean of 36.8 (range 22 to 54 months).<sup>21</sup> Late toilet training (at least 42 months of age) was associated with a later mean age of initiating toilet training, lower language score at 18 months, stool toileting refusal, increased constipation, and hiding during toilet training. In a second study examining the same cohort of children, Blum et al. concluded that training children at a younger age, that is, between the ages of 18 and 26 months, resulted in a longer training duration; however, there were no adverse events (constipation, stool toileting refusal, stool withholding, or hiding during training) associated with early training.<sup>19</sup>

**Constipation.** Constipation has a reported prevalence in young children ranging from 0.3 to 28 percent.<sup>23 24</sup> In a retrospective chart review, Loening-Baucke found the prevalence of constipation in 4157 children of two years of age to be 4.5 percent. The prevalence in the first year of life was 2.9 percent and 10.1 percent in the second year. Partin found that the majority of constipated school-aged children presented with pain, impaction and severe withholding and recommended treating constipation in infancy in hopes to reduce the likelihood of developing chronic fecal impaction and soiling on older children.<sup>25</sup>

Pediatric gastroenterologists from the North American Society of Gastroenterology and Nutrition define constipation as a “delay or difficulty in defecation, present for two or more weeks and sufficient to cause significant distress to the child.”<sup>26</sup> An international group of pediatric gastroenterologists defined functional constipation in infants and preschool children as “at least two weeks of hard, pebble-like stools for most stools, or firm stools two or fewer times per week, in the absence of structural, endocrine, or metabolic disease.” This definition is known as the ROME II criteria.<sup>27</sup>

Being constipated can make defecation painful, and this may be one reason a child may resist toilet training and passing a stool. If a child passes a hard stool that causes difficulty or even an anal fissure, he suddenly feels unexpected pain. Fear of recurrence may make a child unwilling to try a new way of defecating (i.e. in a potty), and the child will continue to stool in diapers or pants. Since only the child can feel the urge and initiate defecation, the training method needs to be sensitive to the child’s feelings and perceptions of the act.<sup>28</sup> Signs and symptoms of constipation include a reduced frequency of bowel movements (generally abnormal to have fewer than three bowel movements a week<sup>29</sup>), hard consistency, presence of pain, stool withholding, blood while defecating, and the presence of rectal impaction or abdominal fecal mass. Blum reported that constipation contributes to stool toileting refusal, rather than being a result of it.<sup>21</sup>

**Culture.** Toilet training is approached differently among various cultures. For example, cultures that depend on disposable diapers tend to toilet train children at a later age. It has been suggested that the increased availability of disposable diapers has been linked to a delay in toilet training.<sup>1</sup>

Abramovitch (2000) interviewed mothers in one of three Israeli ethnic groups: Moroccan, Kurdish, or Ashkenazi.<sup>30</sup> Moroccan and Kurdish mothers tended to begin toilet training at a younger age than Ashkenazi mothers (Moroccans at 1.19 years and Kurdish at 1.28 years versus 1.92 years by Ashkenazi mothers). The methods employed for toilet training were also different; Moroccan and Kurdish mothers adopted an early, permissive, symbiotic style, whereas Ashkenazi mothers practiced a strict toddler style that may be authoritarian in nature. Moroccan and Kurdish children were more likely to develop enuresis than their Ashkenazi counterparts.

**Race and culture.** Age at initiation and completion of toilet training appears to be partially explained by race. The Digo people of East Africa begin toilet training within the first few weeks of life and expect the infant to be reasonably well trained between the ages of four to six months.<sup>5</sup> Compared to other races, African-American children were found to start and complete toilet training at an early age.<sup>18</sup> African-American children began toilet training at median of 21 months of age and were trained by 30 months. In contrast, Caucasian children commenced toilet training at 30 months and were trained at 39 months of age. When surveyed, 50 percent of African-Americans felt it was important their child be toilet trained by the age of two, while only 4 percent of Caucasian parents agreed with the statement. A second study surveyed four cultural groups in the United States to determine their beliefs regarding healthy infant and child development.<sup>31</sup> European American mothers stated children were toilet trainable at 28.1 months of age, where as Puerto Rican, African-American, and West Indian-Caribbean mothers felt children reached toilet training age between 20.2 to 22.2 months.

**Physical, mental, behavioral, and developmental handicap(s).** Toilet training children with mental or physical handicaps present its own unique set of challenges. Compared to toilet

training healthy children, there are additional components that need to be taken into consideration, such as communication delays, sensory process difficulties, sensitivity to stimulation, limited ability to imitate, compromised motor planning, and preference for routine.<sup>32</sup>

The CPS guidelines recommend that prior to toilet training, parents have their child assessed by a pediatrician to determine the obstacles associated with training a child with special needs.<sup>17</sup> The CPS also calls for a comprehensive study to examine the effects and challenges of toilet training children with special needs.

Physical and mental handicaps such as Hirschsprung's disease, anal atresia, spina bifida, and mental retardation, may hamper toilet training. Communication may be an obstacle, particularly among children with mental handicaps. When a child has impaired communication skills, determining the child's readiness to toilet train is more difficult. Azrin and Foxx's toilet training method was first tested in severely retarded adults and after proving successful, was adapted to children.<sup>3</sup> Several researchers have hypothesized that toilet training will be less successful among children with delayed cognitive development; however, this association has not been consistently shown. Schum et al. found that cognitive development was not related to success of toilet training; however, children attending a program for the developmentally delayed were excluded from the cohort.<sup>18</sup>

Also, children with behavioral and developmental problems such as autism<sup>33</sup> or pervasive developmental disorder<sup>34</sup> may experience difficulty mastering toileting. Toilet training children with behavioral and developmental disorders is poorly researched and recommendations are not evidence based.

**Previous attempts.** Regression is a common component of toilet training and it is important for the parents not to appear anxious or disappointed and reflect this anxiety onto the child.<sup>16</sup> If a child's toilet training regresses, the general advice is to abort toilet training and begin again in three months. This may remove barriers in the parent-child power struggle. Also, toilet training should not be initiated during a stressful time of a child's life, such as birth of a sibling, moving, or parental divorce.

## **Adverse Outcomes During Toilet Training**

While the majority of children are toilet trained without incident, approximately 2-3 percent experience an adverse outcome. Five common problems involving elimination behaviors encountered during the toilet training period are enuresis, encopresis, stool toileting refusal, stool withholding, and hiding while defecating.<sup>35</sup> A sixth potential problem may be psychological consequences; however, there are no studies that investigate this.

**Enuresis.** Initially enuresis simply meant wetting and nocturnal enuresis was bedwetting. Each were thought to be psychiatric conditions and as such definitions were created in the Diagnostic and Statistical Manual. The Diagnostic and Statistical Manual (DSM) IV-TR defines enuresis as

- 1) the repeated voiding of urine into bed or clothes (whether involuntary or intentional);
- 2) the behavior manifests twice a week for at least 3 consecutive months or there is the presence of clinically significant distress or impairment in social, academic (occupational), or other important areas of functioning;
- 3) the chronological age is at least 5 years (or the equivalent developmental level); and

- 4) the behavior is not due exclusively to the direct physiological effect of a substance (e.g., diuretics) or a general medical condition (e.g., diabetes, spina bifida, a seizure disorder).<sup>36</sup>

New theories developed regarding the pathophysiology of nocturnal enuresis which included the presence of nocturnal polyuria versus uninhibited bladder contractions. Physicians then considered two pathological conditions involving wetting which included enuresis meaning day and night wetting, or nocturnal enuresis which was simply night wetting. Most of the current literature is written reflecting this. Enuresis is further divided into primary or secondary enuresis. Primary enuresis occurs when a child has not achieved urinary continence by 5 years of age. Secondary enuresis occurs when a child who has achieved bladder control regresses to urinary incontinence. The International Children's Continence Society is considering new definitions to better define these terms and improve consistency in publications however in writing this review we rely on older terminology which is potentially flawed. There is also literature that suggests that some children thought to suffer from simple nocturnal enuresis may in fact have daytime symptoms which have not been identified. It is possible that toilet training methods may impact this complicated and not well understood pathophysiologic condition.<sup>37</sup>

Permissive and coercive toilet training methods have been associated with the development of enuresis in the literature.<sup>8 30</sup> There are a variety of treatment options for enuresis, including behavioral, physical, and pharmacological interventions.<sup>38 39</sup>

**Encopresis.** Encopresis was also initially thought to be psychological and as such was given a DSM diagnosis. To be diagnosed with encopresis, a child must meet the following DSM IV-TR criteria:

- 1) repeated passage of feces into inappropriate places (e.g., clothing or floor) whether involuntary or intentional;
- 2) at least one such event a month for at least 3 months;
- 3) chronological age is at least 4 years (or equivalent developmental level);
- 4) behavior is not due exclusively to the direct physiological effects of a substance (e.g., laxatives) or a general medical condition except through a mechanism involving constipation (<http://www.psychiatryonline.com/content.aspx?aID=8096>).

As with enuresis there are likely many factors which lead to encopresis and toilet training may be a component. Encopresis can also exist as a primary or secondary condition. Fishman et al. examined encopretic children and found that interrupted toilet training and punishment were associated with primary encopresis rather than secondary encopresis (50 percent versus 23 percent and 52 percent versus 26 percent respectively).<sup>40</sup> Encopresis can occur with or without constipation and overflow incontinence. Encopresis with constipation and overflow incontinence is characterized by the passing of loose stool that may include leakage varying in frequency, and it is most likely to occur during the day. Encopresis without constipation and overflow incontinence is sometimes associated with oppositional defiant disorder and conduct disorder (<http://www.psychiatryonline.com/content.aspx?aID=8096>).<sup>36</sup>

**Stool toileting refusal (STR).** There are conflicting beliefs regarding whether children master bowel control prior to or simultaneously with bladder control.<sup>8 41</sup> STR occurs when the child is trained to urinate in the toilet but refuses to defecate in the toilet for a period of at least 1 month.

In a study conducted in a single suburban pediatric practice, researchers reported that 20 percent of children suffered from STR.<sup>41</sup> There was a significant association between STR and training at a later age, having younger siblings, and the parents' inability to set limits.<sup>41</sup> In addition, children with STR are more likely to withhold stool and develop primary encopresis.<sup>41 42</sup> In a recent study, children who resolve STR are not at a higher risk for developing secondary encopresis.<sup>41</sup> In a case-control study that examined whether children with behavioral problems were more likely to exhibit STR, Blum et al. found that oppositional and noncompliant behaviors were not associated with STR. They found that children with STR tended to be constipated and have painful bowel movements and recommended dietary changes or stool softening medications in the treatment of STR. In general, many parents do not perceive STR to be problematic and believe that it frequently resolves on its own.<sup>41 43</sup>

There has been one RCT that examined an intervention to prevent STR.<sup>44</sup> Taubman et al. enrolled children in an RCT between the ages of 17-19 months of age. Children randomized to the treatment group received a three-prong intervention consisting of: 1) child-oriented toilet training guidelines, 2) parents only use positive words when referring to feces; and, 3) prior to toilet training, parents praise their child for defecating in their diaper. Children randomized to the control group received the same toilet training guidelines as the intervention group. While there was no difference in the incidence of STR between groups, the duration of STR and time to complete toilet training were significantly less among children in the intervention group.

**Stool withholding.** Stool withholding refers to any physical maneuvers a child may perform in an effort to avoid defecating.<sup>14</sup> These acts include doing a “potty dance,” running, or crossing one’s legs. Stool withholding can result in constipation because it often involves contracting the perineal muscles while the bladder and rectum are constricting.

Of 29 parents who sought medical intervention for STR, 23 cited “severe stool withholding” as the reason for requesting an intervention.<sup>41</sup> The most common intervention was to return the child to diapers. Stool withholding may be further complicated if parents misinterpret stool withholding behavior as an indication that the child is not able to have a bowel movement.<sup>41</sup>

**Hiding to defecate.** Some children will hide from adults while defecating. This phenomenon can begin either prior to toilet training or after toilet training has commenced. Some children who hide while defecating are able to control when and where they will defecate and chose not to utilize the toilet.

This behavior is not well researched. In a cross-sectional study, Schonwald et al. (2004) found that 74 percent of children who had difficulties toilet training hid to defecate. Stool withholding is associated with hiding while defecating.<sup>45</sup> Taubman et al. compared children who hid to those that did not and found that children who hid to stool were more likely to exhibit stool toileting refusal, stool withholding, constipation behaviors, and toilet training completion at a later age.<sup>46</sup> The median age for the onset of hiding to stool was 22 months. While the authors were unable to determine why children hid while defecating, they hypothesized that this behavior may be in response to embarrassment, fear, or not having observed adults defecating, thus assuming it is a private behavior.

## Objectives of this Review

All healthy children and many children with special needs attempt toilet training. During the developmental period, the child gains independence while attempting to conform to parental and societal expectation and norms. Several societies and organizations have published toilet training guidelines (Table 2).

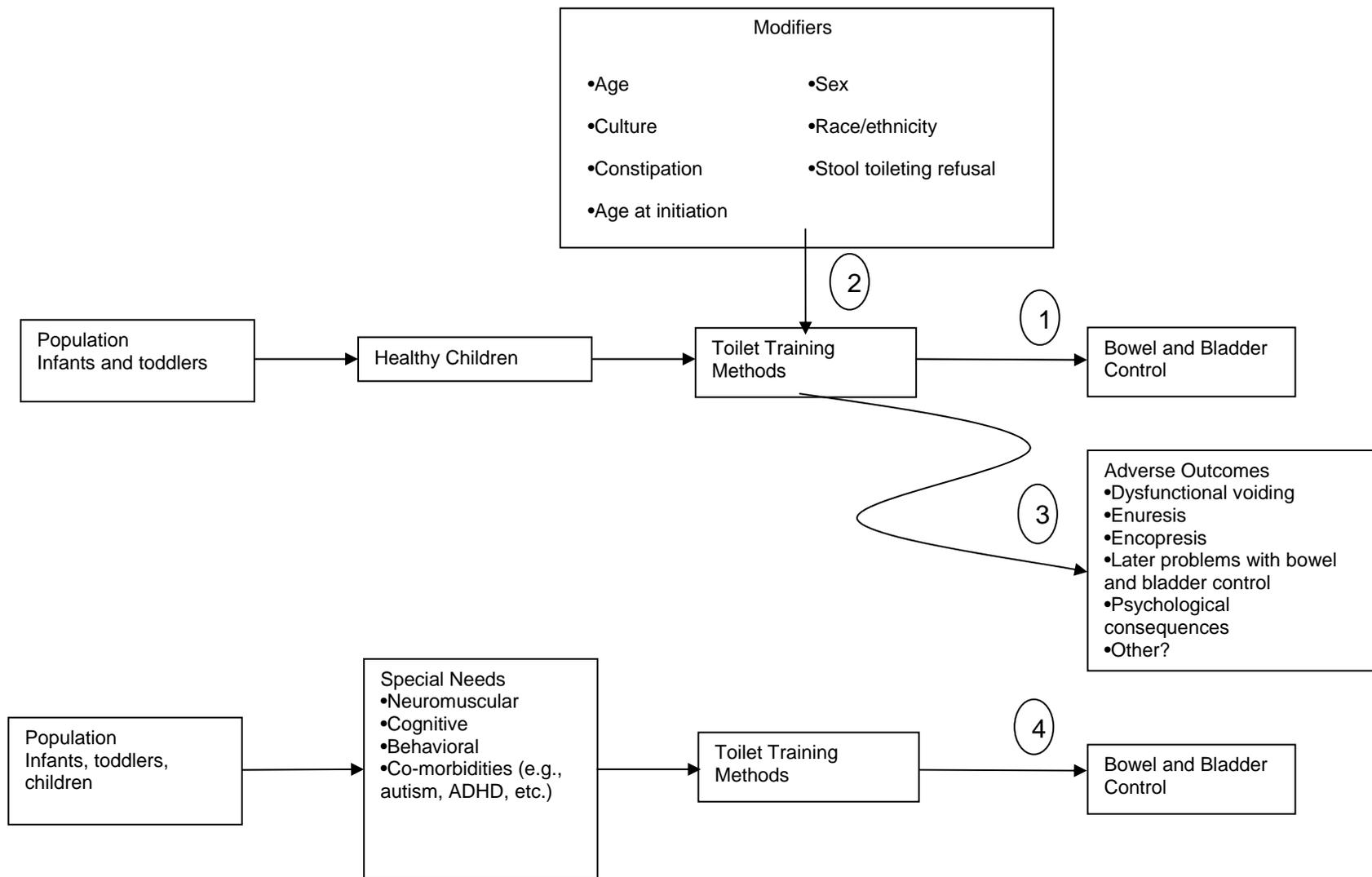
**Table 2. Summary of toilet training guidelines**

Guideline	Year	Location	Recommended Method(s) and Special Needs Recommendations
American Academy of Family Physicians	2005	USA	Method: Begin when parent and child are ready (approximately 2 years). Use child-oriented approach, praise successes, do not express disappointment at accidents, and avoid punishment.  Special needs: not mentioned
American Academy of Pediatrics	2000	USA	Method: Begin when developmentally ready and the child shows signs of readiness (approximately 2 years). Use child-oriented approach, praise successes with positive terminology, and avoid punishment or shaming. Make the process positive, natural and non-threatening. Do not force child.  Special needs: not mentioned
Canadian Paediatric Society	2005	Canada	Method: Begin when child is physiologically and psychologically ready. Anticipatory guidance with child-oriented approach, praise successes, and do not punish or use negative reinforcement.  Special needs: Assess readiness and degree to which child is hampered with the physician involved with care of the special needs child.
Pampers Parenting Institute Pediatric Roundtable	2006		Method: same recommendations as AAP  Special needs: not mentioned

Although all children undergo toilet training, there is limited research that has examined the effectiveness of different methods. We were unsuccessful at finding clinical practice guidelines published by the following organizations: American Academy of Child and Adolescent Psychiatry, American Academy of Neurology, American Pediatric Society, Asian Society for Pediatric Research, National Enuresis Society, Society for Developmental and Behavioral Pediatrics, and European Society for Pediatric Research. To the best of our knowledge, the organizations listed above do not have toilet training clinical practice guidelines.

Our objective was to systematically gather the existing evidence to determine the optimal toilet training method for both healthy children and those with special needs. We assessed which toilet training methods best achieved bladder and bowel continence and whether the methods were associated with the development of adverse outcomes. The objectives are pictorially displayed in Figure 1.

**Figure 1. Analytical framework for the effectiveness of different methods of toilet training for bowel and bladder control**



## Key Questions

The American Academy of Pediatrics put forth the following four questions:

1. What is the evidence for effectiveness of various toilet training methods to achieve bowel and bladder control?
2. What factors modify the effectiveness of toilet training, such as age, sex, race, ethnicity, culture, age at initiation, constipation, or stool toileting refusal?
3. What is the evidence for various toilet training methods as a risk factor for adverse outcomes, such as dysfunctional voiding, enuresis, encopresis, later problems, and psychological consequences?
4. What is the effectiveness of toilet training methods for achieving bowel and bladder control among patients with special needs?

## Chapter 2. Methods

### Methods for the Systematic Review

#### Literature Search

The research librarian, in collaboration with the TEP (Technical Expert Panel), identified appropriate electronic databases and developed search strategies tailored to the specific database. The search strategies were based on variations of the following keywords and subject headings: “toilet training,” “potty training,” and a combination of “toilet” or “potty” with “learning,” “conditioning,” “teaching,” “educating,” and “behaviors.”

The search strategies were used to search the following electronic databases: MEDLINE<sup>®</sup>, Ovid MEDLINE<sup>®</sup> In-Process & Other Non-Indexed Citations, Ovid OLDMEDLINE<sup>®</sup>, Cochrane Central Register of Controlled Trials (which contains the Cochrane Developmental, Psychosocial and Learning Problems Group’s specialized register of trials and the Cochrane Incontinence Group’s specialized register of trials; these groups hand search journals pertinent to their content areas and add relevant trials), EMBASE, CINAHL<sup>®</sup>, PsycINFO<sup>®</sup>, ERIC<sup>®</sup> (Educational Resources Information Center), EBM Reviews (Cochrane Database of Systematic Reviews, ACP Journal Club, Database of Abstracts of Reviews of Effects), HealthSTAR, AMED (Allied and Complementary Medicine), Web of Science<sup>®</sup> (Science Citation Index Expanded and Social Sciences Citation Index), Biological Abstracts, Sociological Abstracts, OCLC ProceedingsFirst, OCLC PapersFirst, Dissertation Abstracts, Index to Theses, and the National Research Register’s Projects Database. Trials registers (Current Controlled Trials and ClinicalTrials.gov) were searched for trials. Position statements by the American Academy of Pediatrics (Web site at <http://www.aap.org/>) and the Canadian Paediatric Society (Web site at <http://www.cps.ca/>) were sought. The NLM Gateway was searched for identification of meeting abstracts. The detailed search strategies appear in Appendix A\*.

In addition to the above search strategy, annual conference proceedings of the American Academy of Pediatrics and the Canadian Paediatric Society were hand searched for the years 2002–2005 inclusive. Also, reference lists were reviewed. Sentinel articles identified by TEP members were tracked forward using the Cited Reference Search feature in Web of Science<sup>®</sup>.

#### Selection and Inclusion

**Screening.** Once all duplicate references were removed, two reviewers independently screened the electronic search output. The title and when available, the abstract were assessed for possible inclusion using general inclusion criteria (i.e., was it primary research assessing a toilet training method) and classified as “include,” “exclude,” or “unclear.” The full text of all “include” and “unclear” studies was obtained and formally assessed for inclusion.

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\* Appendixes and Evidence Tables are provided electronically at <http://www.ahrq.gov/clinic/tp/toiletrtrtp.htm>

**Inclusion.** A priori inclusion criteria were developed (Table 3) and the studies were assessed for inclusion using a standardized form (Appendix B). Two reviewers independently applied the inclusion criteria and all discrepancies were resolved through discussion or consulting with a pediatrician and a pediatric urologist.

Studies examining the treatment of children with enuresis and/or encopresis were excluded. Although treatment components of enuresis and encopresis are similar to toilet training, it was believed that an enuretic and/or encopretic child would have already experienced at least one method of toilet training. The treatment of enuresis and encopresis was considered to be outside the scope of this review and there are several published systematic reviews that address these topics. Studies that measured the development of enuresis or encopresis as the result of a specific toilet training method were included.

The studies must have been published in English and all study participants had to be children, defined as less than 18 years of age. With the special needs literature, studies have applied toilet training methods to both children and adults. If the pediatric and adult data were presented separately, the study was included. In addition, the exact condition or diagnosis of special needs was not required. For example, studies describing children as “severely retarded” or “profoundly retarded” were included.

A wide spectrum of toilet training programs was included. The study could examine a program specifically designed to toilet train children or, for example, an operant conditioning program that aimed to change several behaviors. The study was included as long as toileting was one of the targeted behaviors and a toileting outcome was measured.

When it appeared that outcomes on the same or a portion of the same cohort of children were reported upon in multiple publications, a primary publication was identified. In general, the largest, most recent publication was assigned as the primary publication. If it was unclear if the studies reported on discrete children, individual investigators were contacted.

**Table 3. Inclusion and exclusion criteria for review on the effectiveness of different methods for bladder and bowel control\***

Criterion	Toilet Training Review
Study Design	Include: RCT, CCT, prospective or retrospective cohort, case-control, cross-sectional or case-series of at least 5 children. Exclude: case studies or case-series of <5 children.
Participants	Include: infants, toddlers, or children with or without co-morbidities, neuromuscular, cognitive, and/or behavioral disabilities. Exclude: children with enuresis or encopresis and adults with special needs.
Intervention	One or more of the following methods: Azrin and Foxx method, child-oriented method, operant conditioning, assisted infant toilet training, or any other toilet training program or intervention aimed at achieving bladder and/or bowel control.
Outcome Measures	Bladder control, bowel control, successes, failures/accidents, adverse outcomes (e.g.: enuresis, encopresis, stool withholding).

\* RCT indicates randomized controlled trial; CCT, controlled clinical trials

## Quality Assessment

Two reviewers independently assessed the methodological quality of the included studies. Any discrepancies were resolved through discussion or consulting a third party as needed. The reviewers, a pediatrician, and a pediatric urologist developed a priori guidelines regarding the interpretation and implementation of the quality tool. If a specific question from the quality assessment tool was not applicable to the study design, the question was answered “no.” When the same cohort of children was examined in multiple publications, the methodological quality was assessed on the primary publication.

The methodological quality of observational studies was assessed using the Downs and Black partially validated “Checklist of the assessment of methodological quality of both randomized and non-randomized studies of health care interventions” (Appendix B\*).<sup>47</sup> This tool comprises six sections that assess reporting (10 questions, total score 11), external validity (three questions, total score three), internal validity–bias (seven questions, total score seven), internal validity–confounding (six questions, total score six), and power (two questions, total score two). A maximum score of 29 indicates the highest methodological quality and a score of zero represents the poorest methodological quality. The funding source of each study was recorded.

The Jadad Scale was used to assess the methodological quality of randomized and non-randomized controlled clinical trials.<sup>48</sup> The Jadad Scale is a validated five-point scale that examines the methods of randomization, double-blinding, and the reporting of withdrawals and dropouts. In addition, Schultz’s definitions of concealment of allocation were applied and each trial was described as “adequate,” “inadequate,” or “unclear.”<sup>49</sup> The funding source of each study was recorded.

## Data Extraction

The reviewers, a pediatrician and a pediatric urologist, developed and piloted a data extraction form (Appendix B). Data were extracted by one reviewer and checked for accuracy and completeness by a second. All data were entered into SRS 3.0, a web-based software program designed specifically for systematic reviews. Any discrepancies were resolved through consensus or consultation with the co-task leaders as required. To facilitate extracting graphical data points with the greatest accuracy, graphs were scanned into CorelDraw®.

Data regarding the study design, toilet training objective (bladder versus bowel and daytime versus nighttime), patient demographics, toilet training interventions, and outcomes were extracted. Children were described as healthy, mentally handicapped, or physically handicapped. Sex, race, culture, socioeconomic status, age of toilet training initiation, and baseline bladder and bowel function were extracted. Chronological age and developmental or social ages or both if reported were also extracted. Developmental or social age refers to a child’s specific motor and mental capabilities. The source of the study population was also recorded. Details concerning the toilet training program were documented. The toilet training intervention was classified as Azrin and Foxx, child-oriented, operant conditioning, or other. In situations where the toilet training method was not specifically called one of the specific methods but was similar, it was classified as the specific method. When applicable to the specific toilet training intervention, the frequency

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\* Appendixes and Evidence Tables are provided electronically at <http://www.ahrq.gov/clinic/tp/toiletrtrp.htm>

of accident checks, and toileting was documented. Information on the length of the program, use of positive or negative reinforcement, external signaling devices, special toilet training equipment, and/or a specific toilet training room was recorded. Any training the parents or caregivers received was also recorded. A number of outcomes were extracted, including change in bladder and bowel function, number of successes and accidents, success and failure rates, time to toilet train, and the occurrence of adverse events (e.g., enuresis, encopresis, stool withholding, etc.). Where possible, results were extracted by effect modifiers, such as age or sex.

## Data Analysis

Due to extreme clinical heterogeneity with respect to study designs, interventions, populations, and outcomes, no statistical meta-analysis was performed. Each study was organized by population (healthy, mentally handicapped, and physically handicapped) and the toilet training program was grouped as Azrin and Foxx (also including modified Azrin and Foxx), child-oriented, operant conditioning, and other. Each study was qualitatively summarized and the vast majority of this summary was taken directly from studies themselves. However, there were a few instances where the authors did not perform a statistical analysis and a Fisher's exact test was used to compute a p-value to compare dichotomous data between two groups.

There were instances when the data were manipulated. When individual data were presented in tabular form, a standard deviation (SD) was calculated. There were situations when the baseline characteristics and outcomes were stratified by age or another variable. When possible, the data were combined by toilet training program using the following formulas:

$$\text{Exposure group mean} = \frac{\sum_{i=1}^k n_i \mu_i}{\sum_{i=1}^k n_i}$$

$$\text{Exposure group SD} = \sqrt{\frac{\sum_{i=1}^k (n_i - 1) \sigma_i^2}{(\sum_{i=1}^k n_i) - k}}$$

When applicable, each study was analyzed with respect to its definition of a child being successfully toilet trained and graphical summaries of such information were presented. The studies varied in their definitions of success and we attempted to classify the patients in each study as to whether they were toilet trained, i.e.: a "success." Definitions considered equivalent to "fully trained" included (among others) self initiated elimination in toilet, daytime continence for bowel and bladder, continued absence of wetting or soiling between toileting, and complete toileting with no prompts. Definitions that were considered partial successes included (among others) one or fewer accidents per month, reduced number of accidental daytime wettings, increased toileting in commode, and less than four bladder and two bowel accidents per week. Only those studies that reported these numbers and had a well-defined intervention were included in the graphs.

Statistical tests were calculated using StatXact (Version 7, Cambridge, USA) while the graphs were produced using S-Plus (Version 7.0, Seattle, USA).

## **Peer Review**

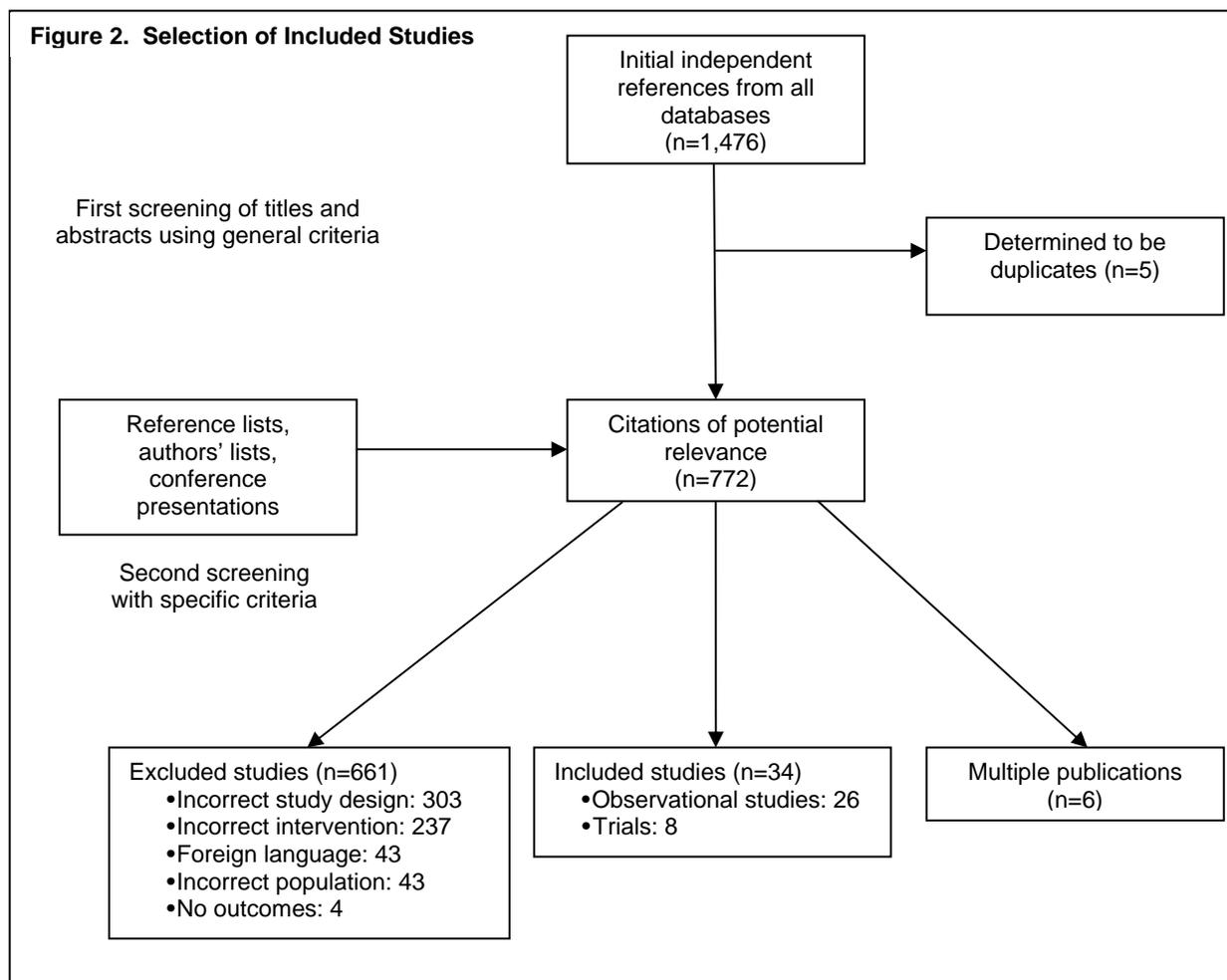
Fourteen toilet training experts, developmental pediatricians, and methodological experts were asked to peer-review the draft of this evidence report. Nine agreed to do so and six provided comments within the allocated time period. We reviewed all comments and revised this report accordingly. A list of the peer-reviewers appears in Appendix F and is available on the AHRQ Web site.



# Chapter 3. Results

## Literature Search

Database specific search strategies were applied to the electronic databases and output generated 1476 unique citations. Five potentially relevant studies were identified by hand searching the conference proceedings from the Canadian Paediatric Society and American Academy of Pediatrics. In total, 1481 unique studies were reviewed and five were later determined to be duplicates. Study identification and selection is outlined in Figure 2.



Seven hundred and seventy-two studies were identified as being potentially relevant. Studies were then excluded for the following reasons: inappropriate study design (n=303), inappropriate intervention (n=237), foreign language (n=43), incorrect study population (n=43), or inadequate data or outcomes not reported (n=4) (Appendix E\*).

\* Appendixes and Evidence Tables are provided electronically at <http://www.ahrq.gov/clinic/tp/toiletrtrtp.htm>

There were several instances where the same cohort children, or a portion of the same cohort, was included in more than one publication. In such cases, the most recent and complete study was chosen as the primary study and additional information was extracted from the related publications. A description of these multiple publications appears in Appendix C.

## Description of Included Studies

Thirty-five studies were included in this systematic review. There were three instances of multiple publications that examined toilet training within the same group of children.

**Observational Studies.** The median year of publication was 1976.5. Half of the studies were conducted in the United States (13/26; 50 percent), followed by the Netherlands (4/26; 15 percent). One study was conducted in Japan<sup>33</sup>, the only study occurring outside of the United States or Europe. The median sample size was 34.5; five studies included one hundred or more children.<sup>1 8 41 50 51</sup>

The included observational studies are described in Appendix D, Evidence Tables D-1, D-2, and D-3\*. Six of the 26 (23 percent) included studies that examined healthy children. Fifty percent (13/26) of the studies assessed toilet training methods in children with mental handicaps and 5 of the 26 studies examined physically handicapped children. Thirteen of 20 studies stated the children's specific handicap. Three studies included autistic children and two studies examined children with spina bifida. Two studies included mixed populations: one was a combination of healthy and mentally handicapped children and the other was a combination of mentally and physically handicapped children. Children were most commonly recruited from special care facilities (13/26; 50 percent), followed by clinical practice (7/26; 27 percent), community (2/26; 8 percent), school (2/26; 8 percent), and community and clinical practice (1/26; 4 percent). One study did not report the source of the children.

The goals of the specific toilet training programs were summarized as self-directed daytime bladder control (5/26; 19 percent), daytime bowel and bladder control (4/26; 15 percent), daytime and nighttime bladder control (2/26; 8 percent), daytime and nighttime bowel control, prompted bladder and bowel control anytime (2/26; 18 percent), and self-directed daytime bladder and bowel control (2/26; 8 percent). The remaining studies examined a variation of daytime versus nighttime, self-directed or promoted, bladder or bowel control. Twenty of the included studies examined one toilet training program and the remaining six studies assessed two programs, for a total of 32 programs. The most common toilet training program was operant conditioning (8/32; 25 percent) and Azrin and Foxx (5/32; 16 percent). Child-oriented toilet training was assessed in three studies. The remaining studies examined 'other' toilet training programs, which often included components of reinforcement and increasing liquids.

The outcomes were heterogeneous. The primary outcome in 23 of the 26 (88 percent) studies measured success or failure of toilet training; however, 'success' had variable definitions, such as bladder and/or bowel continence, self-toileting, directed toileting, lack of accidents, etc. The outcomes assessed in the remaining three studies were lower urinary tract symptoms, enuresis, and stool toileting refusal.

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\* Appendixes and Evidence Tables are provided electronically at <http://www.ahrq.gov/clinic/tp/toiletrtp.htm>

**Trials.** In this review, there were 13 trials that examined eight unique cohorts of children (Appendix D Evidence Table D-4, D-5, and D-6). The median year of publication was 1977 and only three of the eight (38 percent) trials were conducted after 1991<sup>44 52 53</sup>. Six trials were conducted in the United States (75 percent) and one of each in the United Kingdom (13 percent)<sup>53</sup> and Netherlands (13 percent)<sup>52</sup>. The median sample size was 22.5 children; two trials included more than 50 children (25 percent).<sup>44 54</sup> All eight trials employed a parallel arm study design. Three trials had three arms (38 percent)<sup>53 55 56</sup>; the five remaining trials were two-armed.

The included populations were heterogeneous. Three of the trials included healthy children (38 percent), four included children with a mental handicap (50 percent); and one trial included children with Hirschsprung’s disease (13 percent). All of the mentally handicapped children were recruited from a special care facility. Taubman et al. enrolled children from their clinical practice, while the remaining studies recruited children from the community.

The included trials had a range of toilet training objectives: mastery of daytime and nighttime bladder control (2/8; 25 percent), daytime bladder control (2/8; 25 percent), and self-directed daytime bladder control (2/8; 25 percent), self-directed and prompted daytime bladder control (1/8; 13 percent), and self-directed daytime bladder and bowel control (1/8; 13 percent). The toilet training methods were diverse. Azrin and Foxx was the most common method and it was examined in at least one arm of four of the trials. In two trials, variations of the Azrin and Foxx method were compared to one another. The remaining trials used other toilet training methods, such as Spock’s baby book<sup>54</sup>, relaxation-tension exercise regimen<sup>57</sup>, operant conditioning<sup>55</sup>, praising defecation<sup>44</sup>, and a biopsychosocial approach aimed to reduce defecation associated anxiety and stool avoidance. Two trials contained a control group that was comprised of no toilet training method (2/8; 25 percent).<sup>55 56</sup>

Seven of the included eight studies measured a variation of toileting accidents or successes, such as the frequency or number of accidents/successes or proper use of the toilet. One study measured the development of stool toileting refusal.<sup>44</sup>

## Methodological Quality of Included Studies

**Observational Studies.** The mean Downs and Black score of the 26 included observational studies was 17.2 (SD 2.8) of a maximum possible score of 29. The mean scores of the individual components of the quality tool are presented in Table 4 and additional details are reported in Appendix D Evidence Table D-7\*.

**Table 4. Summary of components of Downs and Black Score**

	Reporting	External Validity	Bias	Confounding	Power	Overall
Maximum Score	11	3	7	6	2	29
Mean Score (SD)	8.1 (1.3)	1.3 (1.1)	4.2 (0.8)	3.0 (1.0)	0.5 (0.5)	17.2 (2.8)

SD indicates standard deviation

\* Appendixes and Evidence Tables are provided electronically at <http://www.ahrq.gov/clinic/tp/toiletrtp.htm>

The majority of the studies collected data prospectively (14/26; 54 percent). Seven studies (27 percent) reported their funding source: government agency (1/26; 4 percent), private industry (1/26; 4 percent), foundation (1/26; 4 percent), combination of government and foundation (1/26; 4 percent), or other (3/26; 12 percent).

**Trials.** The methodological quality among the included studies was very similar. With the exception of one trial<sup>52</sup>, all of the trials scored two on the Jadad scale. The two points were earned for stating the trial was randomized and adequately describing the children who withdrew or dropped out from the trial. Van Kuyk (2001) was a clinical controlled trial, but not randomized and scored 1 on the Jadad scale.<sup>52</sup> All trials failed to describe the method used to conceal allocation. Four of the trials were funded by government organizations (50 percent) and one received funding from an internal source (13 percent); the remaining three trials did not comment on funding source (38 percent). Appendix D Evidence Table D-8 provides additional information about the methodological quality of the included trials.

## Toilet Training Success

Toilet training successes are displayed pictorially in Figures 2 to 4. The arms of all the studies reporting success rates are presented by the type of toilet training method, study design, and healthy versus handicapped child. Because the studies are heterogeneous with respect to toilet training definitions, type of children (even within the broad categories of healthy, physically and mentally handicapped), and intervention (even within the categorizations) these comparisons are meant only for broad illustrative purposes and can not be used to compare the toilet training methods to one another. In addition, the findings of the individual studies are described in Appendix D Evidence Table D-9 and D-10\*.

Figure 3 shows, perhaps not surprisingly, that healthy children tended to have the highest success rates, generally ranging from 80 to 100 percent. There was only one small study that had a lower success rate and the children were toilet trained by the Azrin and Foxx method. Studies conducted with healthy children tended to be a mix of RCTs, and both prospective and retrospective cohorts.

The studies examining mentally handicapped children were all relatively small and generally prospective in nature. Success rates encompassed the full spectrum from 0 to 100 percent; the operant conditioning method results were particularly dispersed (Figure 4).

The studies assessing physically handicapped children primarily used toilet training methods categorized as “other” with the exception of one small study that examined operant conditioning (Figure 5). Similar to studies of mentally handicapped children, success rates were variable, ranging from 15 to 100 percent, although the majority of studies and the larger ones had rates under 50 percent.

## Direct Comparisons

**Healthy children.** There were four studies that examined head-to-head comparisons between methods among normal children.

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\* Appendixes and Evidence Tables are provided electronically at <http://www.ahrq.gov/clinic/tp/toiletrtrtp.htm>

Matson randomized ten children (age 20 to 26 months) into one of the following groups: Azrin and Foxx method with an experienced trainer or mothers training their children using a book to guide the toilet training process.<sup>58</sup> Four out of five children in the former group were successfully trained, while only one of five in the latter group was completely successful, one obtained partial success, the remaining three failed. The small sample size precludes statistical significance and would in even the most extreme case (80 percent success rate versus 20 percent success rate; p-value for Fisher's exact test (2 sided): 0.21).

The Azrin and Foxx method was also used in an RCT conducted by Candelora (1977) to compare it to the Spock method in 71 healthy children aged 18 to 35 months.<sup>54</sup> Three primary outcomes were examined: number of accidents, number of successes, and number of wet mornings. Three time periods were examined: pre-treatment, post-treatment, and at follow-up. When looking at difference in pre-training and post-training results as well as in pre-training and follow-up results, the Azrin and Foxx method was found to be superior to the Spock method in all three outcomes. However, there was no significant difference between the groups with respect to post-training and follow up. Using the Azrin and Foxx method, the number of accidents per child per day was reduced by 2.48 from pre-training to post-training under the Azrin and Foxx method and reduced an additional 0.70 at follow-up, resulting in a total reduction of 3.17. For the Spock method, there was a reduction of 1.37 in post-training and an additional 0.52 at follow up (1.90 total reduction). The number of successes per child per day was increased by 2.50 in post-training and by an additional 0.87 at follow-up, for a total increase of 3.37 when using the Azrin and Foxx method. For children trained using the Spock method, there was an increase of 1.12 in post-training and an additional 0.79 in follow-up (1.90 total increase). Finally, the percentage of mornings wet was reduced in the Azrin and Foxx group by 21 percentage points in post-training and an additional 10 points in follow-up (total of 31 percentage points), compared to a reduction in the Spock method of 6 percentage points in post-training and an additional 9 points at follow-up, for a total reduction of 15 percentage points.

Taubman enrolled 406 children aged 17 to 19 months in a toilet training study using a child-oriented approach, and the parents determined when toilet training would commence. The children were randomized into two groups: one group was given instructions to avoid negative terms to describe defecation or to a group who received no such direction.<sup>44</sup> The groups were equivalent in terms of number of children with stool toileting refusal (STR) (26 percent in the intervention group compared to 23 percent in the control group) but duration of STR was significantly longer in the control group (7.3 months compared to 5.1 months; p=0.03). No significant differences were found between the groups in terms of incidence of stool withholding (intervention 52 percent; control 55 percent) or incidence of hiding during defecation (intervention 68 percent; control 70 percent). The intervention group did find that toilet training was completed significantly sooner (intervention 40 months; control 43 months; p=0.04).

Bakker conducted a retrospective study that collected data on 4332 primary school age children and compared children who did and did not develop abnormal outcomes in bladder control.<sup>59</sup> There were 3404 children in the control group and 928 in the symptom group. The authors found that significantly more children in the control group had prompting from their parents during toilet training than those in the symptom group (68 percent versus 62 percent; p < 0.001). Parents of the symptom group tended to reward and punish more so than the control group (53 percent versus 46 percent). Parents reacted differently when an attempt to void was unsuccessful. Parents in the control group were much more likely to encourage the child to try again later (83 percent compared to 67 percent; p < 0.001). Those in the symptom group were

more likely to make the child wait until voiding (8 percent to 3 percent;  $p < 0.001$ ), make the child push or strain (13 percent to 5 percent;  $p < 0.001$ ), make special noises (43 percent to 37 percent;  $p = 0.002$ ), and open a tap (26 percent to 21 percent;  $p = 0.003$ ).

**Mentally handicapped children.** There were eight studies that contained direct comparisons of interventions in mentally handicapped children: four were RCTs, two were multiple cohort studies, while the remaining two were single cohort studies.

Smith conducted an RCT to look at three methods of training fifteen severely mentally retarded children with social ages ranging from 0.94 to 2.2 years on the VSMS scale.<sup>60</sup> The first method was an intensive individual regular “potting” program, the second was group training with regular “potting” program and the third was an intensive individual timing training program. The primary difference between regular “potting” and timing training is in which the manner incontinent events are handled. In the timing training method, the child is promoted to toilet and positively reinforced for urinating after an incontinent event. An incontinent event among the regular “potting” group resulted in a reprimand and 10 minute timeout. The number of children who achieved independent toileting at the end of training was 5/5 in the first method, 1/5 in the second method, and 4/5 in the third method. Despite the small sample sizes, the exact three-way test for independence is approaching significance ( $p = 0.051$ ). In addition, the comparison of method 1 versus 2 does show a significantly greater odds of being trained in group 1 (Fisher exact  $p$ -value = 0.048). Looking at percentage reduction in incontinence at the end of the 12-week study, methods 1 and 3 (about 97 percent and 80 percent respectively) did achieve greater reductions than method 2 (about 45 percent), although the difference was not significant (F  $p$ -value = 0.10). The authors completed a 10-year follow-up study.<sup>53</sup> Only one child (in method 1) was still independent after 10 years. The authors also examined incontinence reduction both after the initial study and at the 10-year follow-up, although no comparisons among groups were presented. The first method showed a 99 percent reduction in incontinence after initial training and this dropped to 88 percent after 10 years. For the second method, incontinence was initially 39 percent and improved to 52 percent after 10 years. For the third method, incontinence decreased from 80 percent to 74 percent after 10 years.

Edgar completed an RCT of 20 severely and profoundly retarded children (developmental ages between 15 and 23 months) to examine relaxation methods versus a control group.<sup>57</sup> Among the children who received relaxation exercises, there was a significant reduction in accidents and toilet training was successful (8/10 versus 2/10;  $p = 0.02$ ). Self-initiated toileting was identical in the two groups: two children from each group eventually achieved it. Compared to the control group, the relaxation group also showed significant reduction in accidental urination and improvement in appropriate urination.

Hundziak randomized 29 severely mentally retarded boys with a social quotient between 8 and 33 months to one of three interventions: operant conditioning, conventional training, or a control group.<sup>55</sup> Scores for defecation and urination in toilet were determined and non-parametric tests conducted. The operant conditioning group advanced significantly more in both defecation and urination than the conventional training group, and more in defecation (although not in urination) than the control group. There were no significant differences between the conventional and control groups. The authors concluded that the operant conditioning method is useful in training severely retarded children.

Sadler conducted an RCT among 14 severely retarded children aged 7 to 12 years.<sup>56</sup> Children were randomized to Azrin and Foxx method, a no training group, or a scheduling toilet training

method. The primary outcome was the number of accidental urine-dampened pants and was analyzed using a repeated measures ANOVA while controlling for time. Compared to both the no-training group and the scheduling method, the Azrin and Foxx method proved to significantly reduce dampened pants (3 months and 4 months,  $p < 0.01$  in all comparisons). As the experiment continued to its second phase, the scheduling group and half the no-training group were moved to the Azrin and Foxx group, which had a significantly lower number of dampened pants than the remaining no-training group ( $p < 0.01$ ).

Kimbrell examined 40 severely retarded female children (VSMS range 6 to 28 months).<sup>61</sup> Based on age, race, length of institutionalization and VSMS, children were systematically allocated to an operant conditioning behavior modification intervention or a control group. Compared to children in the control group, the children receiving operant conditioning had significantly greater gains in the toilet training score component of the VSMS (gain of 4.10 versus 0.30,  $p < 0.001$ ).

Tierney studied 36 mentally subnormal children with mental ages between 4 and 22 months.<sup>62</sup> Age, mental age, level of functioning, degree of incontinence, and degree of mobility were used to systematically separate the children into an operant conditioning behavior modification group and a control group. Seven patients in the operant conditioning group achieved consistent continence while an additional seven showed a marked improvement. The remaining four patients failed to improve. None of the eighteen control patients improved. The differences in both achievement of consistent continence and improved continence were significant (Fisher's exact test:  $p < 0.0001$  and  $p=0.008$  respectively).

Connolly looked at nine children between the ages of 3 and 18 years that exhibited moderate to severe mental handicaps.<sup>63</sup> Four children who were already toilet trained were included as controls. The toilet training program consisted of a three-stage operant conditioning process that involved both positive and negative reinforcement. The amount of soiling and wetting from baseline to program completion improved by 15.8 percent and 75.0 percent respectively. Improvements were still evident at the six-week follow-up; however, they had decreased to 14.0 percent and 25.0 percent respectively. Two of the nine children were considered fully trained.

Lancioni describes two separate experiments on toilet training autistic, retarded children.<sup>64</sup> The first looked at 5 children (aged 10.6 to 14.6 years) that were divided into two similar interventions. For the 3 children assigned to intervention A, 25 potties were placed throughout the room and there were no potties placed in the room for the 2 children in intervention B. The other aspects of the toilet training program were identical. All three subjects in A showed independent toileting, while neither of the two subjects in B did. For the second phase of the study the two B children were transferred to intervention A and achieved independent toileting. The second study was almost identical in design to the first with the exception that no negative reinforcement was employed. Four children (ages 11.0 to 13.8 years) were put into the two interventions A and B (two in each intervention). Once again the subjects in A exhibited independent toileting, while those in B did not until moved into intervention A for the second phase. The authors conclude that intervention A, with or without negative reinforcement, is effective in promoting independent toileting for autistic, retarded children.

**Physically handicapped children.** There was only one study that contained direct comparisons of interventions involving physically handicapped children. Van Kuyk (2001) randomized 27 children (aged 2 to 12 years) with Hirschsprung's disease to either a multidisciplinary behavior treatment or a waiting list control.<sup>52</sup> An ANOVA was performed on the change scores for six

different outcomes and the intervention group was found to be significantly superior to the control group in all outcomes. There were three scores used to measure toileting: the Templeton score (intervention: 1.1 reduction; control: 0.0 reduction), the Wingspread score (intervention: 1.3 reduction; control: 0.1 reduction) and the Wingspread constipation score (intervention 0.7 reduction; control: 0.1 reduction). The remaining three outcomes were percent of feces in toilet (intervention: 53.7 percent increase; control: 2.3 percent decrease;  $p<0.001$ ), number of days without soiling (intervention: 8.4 day increase; control: 0.7 day increase;  $p<0.001$ ), and scale determining parental judgment incontinence (intervention: 5.2 reduction; control: 0.9 reduction;  $p<0.05$ ).

## Single Cohorts

**Healthy children.** Five studies examined toilet training in healthy children: three studies assessed a child-oriented approach and the remaining two evaluated Azrin and Foxx methods.

Three studies examined the child-oriented approach to toilet training. Stool toileting refusal of at least one month duration occurred in 22 percent of the children (106/482) and 29 children required an intervention, such as returning the child to diapers or using suppositories. Stool toileting refusal was associated with presence of a younger sibling and the parents' inability to set limits for the child. The study was conducted in a private pediatric practice of middle and upper class families. In a second study, Brazelton describes 1170 children who were toilet trained during ten years of his pediatric practice.<sup>8</sup> All children were trained using a child-oriented approach and training occurred in a pressure-free environment and only begun once the child has expressed interest (at approximately 18 months of age). The clinical population consisted of primarily upper-middle class families. For the majority of children, bowel and bladder training occurred simultaneously (930/1170; 79.5 percent). Daytime continence was achieved at a mean age of 28.5 months and nighttime continence by 33.3 months. While males and females completed daytime training at the same age, girls achieved nighttime continence approximately 2.46 months sooner than boys. Sixteen children were not trained by five years of age and suffered from at least one of the following: 12 had enuresis, 4 soiled in stressful situations, and 8 suffered from chronic constipation. Finally, Kaffman examined children living in one of twelve kibbutzes in Israel.<sup>50</sup> Toilet training is conducted by at least six people and is led by the head metapelet (caregiver). The toilet training program is child-oriented and is tailored to the child's temperament, emotions, and neurophysiological development. Enuresis was defined as a lack of complete bladder control by the age of three and half years and the prevalence was 13.9 percent (192/1376).

Two studies assessed the Azrin and Foxx method in healthy children. Foxx et al. identified 34 children who previously attempted toilet training. The children were assessed with a screening test to ensure their ability to follow the toilet training program.<sup>9</sup> Two trainers applied the Azrin and Foxx method and the children were toilet trained with a mean time of 3.9 hours. Older children (aged 26 to 36 months) completed unprompted toileting within 2.3 hours, whereas the younger children required approximately 5 hours. After the Azrin and Foxx method, bladder and bowel accidents were reduced by 97 percent and this success was maintained at four months follow-up. With the exception of one parent, the parents were pleased with their child's progress; however, the parent's displeasure was not related to the toilet training method. A second study examined 49 children toilet trained according to Azrin and Foxx's Toilet Training in Less than a Day program. Parents went to three weekly classes where they were taught the principle of the

Azrin and Foxx method. Ten children failed to achieve continence within the intensive training session; nine of the children were less than 25 months of age. Reasons for failure include the child's severe emotional reaction (n=6) and parents quitting the program (n=4). The average toilet training time was 4.5 hours. At 8-week follow-up, bladder and bowel control continued to improve, but many children were lost to follow-up.

**Mentally handicapped children.** A total of ten studies examined toilet training methods among mentally handicapped children. Four studies assessed variations of the Azrin and Foxx method and six utilized operant conditioning programs.

Five studies examined variants of operant conditioning programs. Van Wagenen used forward-moving series toilet training to toilet train nine mentally handicapped children.<sup>65</sup> The children wore an alarm that sounded at the time of urination. The trainer then said "no," led the child to the toilet, and placed the child on the toilet where the child continued to urinate. Once this sequence was established, the alarm was replaced with cotton underwear and the children were taught to dress and undress. All of the children were successfully trained with this method and toileting skills were maintained in different toileting facilities. In the second study, Ando utilized operant conditioning techniques to toilet train five institutionalized autistic boys.<sup>33</sup> Positive reinforcement for correct toileting included candy, praise, and affection, while physical and verbal punishment was used to negatively reinforce improper toileting behavior. The children were toileted every two hours or when they appeared to have to urinate. Three of the children improved self-initiating toileting (approximate improvement ranged from 30-60 percent). One child had minimal improvement; self-initiating toileting increased from 0 to 20 percent after twelve months of training. The fifth child failed to increase self-initiating toileting and the child did not respond to any of the positive or negative reinforcers. In the third study Giles et al. attempted to toilet train five severely and profoundly mentally retarded children who rarely displayed self-initiated toileting.<sup>11</sup> Bladder training was only initiated after some bowel continence was achieved. Correct toileting behavior was positively reinforced. If positive reinforcement did not produce behavior modification, aversive consequences in the form of physical restraints were used to correct inappropriate toileting behavior. The length of the training program was eight weeks. All five children were successfully toilet trained. In the fourth study, Spencer attempted to establish bowel control in nine severely and 29 profoundly retarded boys.<sup>66</sup> The operant conditioning program consisted of positive reinforcement for defecating in the toilet and sitting on the toilet (providing the boys were incontinent at least half of the time). The program was 6 weeks in length. Achieving bowel control was not significantly correlated to mental age, chronological age, leg coordination, sociability, negativism, emotionality, bowel movement frequency, brain damage or, time in institution. Spontaneous toileting increased by 9 percent and accidents decreased by 17 percent. Improvement was more profound in children with a higher degree of incontinence. Using an operant conditioning program, Colwell attempted to improve toileting, dressing, and eating behaviors among 47 profoundly and severely mentally retarded children.<sup>67</sup> The objective was to bring these behaviors under verbal control. Initially, tangible items were used to positively reinforce proper behavior and were then replaced with social praise. A 23-item toileting scale was used to measure changes in behavior. Follow-up ranged from 3 to 12 months. Thirty-three of the 47 children increased their toileting skills, 3 children decreased toileting skills and the remaining 8 children experienced no change. The mean toileting score improved from 6.0 out of 18.0 at baseline (goes to bathroom area when

asked, requires assistance with clothing, and has accidents) to 10.1 after the intervention (toilets on command, manages own clothing, and has few or no accidents).

Four studies evaluated variations of the Azrin and Foxx program. Didden attempted to achieve prompted bowel and bladder control with six children diagnosed with Angelman syndrome.<sup>68</sup> The daily 6-hour training sessions included walking to the bathroom, drinking every 30 minutes, scheduled toileting in 30-minute intervals, remaining on toilet until elimination or 20 minutes expires, positive reinforcement for successes, and self-dressing. If the child had an accident, the child was reprimanded, changed clothing, cleaned the soiled area, was denied toys, and had a one-hour timeout. Children were followed up at 2.5 years. At baseline, the average frequency of correct daily toileting was 0.8 (SD 0.95). This increased to 3.5 (SD 1.23) at post-treatment and similar results were observed at follow-up (3.1; SD 0.57). The mean time spent toilet training was 108.2 hrs (30.6). In the second study, Lancioni used the Azrin and Foxx method to toilet train nine profoundly deaf and blind children who had never shown any signs of self-initiated toileting.<sup>69</sup> The training program consisted of increased liquid and decreased food, positive reinforcement for proper toileting behavior and remaining dry, punishment for accidents, increasing distance from the toilet, and removing environmental stimulus. Training was conducted in three phases and followed by a maintenance phase. At day 44 of follow-up, eight of the nine children exhibited self-initiated toilet training. In the third study, Smith retrospectively examined 13 mentally retarded children who were toilet trained by the Azrin and Foxx method.<sup>70</sup> The children wore a urinary training device, fluid intake was increased, and operant conditioning techniques were used to elicit the desired toileting behavior. At baseline, the children had a 50 percent frequency of wetting accidents, which was reduced to approximately 10 percent by week 5 to 6. All three of the higher social-aged children and three of the five lower social-aged children maintained a near-zero accident rate at follow-up (6 to 18 months). The remaining children experienced a slight increase in accidents. In the final study, a toilet training method similar to that of Azrin and Foxx was used to toilet train nine mentally handicapped children.<sup>71</sup> The Azrin and Foxx method was augmented with the Big Kids book, which was read to the children at least once a day. There was no punishment or reinforcement of accidents. Follow-up measurements were taken at 2, 4, and 6 weeks. The authors found an increased number of success and a decreased frequency in the number of accidents. When compliance to each component of the toilet training program was measured, there was poor compliance to the Big Kids book and was deemed an unnecessary component to toilet training. In the final study, the population consisting of three healthy children and five mentally handicapped children.<sup>72</sup> The children were subjected to a two-step operant conditioning program aimed at establishing all components of toileting behavior. During the first step, the children responded to physical, verbal, and auditory stimuli. Prompts were then elicited by the auditory stimulus alone. Seven of the eight children were successfully toilet trained with this method.

**Physically handicapped children.** Five studies examined toilet training among children with various physical handicaps. All toilet training methods were classified as “other” and, with the exception of two papers,<sup>73 74</sup> the toilet training programs were different.

Van Kuyk conducted two studies that retrospectively assessed a multidisciplinary toilet training program among children diagnosed with anal atresia<sup>73</sup> and Hirschsprung’s disease.<sup>74</sup> The toilet training program aimed to teach adequate defecation behavior by reducing fear and anxiety concerning defecation and stool withholding, learning how to use the lower body to defecate, improving straining techniques, and defecating on a regular schedule. The program was

conducted by a variety of health care professionals, including a child psychologist, pediatric physiotherapist, and pediatric surgeon. Among the 43 children with anal atresia, there was a significant improvement in the three-point continence score after treatment compared to baseline (Templeton score at baseline:  $2.2 \pm 0.45$ ; post treatment:  $1.6 \pm 0.59$ ). The Templeton score measures awareness of impending defecation, occurrence of accidental defecation, need for additional underwear or diaper liners, presence of diaper rash, social problems, and restriction of physical activity. There were also significantly fewer children suffering from constipation (18 versus 8). Among the 16 boys diagnosed with Hirschsprung's disease, there was significant improvement in Templeton score after completing the toilet training treatment program. After treatment, the Templeton score decreased to 1.1 (SD 0.34) from 2.7 (SD 0.48). The number of constipated children was reduced from 12 to 4. The treatment was effective, regardless of the age of the child or the specific physical handicap.

Three studies developed toilet training programs for establishing bowel control in children with spina bifida.<sup>51 75 76</sup> In the study by King, the toilet training program aimed to establish neurogenic bowel habituation.<sup>75</sup> It included training provided by a psychiatrist and establishing a set time for bowel elimination. Specifically, the bowel was cleaned and stool softeners, glycerin suppositories, bisacodyl suppositories, digital stimulation, and oral medication were incorporated to result in a timed defecation. The age range of the study population was 18 months to 29 years and results were stratified by age ( $\leq 6$  years versus  $> 6$  years of age). Among children less than or equal to 6 years of age, continence improved from 0 percent (0/17) to 65 percent (11/17) and further improved to 88 percent (8/9) among children who completed the toilet training program. In the second study, Forsythe created a similar program for 47 children.<sup>76</sup> The children worked through the following steps sequentially until an intervention was successful: regular toileting after supper, daily enemas, enemas plus suppository or microenema before evening meals, and enemas and daily use of laxatives. At each stage, the prior intervention(s) were also used. Regular toileting resulted in bowel control in 8 of the 47 children (17 percent). Seven of the 39 children (18 percent) achieved bowel control with a combination of regular toileting and enemas; 2 other children experienced initial success but relapsed after 6 to 8 months. Of the 25 children treated with daily suppositories or micro-enemas, enemas, and regular toileting, only 5 children attained bowel control (20 percent). Glycerin suppositories were ineffective; three treatment successes occurred in the bisacodyl group and two in the microenema group. Twenty-seven children received a combination treatment of laxatives, enemas, and regular toileting. Among the 16 children using bisacodyl tablets, 12 were free from stooling accidents and were followed up from 9 to 24 months. All 15 children who received a laxative syrup experienced bowel control and were followed up for at least 6 months. In the third study, a bowel and bladder toileting program was evaluated in 525 children with spina bifida and aged 1 to 18 years.<sup>51</sup> The bowel training program consisted of five components: (1) untimed collection of a diaper or insert and cleaning by a primary care giver, (2) infrequent enemas, (3) small, rapid, low-level enemas, (4) suppositories, and (5) timed evacuation with or without digital stimulation. The control program was comprised of (1) diaper or pant insert, (2) penile collectors, and (3) urinary diversions with either timed bladder emptying with or without medication or clean intermittent catheterization with or without medication. Dependent socially acceptable bowel control among children less than 3 years of age was best achieved with diaper care (15/41) and suppositories (14/41). Thirty-nine of the 41 children were trained. Among children over the age of 4 years, dependent socially acceptable bowel control was best achieved by suppository use (24/184) and expansion enema (12/184). The timed method was most successful for achieving independent

socially acceptable bowel control (55/184), followed by suppository use (24/184). Regardless of age, 44 children failed to achieve socially acceptable bowel control. Among children less than 6 years of age, socially acceptable dependent training was most frequently achieved by a diaper/pants insert (32/57). Only one child achieved independent socially acceptable bladder control and this was achieved by clean intermittent catheterization. Socially acceptable independent and dependent bladder control was achieved by ileal diversion (23/158 and 27/158, respectively). In total, 62 children did not achieve socially acceptable bladder control.

## Chapter 4. Discussion

In many cultures, including North America, parents regard a child achieving independent toileting skills as a significant accomplishment. It is one of the first steps in becoming self-sufficient; caregivers no longer need to spend time or energy on diaper changes and there are financial savings in diaper costs. As such, successful toilet training is an adaptive skill that caregivers expect their healthy child will achieve. However, the toilet training process can cause some anxiety for caregivers, particularly among parents with children who have significant physical, mental, or behavior problems. Achieving independent toileting requires that a child have a combination of skills in language, motor, sensory, neurological, and social domains. For the child with a significant impairment in one or more of these, successful toileting can be problematic.

This review summarizes the scientific evidence relating to the effectiveness of defined methods used to toilet train children to achieve bowel and bladder control. In addition to overall effectiveness, the review looked at evidence to support or refute proposed factors that might modify the effectiveness of toilet training (e.g. age, sex, race/ethnicity, culture, age at initiation), and to assess if some toilet training methods pose a risk for developing adverse outcomes such as dysfunctional voiding, enuresis, or encopresis. This review sought to determine the optimal toilet training methods for healthy children and those with mental, physical or behavioral problems.

An extensive search for trials was conducted in databases from education, psychology, social sciences, and health sciences. We searched for meeting abstracts, theses, and dissertations; we searched for position papers from professional pediatric societies and conference proceedings. Only eight RCTs were identified; all compared different versions of the same method. The remaining 26 included studies were retrospective and prospective cohort studies; only 3 had a comparison group and all were children receiving usual care. For these reasons, we were not able to conduct a meta-analysis and the results are presented qualitatively. Notwithstanding, some valuable general information does arise from this review in the form of a descriptive analysis.

Three primary toilet training methods were identified and examined for training healthy and mentally handicapped children: Azrin and Foxx, operant conditioning, and a child-oriented approach. The interventions used to train some children, particularly those with physical handicaps, were specifically designed to work with their particular problems and abilities; we categorized these as “other” methods.

### Toilet Training Healthy Children

Toilet training for healthy children is not a subject that invokes passion among researchers; however, parents and pediatricians struggle with this seemingly minor problem on a daily basis. Pediatricians faced with the task of providing evidence-based advice have difficulty finding the literature to support the various approaches.<sup>77</sup>

Most parents want to know the quickest, easiest approach to toilet training that does not result in adverse outcomes. Parents are inundated with media and lay information on various methods from the child oriented approach to the extreme and time intensive method of elimination communication where an infant may be diaperless from birth.<sup>78</sup> Despite this method’s growing popularity in North America, we did not identify any studies that examined the elimination communication toilet training method. A method similar to this idea was used among the Digo people of East Africa; however, the article did not report any quantitative results

and thus failed to meet our inclusion criteria. The author did state that toilet training success was achieved by infants 4 to 6 months old.<sup>5</sup>

In this review, we identified three randomized trials looking at toilet training methods in healthy children.<sup>44 54 58</sup> Unfortunately, there were no head-to-head comparisons between the child-oriented approach<sup>8</sup> and the Azrin and Foxx method<sup>9</sup> and this prevented us from drawing definitive conclusions regarding one method's superiority over the other. The rather regimented Azrin and Foxx approach appeared to result in rapid success, Matson reported 50 percent success with 10 toddlers aged 20 to 26 months after 5 four-hour sessions. At the 10 week follow-up, one child had regressed to diapers due to parental problems.<sup>58</sup> Candelora found Azrin and Foxx to be superior at reducing accidents, increasing successes, and reducing the number of wet mornings than the Spock method.<sup>54</sup> In the one large study examining the child-oriented approach, the positive approach to bowel habits and avoidance of negative terminology in reference to defecation improved the time to fecal continence by 3 months; however, this may not be clinically significant.<sup>44</sup> These children were completely toilet trained at a much later age ( $3.5 \pm 0.5$  years) in comparison to those by the Azrin and Foxx method.

While single-cohort studies are a lower level of evidence, they do provide insight into outcomes, particularly when there is limited higher-level evidence available. The two cohort studies examining the effectiveness of the Azrin and Foxx method concurred with the Matson trial.<sup>9 79</sup> Children seem to attain continence quickly, with a relatively high success rate and at a relatively early age. Following one day of training, Butler reported 74 percent success in 34 toddlers under 25 months and 93 percent success in 15 older toddlers; Foxx reported 100 percent success in 34 toddlers ranging from 20-36 months. Success at follow-up was 96 percent and 97 percent respectively. One of the larger studies was a prospective cohort of children who trained using the child-oriented approach.<sup>41</sup> With this approach, 61 percent (292/482) were continent by the age of 3 years and 98 percent were continent by 4 years of age. The study does not state how long it took to achieve continence.

Unfortunately there is insufficient evidence to provide conclusive answers regarding the optimal toilet training method. Overall, we found that in the small studies evaluating the Azrin and Foxx method, success is relatively high and achieved soon after training. Follow-up at 1 to 4 months indicated success was maintained. Successes were also seen in the child-oriented approach, but they generally did not occur as quickly as those displayed by the Azrin and Foxx method. Brazelton's retrospective study reported that 94 percent of parents (1105/1170) started toilet training between 12 to 24 months and that 26 percent (304/1170) had completed day time training by 24 months.<sup>8</sup> In general, both toilet training programs seem to have the ability to teach toilet training in healthy children. It appears from the literature that parents who want quick results should consider the Azrin and Foxx method of toilet training but must be prepared for a regimented approach and should use positive reinforcement. For parents who are not prepared to put as much focus into attaining continence, the child-oriented approach can be successful but may take somewhat longer. Until we have additional studies that compare the toilet training methods, it appears safe to tailor the approaches in healthy children to individual families. This recommendation is in keeping with Brazelton's review article.<sup>3</sup>

## **Toilet Training Mentally Handicapped Children**

Many caregivers of mentally handicapped children want to know if the child will ever attain independent, successful toileting, and if so, what toilet training methods exist to facilitate this process. Our search strategy identified a limited number of comparative and single-arm studies. Many of them were from the 1960s and 1970s and the definition of mental retardation has undergone several revisions, mainly that the lower IQ limit decreased from 85 to 70. As such, some of the children who were classified as mentally retarded in these older studies may not meet the current definition.

One of the key questions was to identify toilet training strategies and/or outcomes of children with behavior problems. Unfortunately, no studies involving this population were identified. Some children with mental retardation can have behavior co-morbidities; however, in studies of mixed populations, results were not specified by the diagnoses. A small (n=5) prospective cohort of children with autism and mental retardation had some success with an operant conditioning method and toilet training was more successful in children with receptive language skills.<sup>33</sup> Another small (n=9) study in autistic mentally retarded children found that improved access to a potty could assist in toilet training.<sup>64</sup> Children who were mentally retarded secondary to Angelman syndrome had partial success in toileting using a modified Azrin and Foxx method.<sup>68</sup> Although this study did not specify the behavior problem(s), Angelman syndrome is often associated with hyperactivity and characteristic bouts of laughter. Given that many children who are otherwise healthy but have significant behavior problems, including but not exclusive to attention-deficit disorder and oppositional defiant disorder, future studies should be designed to examine toileting strategies and outcomes in these children.

Based on single-arm studies, mentally handicapped children had some degree of success regardless of the toilet-training method used. From the comparative studies, the Azrin and Foxx method, operant conditioning, and relaxation techniques were all superior to not using a toilet training method. Unfortunately, none of the studies did a head-to-head comparison between the different toilet training methods. Furthermore, the child-oriented method was not used in any of the studies on mentally handicapped children.

Even though studies are few and have small sample size, the evidence suggests that some mentally retarded children can attain at least partial success with toilet training. At present all of the strategies seem equivocal, thus caregivers and health care providers can try any of the methods. Success may be optimized among those with receptive language skills and easy access to a toilet.

Given there is a broad spectrum of function in mentally retarded children, often confounded by physical and behavior problems, caregivers and health care providers may need to be flexible when developing toilet training strategies.

## **Toilet Training Physically Handicapped Children**

Children with physical handicaps face difficulties with bowel and bladder control related to the physiology and psychology of their conditions. In many conditions, such as Hirschsprung's disease and other congenital anal anomalies (e.g. anal atresia and spina bifida), children may not have the abilities to develop control with standard toilet training methods. We included this patient population into this systematic review in an effort to develop insight into toilet training this particular group of children.

We did not find any studies that evaluated the child-oriented approach or the Azrin and Foxx method in children with physical disabilities. In the one prospective controlled trial 27 children with Hirschsprung's disease were successful with a multidisciplinary (Evidence Table D-6) approach to toilet training.<sup>52</sup> While this was only one small study with only 9 months of follow-up, it is clear that for children with complicated medical conditions, this approach is favored. Not only are results generally better, but also families tend to be more satisfied with their care.

The multidisciplinary approach to bowel control was also assessed in two retrospective cohort studies of children with anal atresia and Hirschsprung's.<sup>73 74</sup> The results confirmed those of the trial and the belief among most specialists was that children with complex conditions required the expertise of many specialists in an interdisciplinary fashion. Children with spina bifida present with different elimination problems due to varying degrees of neurologic impairment at different spinal cord levels. With regard to the bowel, they can suffer from constipation and/or fecal incontinence. Urinary symptoms can include failure to empty as well as incontinence. Standard methods for toilet training rarely work in this patient population. The primary means to control these problems are timed evacuation as described in the three cohort studies.<sup>51 75 76</sup> With timed elimination via clean intermittent catheterization, stool softeners, suppositories and enemas, children have the ability to become continent. The long-term success varied and few children were able to remain continent without some sort of medical intervention. Families of children with complex medical conditions should not expect their children to toilet train as per healthy children; however, there are many options to gain continence. Parents should be made aware of the difficulties and the potential solutions in order to avoid unreasonable expectations. Identifying support groups for families is often helpful in order to expose them to the unique solutions used by other children with complex medical conditions.

## **Modifying Factors that May Affect Toilet Training**

While there were no studies that looked specifically at modifying factors, some common themes were found among the studies. Candelora found that certain parental variables improved outcomes, such as having older and more tolerant mothers, and higher socioeconomic status.<sup>54</sup> Butler and Taubman's studies revealed quicker training in girls than boys.<sup>41 79</sup> On the other hand, Brazelton did not report a difference in attaining daytime continence between sexes but did observe a quicker attainment of nighttime continence in girls.<sup>8 44</sup> Taubman et al. also revealed an association between the presence of younger siblings and a higher incidence of stool toileting refusal.<sup>44</sup> While race and culture were not evaluated in these studies, they may play a role in expectations, choices of interventions, and accepted norms.

## **Adverse Outcomes Associated with Toilet Training**

Only four studies specifically addressed the topic of adverse outcomes: two addressed bladder problems retrospectively,<sup>50 59</sup> one examined bowel problems prospectively,<sup>41</sup> and one reported unspecified residual problems also prospectively.<sup>8</sup> Regarding long term bladder control, one cohort<sup>59</sup> determined that school age children with lower urinary tract symptoms (21 percent of the sample) were trained at a later age (>18 months) and that their parents had used more aggressive methods to provoke voiding (e.g. ran water, asked to push); however, no specific training methods were compared and data were collected via a questionnaire when the children were approximately ten years of age. The second study reported the frequency of enuresis in those that had been trained by multiple caregivers on a kibbutz; training began between 15 and

24 months.<sup>50</sup> At six to seven years of age, they had a higher incidence of enuresis than non-kibbutz raised children, but a lower incidence after age ten. On the topic of prolonged bowel incontinence the one prospective RCT reported an incidence of approximately 22 percent for stool toileting refusal.<sup>41</sup> These problems were associated with the presence of younger siblings, parental difficulty in setting limits, and training at a later age; however, “later” was defined as children >42 months as compared to 18 months, which was used by Bakker<sup>59</sup>. These children were trained in a child-oriented fashion. In contrast, Brazelton reported a 1.4 percent incidence of residual problems at >5 years of age following a child-oriented training approach.<sup>8</sup> None of the operant conditioning or Azrin and Foxx studies reported these outcomes. The only other adverse effects mentioned in these studies were temper tantrums and child and parental refusals and frustration with the training method itself.

## Limitations

There are a variety of limitations associated with this review, including bias, variation in study definitions, weak study design, variability in the toilet training programs, and lack of statistical analysis. Also, the majority of the studies were conducted between the 1960s to the 1980s.

As with all systematic reviews, there is a possibility of publication and selection bias. To reduce publication bias, an experienced medical librarian conducted a comprehensive search of the published literature for potentially relevant studies using a systematic strategy. This was augmented with hand searching of reference lists and conference proceedings and tracking forward sentinel articles. Overall, toilet training was a well-indexed subject and we are confident that the search located all the major literature on this topic. Despite these efforts, we recognize that unpublished negative studies may have been missed. Although the search was conducted without language restrictions, in the end the review was restricted to English articles due to difficulties in obtaining complete, accurate translations in more than ten non-English languages. It is likely that approximately three additional foreign studies might have been included. Selection bias was controlled by having two reviewers apply a priori inclusion criteria independently then resolve all discrepancies with a third party who had clinical expertise. We feel confident that the studies excluded were done so for consistent and appropriate reasons.

Prior to determining effectiveness, it is necessary to have a clear, specific, and measurable definition of the end result. In the case of toilet training, there is no all-encompassing definition and each of the included studies varied in their definition of success. The populations studied in this review displayed great heterogeneity; healthy children and those with special needs involving either mental or physical handicaps are included. As a result, the definition of success had to be modified. For some it meant total and lasting self-directed independent toileting, including recognizing elimination urges, going to a toilet, handling clothing, assuming proper positioning, attending to sanitation, and returning to activities without notifying anyone; other definitions were less inclusive regarding which aspects of the process must be complete and for how long before success was accorded. In institutionalized populations, improvement in frequency of toileting successes and reduced accidents resulting in less laundry and less staff time spent toileting and cleaning was reward enough for implementing a program although some participants did achieve independent toilet skills. For those with neurophysiological handicaps, attaining social acceptability, independently or not, and sometimes not until late teen years was the goal. Some of the populations had been subjected to previous unsuccessful attempts to toilet train; others were attempting training for the first time. These variations in populations,

definitions of success and failure, and reported outcomes proved too disparate to permit pooling of results.

A second limitation of this review is the weakness of the study design that the majority of the studies used. There were only eight RCTs. Among the other studies comparing two or more toilet training programs, the majority of the interventions were non-randomized and the rationale for the intervention decision was largely unknown. The quality of included studies varied and was generally low. All RCTs received a low methodological score (1 or 2 of a possible 5 points); the only reported details were that group assignment was random (with the exception of one study) and withdrawals and dropouts were accounted for. How the randomization code was derived, concealed, and applied is unknown and the nature of intervention does not lend itself to double blinding. The cohort studies scored a mean of  $16.9 \pm 3.1$  of a possible 29 (range 11-22). However, it should be noted that 70 percent of the studies were published before the CONSORT guidelines were introduced to improve reporting requirements particularly for RCTs; therefore, it is unclear if the poor reported methodological quality is a reflection of reporting omissions or true methodological quality.<sup>80</sup> Some of the prospective cohort studies that were dependent on observer evaluation made an effort to have two observers and calculated agreement to improve accuracy.

A third limitation is imposed by the variability in the programs themselves. The most studied intervention was the Azrin and Foxx method and this was assessed in nine studies; however, there was significant variation in which aspects were incorporated, who did the training, and the extent of training the trainers received prior to implementing the program. Four were conducted on healthy children (2 RCTs, 2 prospective cohorts). Three of these studies used the Toilet Training in Less Than a Day Program (TTLD); two involved parents (some pre-trained, some not, some supervised, some not) training the children at home; the other used qualified trainers who conducted the training in a separate facility. The toilet training success rate was lower when the child was trained by parents versus the qualified trainer: 50 and 78 percent compared to 100 percent. Parents reported a high incidence of negative emotional reactions to the procedure while the trainers reported that most children responded as if it were a very pleasant experience. Candelora reported the TTLD program was superior to Dr. Spock's recommendations.<sup>54</sup> The Azrin and Foxx method was used in five studies involving mentally handicapped children (one RCT, three prospective and one retrospective cohort); two used potty and pant alerts (success rates 60 and 89 percent), three did not (success rates 60 percent, 100 percent and significant improvement in successes). All studies modified the method to suit the particular population or staff availability and costs. Because of the heterogeneity in design, populations, implementation, the definitions of success, and outcomes reported, data results could not be pooled. In general, though, it can be said that the Azrin and Foxx method produced many more successes than failures with both healthy and mentally handicapped children.

The toilet training programs and populations were diverse and were assessed using a variety of study designs. A child-oriented toilet training method was used in four studies (1 RCT, 3 single cohort: 1 prospective, 2 retrospective) all involving healthy developing children. Parents were the sole trainers in three of the studies and were part of a multiple caregiver approach on a kibbutz in the other. Only one reported a training success rate (98 percent by age 4 yr). The other studies were investigating on-going bowel and bladder incontinence but training success can be assumed to be 80 percent without problems (generally by 3.5 yrs of age).<sup>8</sup>

An operant conditioning method was investigated in twelve studies (2 RCTs, 9 cohort: 5 single, 5 with a control group). All were prospective, eleven involved mentally handicapped populations, (one study used three healthy children as comparison group) and one was conducted among children with a physical handicap. Two investigators looked at the use of auditory signals

to train children. Three of the healthy children were successful and four of nine mentally handicapped children achieved criterion success levels. Two programs involving ten children administered negative consequences for incontinent episodes in addition to positive reinforcement for appropriate actions. Five subjects achieved consistent self-initiated control, four improved between 18 to 60 percent and one did not respond. The remaining eight studies reported only positive reinforcement procedures were employed. Though results are reported in various ways and cannot be combined, they all indicated that operant conditioning interventions yielded improvements over control groups—toileting scores increased, wetting/soiling accidents decreased, laundry requirements decreased, and Templeton/Wingspread/constipation scores improved.

A fourth limitation lies in the fact that several of the studies did not perform a statistical analysis of their own data and only reported results in a descriptive fashion. A descriptive analysis has several limitations and provides the clinical reader with less information to guide future actions. This review provides a table describing the population, each intervention and a range of outcomes depicting success/partial success/and failure rates along with the authors' conclusions. A handful of studies address negative consequences of a program, thus leaving this topic largely unexplored. It allows the reader to draw their own conclusions but fails to answer specific clinical questions. Without a pooled statistical analysis it is difficult to draw conclusions that can be generalized to similar populations in the clinical setting. While we have made limited progress in determining whether one toilet training program is more effective than another, we do know that all programs elicited a measure of success and that the majority of children achieved a higher level of, if not complete, continence.

## **Future Research Opportunities**

To date, toilet training research is hampered by heterogeneity and methodological flaws. The first step to improving the state of toilet training research is to standardize definitions related to toilet training, such as “toilet trained,” “successes,” and “failures.” Second, studies with larger sample sizes should be undertaken. Because almost all children are toilet trained, there is potential for large-scale research.

Given the findings of this systematic review, the following future research priorities are recommended:

- Definitions of toilet training should be standardized and where appropriate, cultural definitions should be developed. The same principles of standardization should be applied to outcome measures.
- While toilet training interventions do not lend themselves to double-blind trials, the methodological quality of future trials could be enhanced by having blinded outcome assessors and concealing allocation.
- The child-oriented approach requires further evaluation and the effectiveness of the elimination communication method needs to be determined.
- Few studies examined factors that may affect or modify toilet training. Additional research is required to examine the effects of modifiers such as maternal age, parenting experience, child temperament, and match or miss-match of parent-child relationship on toilet training success.
- Studies that directly compare two toilet training methods, such as Azrin and Foxx to child-oriented approach, within the same population should be undertaken to determine the most effective toilet training program.

- In an attempt to reduce bias, future studies should be randomized controlled trials or large prospective cohort studies.
- Among the studies examining toilet training among mentally handicapped children, very few described the exact mental handicap. The applicability of the study results would be enhanced if there were increased details concerning the nature of the handicaps.
- Few studies examined adverse outcomes associated with the particular toilet training method. There is a need for long-term follow-up that measures the occurrence of adverse events, such as enuresis, encopresis, stool withholding, stool toileting refusal, and other psychological consequences.
- It has been hypothesized that toilet training is more challenging among children with behavioral disorders, such as autism and attention deficit disorder; however, there is a paucity of evidence examining toilet training in this specific group of children. Toilet training programs should be assessed in children suffering from behavioral disorders.

## **Conclusions**

Toilet training is an important milestone in pediatric development. There are several different toilet training methods; however, the individual programs have not been well researched. Few trials have examined the various toilet training programs and the existing trials tend to compare variations of the same program and not one toilet training method to another. A more popular study design among the toilet training literature is the single cohort: generally, a small group of children were toilet trained using the same method and continence was subsequently assessed. The individual studies were heterogeneous, as the children, toilet training interventions, measured outcomes, and definitions of 'toilet trained' were variable.

After a comprehensive search of electronic databases, conference proceedings, and reference lists of included articles, we identified 8 controlled trials and 26 observational studies that examined toilet training methods in healthy and handicapped children. Based on the evidence, the following conclusions can be made:

- The studies are heterogeneous and the methodological quality of the included studies is poor. For this reason, the results and conclusions should be interpreted cautiously.
- Both the Azrin and Foxx and child-oriented methods successfully toilet trained healthy children. However, although the effectiveness of variants of the child-oriented approach and Azrin-Foxx has been studied, the child-oriented approach has not been directly compared to the Azrin-Foxx method.
- No study evaluated the early communication method.
- Toilet training methods in children with behavioral or developmental handicaps were not well studied.
- There is some evidence that, among healthy children, the Azrin and Foxx method may train children sooner than the child-oriented approach but there was limited research to determine if the achieved continence was maintained. In addition, the two methods have not been directly compared to determine the time to achieving continence.
- Azrin and Foxx and operant conditioning toilet training programs were used to partially or completely toilet train mentally handicapped children.
- For children suffering from Hirschsprung's disease and anal atresia, a multidisciplinary approach to toilet training proved to be successful for achieving bowel continence.

- Timed evacuation also was successful for obtaining bowel control among children with physical handicaps.
- Few analyses have been conducted to identify effect modifiers; they were only assessed in studies that attempted to toilet train healthy children.
- There was mixed evidence regarding sex of the child and toilet training; two of the three studies concluded that girls trained earlier than boys, while the third study found that girls achieved nighttime continence before boys.
- Adverse outcomes were seldom assessed and only in the child-oriented approach. Later age of training (>42 months), younger siblings, and parents not being able to set limits for their child tended to be associated with adverse events.
- Later age of toilet training and aggressive toilet training methods were associated with subsequent urinary tract symptoms.



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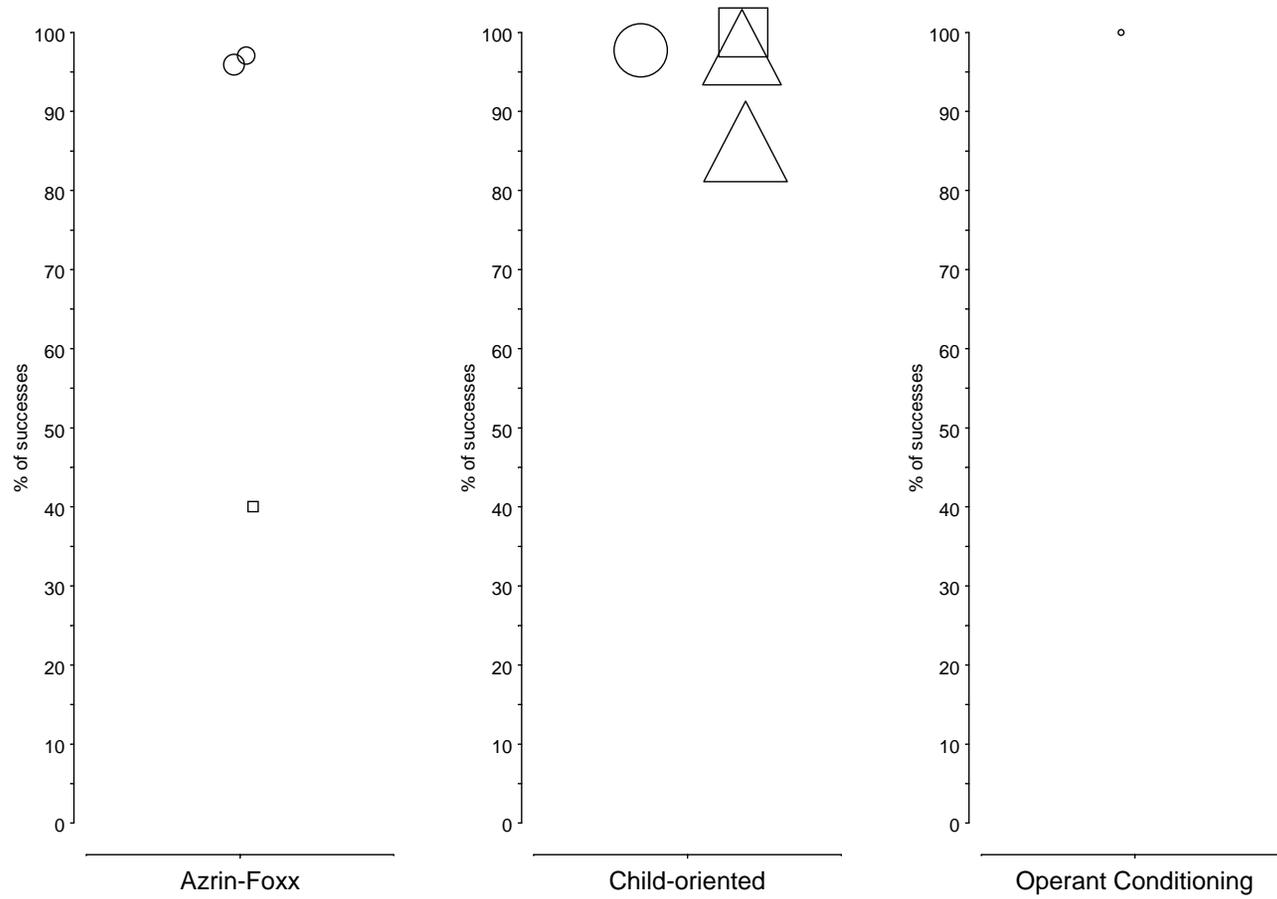
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**Figure 3. Reported success of toilet training among healthy children**

The size of the shape is proportional to sample size.

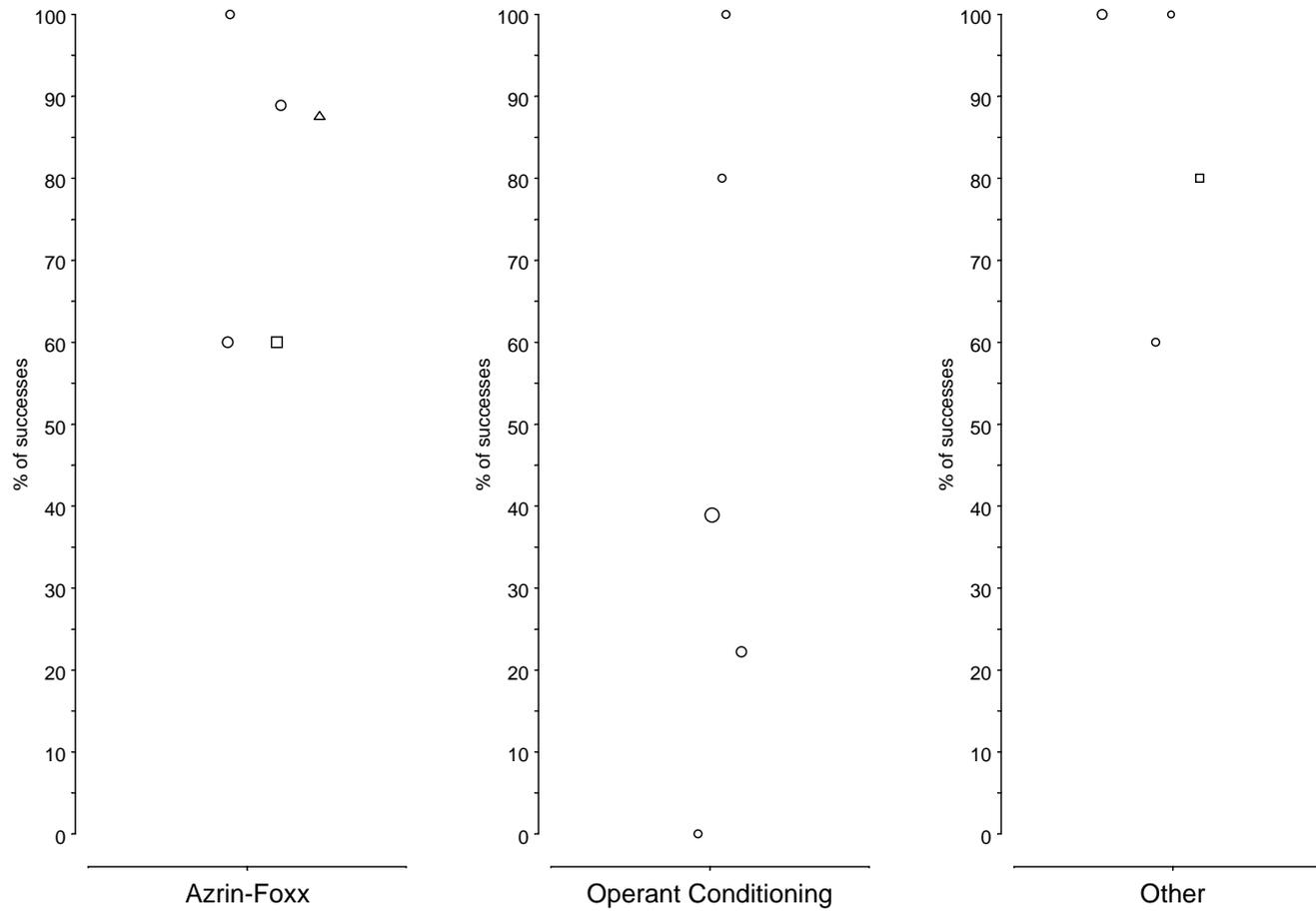
Square=RCT, circle=prospective cohort, triangle=retrospective cohort.



**Figure 4. Reported success of toilet training among mentally handicapped children**

The size of the shape is proportional to sample size.

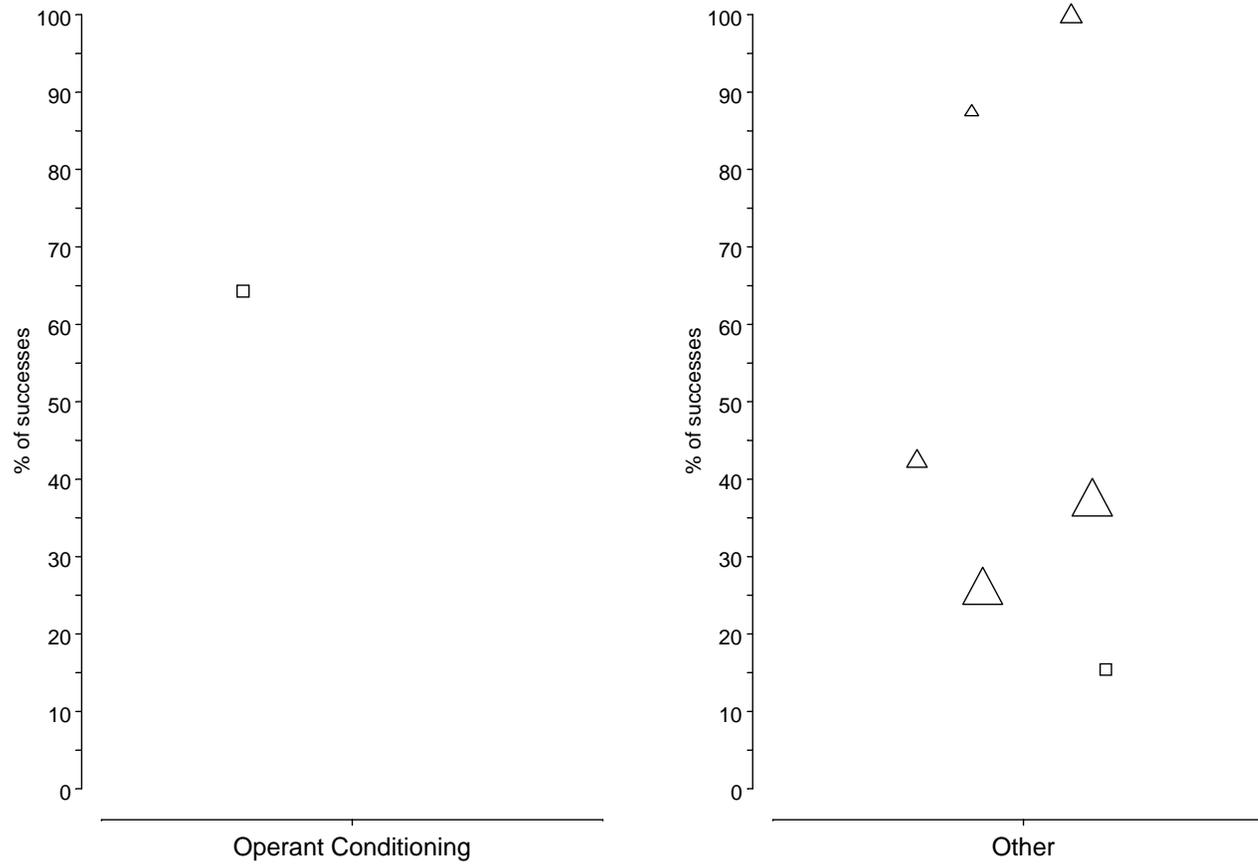
Square=RCT, circle=prospective cohort, triangle=retrospective cohort.



**Figure 5. Reported success of toilet training among physically handicapped children**

The size of the shape is proportional to sample size.

Square=RCT, circle=prospective cohort, triangle=retrospective cohort.





## Appendix A: Exact Search Strings

- Table A-1. MEDLINE®
- Table A-2. OLDMEDLINE®
- Table A-3. MEDLINE® In-Process & Other Non-Indexed Citations
- Table A-4. EBM Reviews - Cochrane Central Register of Controlled Trials
- Table A-5. EMBASE
- Table A-6. CINAHL® (Cumulative Index to Nursing & Allied Health Literature)
- Table A-7. PsycINFO®
- Table A-8. ERIC® (Educational Resources Information Center)
- Table A-9. AMED (Allied and Complementary Medicine)
- Table A-10. EBM Reviews Full Text - Cochrane Database of Systematic Reviews (CDSR), ACP Journal Club (ACPJC), Database of Abstracts of Reviews of Effects (DARE)
- Table A-11. HealthSTAR/Ovid Healthstar
- Table A-12. Biological Abstracts
- Table A-13. Sociological Abstracts
- Table A-14. Web of Science®
- Table A-15. Dissertation Abstracts
- Table A-16. NLM Gateway (U.S. National Library of Medicine)
- Table A-17. OCLC ProceedingsFirst
- Table A-18. OCLC PapersFirst
- Table A-19. Index to Theses
- Table A-20. National Research Register's Projects Database
- Table A-21. American Academy of Pediatrics Web site
- Table A-22. Canadian Paediatric Society Web site
- Table A-23. Current Controlled Trials Web site
- Table A-24. ClinicalTrials.gov Web site

**Table A-1. MEDLINE®—Ovid Version: rel10.2.0**

1966 to May Week 4 2005  
Searched June 2, 2005

**Set # and Keyword Search**

1. exp Toilet Training/
  2. ((toilet or potty) adj3 (train\$ or learn\$ or condition\$ or teach\$ or educat\$ or behavior\$ or behaviour\$)).mp.
  3. or/1-2
- Results: 753

**Table A-2. OLDMEDLINE®—Ovid Version: rel10.2.0**

1950 to 1965 Searched June 2, 2005
Set # and Keyword Search
1. ((toilet or potty) adj3 (train\$ or learn\$ or condition\$ or teach\$ or educat\$ or behavior\$ or behaviour\$)).mp. Results: 8

**Table A-3. MEDLINE® In-Process & Other Non-Indexed Citations—Ovid Version: rel10.2.0**

Searched June 1, 2005
Set # and Keyword Search
1. ((toilet or potty) adj3 (train\$ or learn\$ or condition\$ or teach\$ or educat\$ or behavior\$ or behaviour\$)).mp. Results: 7

**Table A-4. EBM Reviews - Cochrane Central Register of Controlled Trials—Ovid Version: rel10.2.0**

1950 to 2nd Quarter 2005 Searched June 2, 2005
Set # and Keyword Search
1. ((toilet or potty) adj3 (train\$ or learn\$ or condition\$ or teach\$ or educat\$ or behavior\$ or behaviour\$)).mp. Results: 40

**Table A-5. EMBASE—Ovid Version: rel10.2.0**

1988 to 2005 Week 22 Searched June 2, 2005
Set # and Keyword Search
1. ((toilet or potty) adj3 (train\$ or learn\$ or condition\$ or teach\$ or educat\$ or behavior\$ or behaviour\$)).mp. Results: 194

**Table A-6. CINAHL® (Cumulative Index to Nursing & Allied Health Literature)—Ovid Version: rel10.2.0**

1982 to May Week 4 2005  
Searched June 2, 2005

Set # and Keyword Search

1. exp Toilet Training/
  2. ((toilet or potty) adj3 (train\$ or learn\$ or condition\$ or teach\$ or educat\$ or behavior\$ or behaviour\$)).mp.
  3. or/1-2
- Results: 190

**Table A-7. PsycINFO®—Ovid Version: rel10.2.0**

1872 to May Week 4 2005  
Searched June 2, 2005

Set # and Keyword Search

1. exp toilet training/
2. ((toilet or potty) adj3 (train\$ or learn\$ or condition\$ or teach\$ or educat\$ or behavior\$ or behaviour\$)).mp.
3. or/1-2

Results: 437

**Table A-8. ERIC® (Educational Resources Information Center)—Ovid Version: rel10.2.0**

1966 to July 2004

Searched June 2, 2005

Set # and Keyword Search

1. ((toilet or potty) adj3 (train\$ or learn\$ or condition\$ or teach\$ or educat\$ or behavior\$ or behaviour\$)).mp.
2. exp Toilet Training/
3. or/1-2
4. limit 3 to "audiovisual or non print materials"
5. 3
6. limit 5 to ("guides for all non classroom use" or guides for classroom use, learner or guides for classroom use, teacher or guides, general)
7. 3
8. limit 7 to ("book or product reviews" or books or "collected works (general and serials)")
9. 3 not (4 or 6 or 8)

Results: 87

**Table A-9. AMED (Allied and Complementary Medicine)—Ovid Version: rel10.2.0**

1985 to May 2005 Searched June 2, 2005
Set # and Keyword Search
1. ((toilet or potty) adj3 (train\$ or learn\$ or condition\$ or teach\$ or educat\$ or behavior\$ or behaviour\$)).mp. Results: 13

**Table A-10. EBM Reviews Full Text - Cochrane Database of Systematic Reviews (CDSR), ACP Journal Club (ACPJC), Database of Abstracts of Reviews of Effects (DARE)—Ovid Version: rel10.2.0**

CDSR: 2nd Quarter 2005; ACPJC: 1991 to March/April 2005; DARE: 2nd Quarter 2005 Searched June 2, 2005
Set # and Keyword Search
1. ((toilet or potty) adj3 (train\$ or learn\$ or condition\$ or teach\$ or educat\$ or behavior\$ or behaviour\$)).mp. Results: 9

**Table A-11. HealthSTAR/Ovid Healthstar—Ovid Version: rel10.2.0**

1975 to May 2005 Searched June 2, 2005
Set # and Keyword Search
1. ((toilet or potty) adj3 (train\$ or learn\$ or condition\$ or teach\$ or educat\$ or behavior\$ or behaviour\$)).mp. 2. limit 1 to nonmedline Results: 1

**Table A-12. Biological Abstracts—WebSPIRS from SilverPlatter<sup>®</sup>, Version 4.3**

1969 to April 2005 Searched June 2, 2005
Set # and Keyword Search
1. (TOILET-TRAINING-AGE) or (TOILET-TRAINING-EATING) or (TOILET-TRAINING-ONSET) or (TOILET-TRAINING-PROCEDURES) or (TOILET-TRAINING-REGRESSION-SLEEP-PATTERN-CHANGE-FEEDING-HABIT-CHANGE-PEER-RELATIONSH) or (TOILET-TRAINING) Results: 41

**Table A-13. Sociological Abstracts—CSA Illumina**

1963 to May 2005 Searched June 6, 2005
Set # and Keyword Search
1. Toilet train* or potty train* Results: 23

**Table A-14. Web of Science® (Science Citation Index Expanded and Social Sciences Citation Index)—ISI Web of Knowledge**

1900 to June 4, 2005 Searched June 6, 2005
Set # and Keyword Search
1. TS=(toilet train*) OR TS=(potty train*) Results: 273
The <i>Cited Reference Search</i> feature in Web of Science was used to find articles that cited any of the following:
<ol style="list-style-type: none"> <li>1. Bakker E, Van Gool JD, Van Sprundel M, et al. Results of a questionnaire evaluating the effects of different methods of toilet training on achieving bladder control. <i>BJU International</i> 2002;90(4):456-61.</li> <li>2. Blum NJ, Taubman B, Nemeth N. Relationship between age at initiation of toilet training and duration of training: a prospective study. <i>Pediatrics</i> 2003;111(4):810-4.</li> <li>3. Brazelton TB, Christophersen ER, Frauman AC et al. Instruction, timeliness, and medical influences affecting toilet training. <i>Pediatrics</i> 1999;103(6):1353-8.</li> <li>4. Issenman RM, Filmer RB, Gorski PA. A review of bowel and bladder control development in children: how gastrointestinal and urologic conditions relate to problems in toilet training. <i>Pediatrics</i> 1999;103(6):1346-52.</li> <li>5. Schum TR, Kolb TM, McAuliffe TL, et al. Sequential acquisition of toilet-training skills: a descriptive study of gender and age differences in normal children. <i>Pediatrics</i> 2002;109(3):E48.</li> <li>6. Stadtler AC, Gorski PA, Brazelton TB. Toilet training methods, clinical interventions, and recommendations. <i>American Academy of Pediatrics. Pediatrics</i> 1999;103(6):1359-68.</li> <li>7. Taubman B, Blum NJ, Nemeth N. Children who hide while defecating before they have completed toilet training: a prospective study. <i>Arch Pediatr Adolesc Med</i> 2003;157(12):1190-2.</li> <li>8. Taubman B, Blum NJ, Nemeth N. Stool toileting refusal: a prospective intervention targeting parental behavior. <i>Arch Pediatr Adolesc Med</i> 2003;157(12):1193-6.</li> </ol>
Results: 32

**Table A-15. Dissertation Abstracts—ProQuest®**

1861 to May 2005 Searched June 6, 2005
Set # and Keyword Search
1. Toilet train* or toilet learn* or potty train* Results: 36

**Table A-16. NLM Gateway (U.S. National Library of Medicine)**

1950 to June 6, 2005 Searched June 6, 2005
Set # and Keyword Search
1. Toilet Training[MESH] OR "toilet train*" or "potty train*" Results: 0

**Table A-17. OCLC ProceedingsFirst—OCLC FirstSearch**

1993 to June 6, 2005 Searched June 6, 2005
Set # and Keyword Search
1. Toilet train* or toilet learn* or potty train* Results: 1

**Table A-18. OCLC PapersFirst—OCLC FirstSearch**

1990 to June 7, 2005 Searched June 7, 2005
Set # and Keyword Search
1. Toilet train* or toilet learn* or potty train* Results: 6

**Table A-19. Index to Theses—Expert Information Ltd.**

1970 to May 19, 2005 Searched June 7, 2005
Set # and Keyword Search
1. Toilet train* Results: 1

**Table A-20. National Research Register's Projects Database—Update Software Ltd.**

2000 to March 2005 Searched June 10, 2005
Set # and Keyword Search
1. Toilet training (Medical Subject Heading) Results: 3

**Table A-21. American Academy of Pediatrics Web site (<http://www.aap.org/>)**

Searched June 7, 2005
Set # and Keyword Search
1. "toilet training" Results: 2

**Table A-22. Canadian Paediatric Society Web site (<http://www.cps.ca/>)**

Searched June 7, 2005
Set # and Keyword Search
1. toilet training Results: 1

**Table A-23. Current Controlled Trials Web site (<http://www.controlled-trials.com/>)**

Searched June 8, 2005
Set # and Keyword Search
1. toilet training Results: 0

**Table A-24. ClinicalTrials.gov Web site (<http://clinicaltrials.gov>)**

Searched June 8, 2005
Set # and Keyword Search
1. toilet training Results: 0

## **Appendix B: Sample Forms**

- Form B-1. Inclusion form for the effectiveness of different methods of toilet training for bowel and bladder control
- Form B-2. Assessment of methodology for non-randomized controlled trials for the effectiveness of different methods of toilet training for bowel and bladder control
- Form B-3. Assessment of methodology for controlled trials for the effectiveness of different methods of toilet training for bowel and bladder control
- Form B-4. Data extraction for the effectiveness of different methods of toilet training for bowel and bladder control

## **Form B-1. Inclusion form for the effectiveness of different methods of toilet training for bowel and bladder control**

Reviewer: \_\_\_\_\_ Date: \_\_\_\_\_ Reference Number: \_\_\_\_\_

### **TOPIC, include if either:**

- Examining at least one method used to toilet train

### **DESIGN, include if any of the following:**

- Randomized clinical trial  
 Controlled clinical trial  
 Prospective cohort  
 Retrospective cohort  
 Case-series of at least 5 children  
 Cross-sectional

### **PARTICIPANTS, include if:**

Infants, toddlers, or children who do not have enuresis or encopresis and:

- Are normally developed  
 Have special needs, such as physical co-morbidities, neuro-muscular, cognitive, and/or behavioral disabilities

### **INTERVENTION, include if there is at least one of the following toilet training methods:**

- Azrin and Foxx  
 Child-oriented  
 Operant conditioning  
 Behavioral therapy  
 Infant assisted toileting  
 Other: \_\_\_\_\_

### **OUTCOMES, include if there is at least one of the following quantified, objective outcomes:**

- Success or failure in achieving bowel control  
 Success or failure in achieving bladder control  
 Time required to complete toilet training  
 Other: \_\_\_\_\_  
 Adverse events (e.g.: enuresis, encopresis, stool withholding, stool toileting refusal)

**FINAL DECISION:**

INCLUDE (meets all of the above inclusion criteria)

EXCLUDE

CAN'T TELL

***If disagreement between reviewers, final outcome:***

INCLUDED

EXCLUDED

Check box if study provides useful background information

## Form B-2. Assessment of methodology for non-randomized controlled trials for the effectiveness of different methods of toilet training for bowel and bladder control

### Reporting

1. **Is the hypothesis/aim/objective of the study clearly described?** This question refers to a clear statement of the objective, i.e. to measure the effectiveness of x in population y with respect to z, even if x, y and z are not clearly described (see questions 2, 3 and 4).

Yes	1	
No	0	

2. **Are the main outcomes to be measured clearly described in the Introduction or Methods section?** If the main outcomes are first mentioned in the Results section, the question should be answered no. In case-control studies the case definition should be considered the outcome.

Yes	1	
No	0	

3. **Are the characteristics of the patients included in the study clearly described in the Introduction or Methods section?** In cohort studies and trials, inclusion and or exclusion criteria should be given. In case-control studies, a case definition and the source for controls should be given.

Yes	1	
No	0	

4. **Are the interventions of interest clearly described in the Introduction or Methods section?** Treatments and placebo (where relevant) that are to be compared should be clearly described.

Yes	1	
No	0	

5. **Are the distributions of principal confounders in each group of subjects to be compared clearly described?** A list of principal confounders is provided.

Yes	2	
Partially	1	
No	0	

6. **Are the main findings of the study clearly described?** Simple outcome data (including denominators and numerators) should be reported for all major findings so that the reader can check the major analyses and conclusions. This question does not cover statistical tests, which are considered below.

Yes	1	
No	0	

7. **Does the study provide estimates of the random variability in the data for the main outcomes?** In non-normally distributed data the inter-quartile range of results should be reported. In normally distributed data the standard error, standard deviation or confidence intervals should be reported. If the distribution of the data is not described, it must be assumed that the estimates used were appropriate and the question should be answered yes.

Yes	1	
No	0	

8. **Have all important adverse events that may be a consequence of the intervention been reported?** This should be answered yes if the study demonstrates that there was a comprehensive attempt to measure adverse events. (A list of possible adverse events is provided).

Yes	1	
No	0	

- 9. Have the characteristics of patients lost to followup been described?** This should be answered yes where there were no losses to followup or where losses to followup were so small that findings would be unaffected by their inclusion. This should be answered no where a study does not report the number of patients lost to followup.

Yes	1	
No	0	

- 10. Have 95% CIs and/or actual probability values been reported (e.g. 0.035 rather than <0.05) for the main outcomes except where the probability value is less than 0.001 (both CI and p value, either CI or p value, neither)?**

Yes	1	
No	0	

### External validity

- 11. Were the subjects asked to participate in the study representative of the entire population from which they were recruited?** The study must identify the source population for patients and describe how the patients were selected. Patients would be representative if they comprised the entire source population, an unselected sample of consecutive patients, or a random sample. Random sampling is only feasible where a list of all members of the relevant population exists. Where a study does not report the proportion of the source population from which the patients are derived, the question should be answered as unable to determine.

Yes	1	
No	0	
Unable to determine	0	

- 12. Were those subjects who were prepared to participate representative of the entire population from which they were recruited?** The proportion of those asked who agreed should be stated. Validation that the sample was representative would include demonstrating that the distribution of the main confounding factors was the same in the study sample and the source population.

Yes	1	
No	0	
Unable to determine	0	

**13. Were the staff, places, and facilities where the patients were treated, representative of the treatment the majority of patients receive?** For the study to be answered yes the study should demonstrate that the intervention was representative of that in use in the source population. The question should be answered no if, for example, the intervention was undertaken in a specialist center unrepresentative of the hospitals most of the source population would attend.

Yes	1	
No	0	
Unable to determine	0	

**Internal validity – bias**

**14. Was an attempt made to blind study subjects to the intervention they have received?**  
For studies where the patients would have no way of knowing which intervention they received, this should be answered yes.

Yes	1	
No	0	
Unable to determine	0	

**15. Was an attempt made to blind those measuring the main outcomes of the intervention?**

Yes	1	
No	0	
Unable to determine	0	

**16. If any of the results of the study were based on “data dredging”, was this made clear?**  
Any analyses that had not been planned at the outset of the study should be clearly indicated. If no retrospective unplanned subgroup analyses were reported, then answer yes.

Yes	1	
No	0	
Unable to determine	0	

**17. In trials and cohort studies, do the analyses adjust for different lengths of followup of patients, or in case-control studies, is the time period between the intervention and outcome the same for cases and controls?** Where followup was the same for all study patients that answer should be yes. If different lengths of followup were adjusted for by, for example, survival analysis the answer should be yes. Studies where differences in followup are ignored should be answered no.

Yes	1	
No	0	
Unable to determine	0	

**18. Were the statistical tests used to assess the main outcomes appropriate?** The statistical techniques used must be appropriate to the data. For example non-parametric methods should be used for small sample sizes. Where little statistical analysis has been undertaken but where there is no evidence of bias, the question should be answered yes. If the distribution of the data (normal or not) is not described it must be assumed that the estimates used were appropriate and the question should be answered yes.

Yes	1	
No	0	
Unable to determine	0	

**19. Was compliance with the interventions reliable?** Where there was non compliance with the allocated treatment or where there was contamination of one group, the question should be answered no. For studies where the effect of any misclassification was likely to bias any association to the null, the question should be answered yes.

Yes	1	
No	0	
Unable to determine	0	

**20. Were the main outcome measures used accurate (valid and reliable)?** For studies where the outcome measured are clearly described, the question should be answered yes. For studies which refer to other work or that demonstrates the outcome measures are accurate, the question should be answered as yes.

Yes	1	
No	0	
Unable to determine	0	

**Internal validity – confounding (selection bias)**

**21. Were the patients in different intervention groups (trials and cohort studies) or were the cases and controls (case-control studies) recruited from the same population?** For example, patients for all comparison groups should be selected from the same hospital. The question should be answered unable to determine for cohort and case-control studies where there is no information concerning the source of patients included in the study.

Yes	1	
No	0	
Unable to determine	0	

**22. Were study subjects in different intervention groups (trials and cohort studies) or were the cases and controls (case-control studies) recruited over the same period of time?** For a study which does not specify the time period over which patients were recruited, the question should be answered as unable to determine.

Yes	1	
No	0	
Unable to determine	0	

**23. Were the subjects randomized to intervention groups?** Studies which state that subjects were randomized should be answered yes except where method of randomization would not ensure random allocation. For example alternate allocation would score no because it is predictable.

Yes	1	
No	0	
Unable to determine	0	

**24. Was the randomized intervention assignment concealed from both patients and health care staff until recruitment was complete and irrevocable?** All non-randomized studies should be answered no. If assignment was concealed from patients but not from staff, it should be answered no.

Yes	1	
No	0	
Unable to determine	0	

**25. Was there adequate adjustment for confounding in the analyses from which the main findings were drawn?** This question should be answered no for trials if: the main conclusions of the study were based on analyses of treatment rather than intention to treat; the distribution of known confounders in the different treatment groups was not described; or the distribution of known confounders different between the treatment groups but was not taken into account in the analyses. In non-randomized studies if the effect of the main confounders was not investigated or confounding was demonstrated but no adjustment was made in the final analyses the question should be answered as no.

Yes	1	
No	0	
Unable to determine	0	

**26. Were losses to patients to followup take into account?** (yes, no, unable to determine) If the numbers of patients lost to followup are not reported, the question should be answered as unable to determine. If the proportion lost to followup was too small to affect the main findings, the question should be answered yes.

Yes	1	
No	0	
Unable to determine	0	

**Power**

**27. Was a power calculation reported for the primary outcome?**

Yes	1	
No	0	
Unable to determine	0	

**28. Did the study have sufficient power to detect a clinically important effect where the probability value for a difference being due to chance is less than 5%?**

Yes	1	
No	0	
Unable to determine	0	

**Form B-3. Assessment of methodology for controlled trials for the effectiveness of different methods of toilet training for bowel and bladder control**

**JADAD SCORE:** circle the appropriate response and total for the final Jadad score

**Randomization:**

- |                                                 |          |        |
|-------------------------------------------------|----------|--------|
| 1. Was the study described as being randomized? | 1 = Yes  | 0 = No |
| 2. Was the method of randomization appropriate? | 1 = Yes  | 0 = No |
| 3. Was the method of randomization inadequate?  | -1 = Yes | 0 = No |

**Double Blindedness:**

- |                                                   |          |        |
|---------------------------------------------------|----------|--------|
| 4. Was the study described as double-blind?       | 1 = Yes  | 0 = No |
| 5. Was the method of double-blinding appropriate? | 1 = Yes  | 0 = No |
| 6. Was the method of double-blinding inadequate?  | -1 = Yes | 0 = No |

**Withdrawals:**

- |                                                      |         |        |
|------------------------------------------------------|---------|--------|
| 7. Was there an adequate description of withdrawals? | 1 = Yes | 0 = No |
|------------------------------------------------------|---------|--------|

Total Score:

**CONCEALMENT OF ALLOCATION:** was the method used to conceal the randomization list

- adequate
- inadequate
- unclear

## Form B-4. Data extraction form for the effectiveness of different methods of toilet training for bowel and bladder control

### Study Characteristics

First author:	
Title:	
Journal citation:	
Year published:	Country(ies) where conducted:
Funding: <input type="checkbox"/> Private industry <input type="checkbox"/> Government <input type="checkbox"/> Internal <input type="checkbox"/> Foundation <input type="checkbox"/> Other <input type="checkbox"/> NR	
<b>Study design:</b> <input type="checkbox"/> RCT/CCT <input type="checkbox"/> Single cohort <input type="checkbox"/> Multiple cohort <input type="checkbox"/> Case-control <input type="checkbox"/> Other _____	
<b>Data collection:</b> <input type="checkbox"/> Prospective <input type="checkbox"/> Retrospective <input type="checkbox"/> Can't tell	
<b>Subject source</b> <input type="checkbox"/> Community(ies) <input type="checkbox"/> Clinic practice <input type="checkbox"/> Special care facility <input type="checkbox"/> Other _____	<b>Recruitment</b> <input type="checkbox"/> Random <input type="checkbox"/> Consecutive <input type="checkbox"/> All eligible <input type="checkbox"/> Convenience <input type="checkbox"/> Special selection (restricted) <input type="checkbox"/> NR Time frame _____ <input type="checkbox"/> NR
<b>Description of children (inclusion criteria)</b> <input type="checkbox"/> Normal <input type="checkbox"/> Physically challenged <input type="checkbox"/> Hirschprung's <input type="checkbox"/> Spina bifida <input type="checkbox"/> Other _____ <input type="checkbox"/> Mentally challenged <input type="checkbox"/> Autism <input type="checkbox"/> ADHD <input type="checkbox"/> Mix of conditions <input type="checkbox"/> Other _____ <input type="checkbox"/> NR <input type="checkbox"/> Readiness screening <input type="checkbox"/> Other inclusion criteria:	Cultural background:

<b>Toilet training intervention</b>		
<input type="checkbox"/> Azrin & Foxx	<input type="checkbox"/> Child-oriented	
<input type="checkbox"/> Azrin & Foxx modified	<input type="checkbox"/> Behavioral therapy	
<input type="checkbox"/> Operant conditioning	<input type="checkbox"/> Other method described in text _____	
Positive reinforcement used:	<input type="checkbox"/> yes	<input type="checkbox"/> no <input type="checkbox"/> NR
Negative reinforcement used:	<input type="checkbox"/> yes	<input type="checkbox"/> no <input type="checkbox"/> NR
External signalling device used:	<input type="checkbox"/> yes	<input type="checkbox"/> no <input type="checkbox"/> NR
Special toileting equipment needed:	<input type="checkbox"/> yes	<input type="checkbox"/> no <input type="checkbox"/> NR
Special room needed:	<input type="checkbox"/> yes	<input type="checkbox"/> no <input type="checkbox"/> NR
<b>Training objective</b>		
<input type="checkbox"/> Daytime bladder control	<input type="checkbox"/> Daytime bowel control	
<input type="checkbox"/> Nighttime bladder control	<input type="checkbox"/> Nighttime bowel control	
<input type="checkbox"/> Both day and nighttime bladder control	<input type="checkbox"/> Both day and nighttime bowel control	
<input type="checkbox"/> Both bladder and bowel control anytime	<input type="checkbox"/> Improved control	
<input type="checkbox"/> Self-directed toileting	<input type="checkbox"/> Toileting when prompted	

**Patient Flow**

- Initial number selected/screened/eligible: n= \_\_\_\_\_  NR
- Total agreed to participate: n= \_\_\_\_\_
- Exclusions:  Yes n= \_\_\_\_\_  No  Unclear  NR  
Reasons:
- Withdrawals/dropouts/refusals:  Yes n= \_\_\_\_\_  No  Unclear  NR  
Reasons:
- Number who completed the study: n= \_\_\_\_\_
- Describe comparison group(s) if included:

**Data Collection**

- Questionnaire  Interview  Clinical review  Chart review  Can't tell

**Baseline Characteristics**

Please indicate the statistic (% , SD, SEM, range, AND the units)

	Group A: _____ N _____	Group B: _____ N _____	All _____ N _____
<b>Males (n, %)</b>			
<b>Age:</b> mean; SD chronological age			
social age			
<b>Culture/religion/racial breakdown</b>			

<b>IQ or VSMS score</b>			
<b>Position in family</b> 1 <sup>st</sup> child  2 <sup>nd</sup> or later			
<b>Age TT begun</b>			
<b>SES</b>			
<b>Baseline bladder function</b>			
<b>Baseline bowel function</b>			
<b>Other</b>			
<b>Other</b>			

**Definition of Success:**     NR

**Primary Trainer(s):**     NA         NR

Parents        Were parents trained prior to implementation?     Yes     No     NR

Other care givers    Were care givers trained prior to implementation?     Yes     No     NR

**Intervention:**     Toilet training program     Drug therapy     Other \_\_\_\_\_

Describe drug therapy or "other":

Describe toilet training program:

Number of phases:

Duration of phases:

Duration of TT program:

Baseline performance recorded:  Yes     No

Frequency of diaper/pant (accident) checks:

Frequency of toileting:

Tracking method in place (i.e.: chart or home visit)     Yes     No

**Results Reported:**    **Bladder**    **Bowel**    **Both**    **NR**

For all outcomes specify the units reported in e.g. % change, absolute numbers, incidence/time, etc.

	<b>Group A:</b> _____ <b>N</b> _____	<b>Group B:</b> _____ <b>N</b> _____	<b>All</b> _____ <b>N</b> _____
<b>Time of measure</b>			
<b>Change from baseline</b>			
bladder			
bowel			
both			
<b>Mean # successes</b>			
bladder			
bowel			
both			
<b>Mean # accidents</b>			
bladder			
bowel			
both			
<b>Success rate</b>			
<b>Failure rate</b>			
<b>Adverse events</b>			

**Additional Comments**

## Appendix C: Multiple Publications of Toilet Training Cohorts

During study screening and data extraction, several articles were identified in which it appeared that different outcomes or outcomes at followup were reported for the same cohort of children. We did not want either to exclude any relevant results or to over-represent results when the same outcome had been reported for a cohort in multiple publications. After critically reviewing the references to prior publications and cross-referencing patient demographics, the primary (usually the most recent) publication for these cohorts was identified. The cohorts and associated multiple publications are described below.

Linked References	Rationale
Taubman 2003a <sup>1*</sup> ; Blum 2004a <sup>2</sup> ; Taumban 2003b <sup>3</sup> ; Blum 2003 <sup>4</sup> ; Blum 2004 <sup>5</sup>	Taubman et al. (2003a) examines 406 children who were randomized either to the child-oriented approach in combination with avoiding negative terminology to describe defecation and praising defecating in diapers or to the child-oriented approach alone. The incidence of stool toileting refusal is similar in both groups; however, the duration of stool toileting refusal is shorter among the intervention group. Blum et al. (2004a) explores factors related to the increasing age at which toilet training is successful among the same 406 children and data are analyzed as a prospective cohort study; Taubman et al. (2003) is referenced in Blum et al. (2004a). Taubman et al. (2003b) examines 408 children, comparing those who hide while defecating with those who do not, and the data are analyzed as a case-control study. Blum et al. (2003) determines the correlation between age at initiation and completion of toilet training and duration of toilet training among 406 children, and the data are analyzed as a prospective cohort study. Blum et al. (2004b) follows up 380 of 406 children, to compare those who develop stool toileting refusal with those who do not. The data are analyzed as a case-control study and Taubman (2003a) is referenced in Blum et al. (2004b). The reported baseline demographics of the individual studies are very similar.
Hyams 1992 <sup>6*</sup> ; Smith 1979 <sup>7</sup>	Smith et al. (1979) examines a cohort of 14 severely and profoundly mentally handicapped children who were toilet trained with individual intensive regular toileting, group intensive regular toileting, or individual timing toileting. Hyams et al. (1992) describes a 10-year followup of this cohort and references the original study conducted by Smith et al. (1979).
Van Wagenen 1969a <sup>8*</sup> ; Van Wagenen 1969b <sup>9</sup>	Van Wagenen et al. (1969a) describes nine profoundly mentally handicapped children who were toilet trained with a forward-moving series of toileting events. Van Wagenen et al. (1969b) examines what appear to be the same nine children; the data were presented at the 77 <sup>th</sup> Annual APA Convention.

\*primary publication

### Reference List

1. Taubman B, Blum NJ, Nemeth N. Stool toileting refusal: a prospective intervention targeting parental behavior. *Arch Pediatr Adolesc Med* 2003;157(12):1193-6.
2. Blum NJ, Taubman B, Nemeth N. Why is toilet training occurring at older ages? A study of factors associated with later training. *J Pediatr* 2004;145(1):107-11.
3. Taubman B, Blum NJ, Nemeth N. Children who hide while defecating before they have completed toilet training: a prospective study. *Arch Pediatr Adolesc Med* 2003;157(12):1190-2.
4. Blum NJ, Taubman B, Nemeth N. Relationship between age at initiation of toilet training and duration of training: a prospective study. *Pediatrics* 2003;111(4):810-4.
5. Blum NJ, Taubman B, Nemeth N. During toilet training, constipation occurs before stool toileting refusal. *Pediatrics* 2004;113(6):e520-2.

6. Hyams G, McCoull K, Smith PS, et al. Behavioural continence training in mental handicap: a 10-year follow-up study. *J Intellect Disabil Res* 1992;36:551-8.
7. Smith PS. A comparison of different methods of toilet training the mentally handicapped. *Behav Res Ther* 1979;17(1):33-43.
8. Van Wagenen RK, Meyerson L, Kerr NJ, et al. Field trials of a new procedure for toilet training. *J Exp Child Psychol* 1969;8(1):147-59.
9. Van Wagenen R, Keith ML, Kerr NJ, et al. Rapid toilet training: learning principles and prothesis. *Proceedings of the Annual Convention of the American Psychological Association* 1969;4:781-2.

## Appendix D: Evidence Tables

- Table D-1. Description of included studies (observational studies)
- Table D-2. Demographics of included children (observational studies)
- Table D-3. Description of toilet training programs (observational studies)
- Table D-4. Description of included studies (trials)
- Table D-5. Demographics of included children (trials)
- Table D-6. Description of toilet training programs (trials)
- Table D-7. Methodological quality of included studies (observational studies)
- Table D-8. Methodological quality of included studies (trials)
- Table D-9. Outcomes and results of included studies (observational studies)
- Table D-10. Outcomes and results of included studies (trials)
- References. Observational studies
- References. Trials

**Table D-1. Description of included studies (observational studies)**

Author-Year	Location	Toilet Training Method 1	Toilet Training Method 2	Description of Children	Source of Children
<b>Healthy Children</b>					
Bakker 2002	Belgium	Other: increased prompting and encouraged the child to try later	Other: less prompting and encouraged child to push or strain	Healthy	School
Brazelton 1962	United States	Child-oriented		Healthy	Clinical practice
Butler 1976	United States	Azrin and Foxx		Healthy	Community
Foxx 1973	United States	Azrin and Foxx		Healthy	Community and clinic practice
Kaffman 1972	Israel	Child-oriented		Healthy	Community
Taubman 1997	United States	Child-oriented		Healthy	Clinical practice
<b>Mentally Handicapped Children</b>					
Ando 1977	Japan	Operant conditioning		Mentally handicapped: autism	Special care facility
Colwell 1973	United States	Operant conditioning		Mentally handicapped: severely and profoundly	Special care facility
Connolly 1976	Ireland	Operant conditioning	Control	Mentally handicapped: NR	Special care facility
Didden 2001	Netherlands	Modified Azrin and Foxx		Mentally handicapped: Angelman syndrome ± epilepsy	Clinical practice
Giles 1966	United States	Operant conditioning		Mentally handicapped: severely	Special care facility
Holverstott-Cockrell 2002	United States	Azrin and Foxx		Mentally and physically handicapped: NR	School
Kimbrell 1967	United States	Operant conditioning	Control	Mentally handicapped: severely and profoundly	Special care facility
Lancioni 1980	Netherlands	Modified Azrin and Foxx		Mentally handicapped: severely (deaf and blind)	Special care facility
Lancioni 1981a	Netherlands and Italy	Other: increased liquids, regular toilet cues, reinforment, and potties in the room	Other: increased liquids, regular toilet cues, and reinforcement	Mentally handicapped: autism, hearing impairment, or profoundly handicapped	Special care facility

NR indicates not reported

**Table D-1. Description of included studies (observational studies) (continued)**

Author-Year	Location	Toilet Training Method 1	Toilet Training Method 2	Description of Children	Source of Children
<b>Mentally Handicapped Children</b>					
Lancioni 1981b	Netherlands and Italy	Other: increased liquids, regular toilet cues, positive reinforcement, potties in room	Other: increased liquids, regular toilet cues, and positive reinforcement	Mentally handicapped: autism, hearing impairment, or profoundly handicapped	Special care facility
Mahoney 1971	United States	Operant conditioning		Healthy and mentally handicapped	Clinical practice
Smith 1977	United Kingdom	Azrin and Foxx		Mentally handicapped: NR	NR
Spencer 1968	United States	Operant conditioning		Mentally handicapped: severely and profoundly	Special care facility
Tierney 1973	United Kingdom	Operant conditioning	Control	Mentally handicapped: NR	Special care facility
Van Wagenen 1969	United States	Operant conditioning		Mentally handicapped: virtually no speech skills	Special care facility
<b>Physically Handicapped Children</b>					
Forsythe 1970	United Kingdom	Other: if regular toileting is unsuccessful, daily enemas, then enema and suppository, and then enemas and oral purgative		Physically handicapped: spina bifida	Special care facility
King 1994	United States	Other: patient/family education and reflex-triggered bowel evacuation		Physically handicapped: spina bifida	Clinical practice

**Table D-1. Description of included studies (observational studies) (continued)**

Author-Year	Location	Toilet Training Method 1	Toilet Training Method 2	Description of Children	Source of Children
<b>Physically Handicapped Children</b>					
Sullivan-Bolyai 1984	United States	Other: stool - diaper/insert care, infrequent enemas to disimpact, low-level enemas, suppositories, digital stimulations, bladder - diaper/insert care, penile collectors, urinary diversion, and either timed bladder emptying ( $\pm$ medication) or clean intermittent catheterization ( $\pm$ medication)		Physically handicapped: spina bifida	Clinical practice
van Kuyk 2000a	Netherlands	Other: teach adequate defecation behavior including an adequate straining technique		Physically handicapped: anal atresia	Clinical practice
van Kuyk 2000b	Netherlands	Other: teach bowel self-control, training of optimal defecation skills, toilet behavior		Physically handicapped: Hirschprung's disease	Clinical practice

**Table D-2. Demographics of included children (observational studies)**

Author-Year	No. of Children who Completed the study	Male N (%)	Chronological Age (months)	Developmental or Social Age (months)	Baseline Bladder Function	Baseline Bowel Function
<b>Healthy Children</b>						
Bakker 2002	4332	2215/4332 (51)	138 (6.7)*	NR	Incontinent: 100%	Incontinent: 100%
Brazelton 1962	1170	672/1170 (57)	~24	NR	NR	NR
Butler 1976	49	26/49 (53)	69% <25	NR	Mean frequency of accidents: 6.03 (n=32)	Mean frequency accidents: 1.32 (n=32)
Fox 1973	34	22/34 (65)	25 (20–36) <sup>†</sup>	NR	Mean accidents/day: 6	NR
Kaffman 1972	1376	721/1376 (52)	15–26 (range)	NR	Incontinent: 100%	NR
Taubman 1997	482	255/482 (53)	NR	NR	NR	NR
<b>Mentally Handicapped Children</b>						
Ando 1977	5	5/5 (100)	86.4 (13.2)*	NR	NR	NR
Colwell 1973	47	30/47 (64)	108 (32.4)*	16.7 (6.2)*	NR	NR
Connolly 1976	13	NR	84.8 (mean)	NR	Wettings/wk: 57	Soiling/wk: 12
Didden 2001	6	NR	132 (72–228) <sup>†</sup>	NR	Frequency of incorrect toileting: 1.7 (1.76)*	NR
Giles 1966	5	5/5 (100)	122.4 (56.4)*	21.2 (5.4)*	NR	Self directed toileting: 0%
Holverstott-Cockrell 2002	9	7/9 (78)	46.68 (10.2)*	NR	Accidents/day (type not specified): 1.64 (0–3) <sup>†</sup>	Accidents/day (type not specified): 1.64 (0–3) <sup>†</sup>
Kimbrell 1967	40	0/40 (0)	139.5 (109.5–173.2) <sup>†</sup>	16.8 (10.8–24.8) <sup>†</sup>	NR	NR

NR indicates not reported; SD: standard deviation; wk: week

\*mean, SD

<sup>†</sup>mean, range

**Table D-2. Demographics of included children (observational studies) (continued)**

Author-Year	No. of Children who Completed the Study	Male N (%)	Chronological Age (months)	Developmental or Social Age (months)	Baseline Bladder Function	Baseline Bowel Function
<b>Mentally Handicapped Children</b>						
Lancioni 1980	9	3/9 (33)	171.6 (97.2–195.6) <sup>†</sup>	NR	Independent toileting: 0%	NR
Lancioni 1981a	5	3/5 (60)	150 (129.6–175.2) <sup>†</sup>	NR	Accidents/day: 1.25 (range 0–3) <sup>†</sup>	NR
Lancioni 1981b	5	3/5 (60)	150 (129.6–175.2) <sup>†</sup>	NR	NR	NR
Mahoney 1971	8	7/8 (88)	44.9 (29.1)*	NR	Urinate on floor or in pants during 5 1-hour sessions: 15.5 (6.02)*	NR
Smith 1977	13	NR	126 (48)*	22.4 (5.5)*	Mean accidents/wk: 51.88 (2.59)*	NR
Spencer 1968	38	38/38 (100)	102 (48–144) <sup>†</sup>	18 (4–39) <sup>†</sup>	NR	NR
Tierney 1973	36	28/36 (78)	138 (60–252) <sup>†</sup>	4.2–22.6 (range)	NR	NR
Van Wagenen 1969	8	5/9 (55)	6.1 (1.7)*	NR	Number who always urinated through cotton brief and on the floor: 7/9	NR
<b>Physically Handicapped Children</b>						
Forsythe 1970	47	28/47 (60)	24–120 (range)	NR	NR	Chronic constipation: 100%
King 1994	35	NR	18–348 (range)	NR	NR	Incontinent: 100%
Sullivan-Bolyai 1984	Stool training =225 Bladder training =215	NR	12–216 and older	NR	NR	NR
van Kuyk 2000a	43	27/43 (63)	108 (48.1)*	NR	NR	Modified 3-point Templeton Score (1=good, 2=fair, 3=poor): 2.7 (0.45)*
van Kuyk 2000b	16	16/16 (100)	81.6 (45.6)*	NR	NR	Modified 3-point Templeton Score (1=good, 2=fair, 3=poor): 2.7 (0.48)*

\*mean, SD

<sup>†</sup>mean, range

**Table D-3. Description of toilet training programs (observational studies)**

Author-Year	Toilet Training Objective	Readiness Screening	Trainers	Toilet Training Methods	Description of Toilet Training Methods	Reinforcement	Definition of Toilet Trained
<b>Healthy Children</b>							
Bakker 2002	Bladder and bowel control anytime	NR	Parents	Other: NR Other: NR	Other: increased prompting and encouraged the child to try again later when he could not void Other: less prompting and encouraged child to push or strain, make encouraging noises, or open a tap	Positive and punishment	NR
Brazelton 1962	Daytime and nighttime bladder control	No	Parents	Child-oriented: Brazelton 1962	Child oriented: original child-orientated approach	NR	Absence of accidents under the usual stress
Butler 1976	Daytime bladder and bowel control	NR	Parents	Azrin and Foxx: Azrin 1974	Azrin and Foxx: toilet training in less than a day	NR	Daytime continence for bowel and bladder
Foxx 1973	Self-directed daytime bladder and bowel control	Yes	Adult assistants	Azrin and Foxx: Azrin 1971; Azrin 1973	Azrin and Foxx: provided an intensive learning experience that maximized the factors known to be important for learning, then faded out these factors once learning occurred	Positive and punishment	Toileted completely with no prompts
Kaffman 1972	Daytime and nighttime bladder control	NR	Caregivers and parents	Child-oriented: NR	Child-oriented: begun at the discretion of the trained caregivers and assisted by at least 6 others. Readiness based on neuromuscular and intellectual development level and child's will for mastery and cooperation. Process geared to minimize conflict and reduce anxiety in presence of accidents or persistent failure	Positive	Dry during the day and night uninterruptedly for $\geq 2$ mo by age 3.5 yr
Taubman 1997	Self-directed daytime bowel and bladder control	No	Parent	Child-oriented: Brazelton 1962	Child-oriented: began training at ~2 yr. unless the child independently demonstrated an interest at an early age, using a child-oriented approach, positive reinforcement, and patience. Parents were cautioned against using a coercive approach	Positive	Always used potty or toilet for urination and bowel movements

h indicates hour; ml: milliliters; mo: month; NR: not reported; VSMS: Vineland social maturity scale; yr: year

**Table D-3. Description of toilet training programs (observational studies) (continued)**

Author-Year	Toilet Training Objective	Readiness Screening	Trainers	Toilet Training Methods	Description of Toilet Training Methods	Reinforcement	Definition of Toilet Trained
<b>Mentally Handicapped Children</b>							
Ando 1977	Self-directed daytime bladder control	NR	Caregivers	Operant conditioning: NR	Operant conditioning: positively reinforced with candy and praise; negatively reinforced with physical violence, removing wet pants, and taking them to the cleaning receptacle	Positive and punishment	Self-initiated elimination in toilet
Colwell 1973	Prompted bladder and bowel control anytime	NR	Non-professional staff	Operant conditioning: NR	Operant conditioning: trained in self-help skills that include toileting; training was generally based on operant procedures	Positive	To bring toileting behavior under verbal control
Connolly 1976	Daytime bowel and bladder control	NR	Caregivers	Operant conditioning: NR Control: NR	Operant conditioning: verbally praised for accident-free occasions and successful toileting Control: toileted as before	Positive	Continued absence of wetting or soiling in periods between toileting
Didden 2001	Prompted bladder and bowel control anytime	NR	Caregivers	Modified Azrin and Foxx: Azrin 1971	Modified Azrin and Foxx: modifications included establishing prompted toileting rather than self-initiated, no potty or pants alarms, time out from positive reinforcement was used immediately following restitutorial over correction, positive practice was omitted due to participants' motor limitations, and fluid intake was restricted to 70 ml/h	Positive and punishment	Correct toileting in the toilet
Giles 1966	Self-directed daytime bowel control	No	Attendants	Operant conditioning: Ellis 1963	Operant conditioning: combination of methods using operant behavior modification	Positive and punishment	Self-directed bowel movements in toilet

**Table D-3. Description of toilet training programs (observational studies) (continued)**

Author-Year	Toilet Training Objective	Readiness Screening	Trainers	Toilet Training Methods	Description of Toilet Training Methods	Reinforcement	Definition of Toilet Trained
<b>Mentally Handicapped Children</b>							
Holverstott-Cockrell 2002	Daytime bladder and bowel control	No	Parents, teachers, aides	Modified Azrin and Foxx: Holverstott-Cockrell 1997	Modified Azrin and Foxx: training program involved the use of positive reinforcement, data collection, training pants, Big Kid coloring book, and dry pants checks	Positive	Urination or defecation in the toilet
Kimbrell 1967	Prompted daytime bladder and bowel control	NR	Attendants	Operant conditioning: Ellis 1963; Roos 1965 Control: NR	Operant conditioning: an operant conditioning program to improve behavior in several areas, including toileting Control: usual care	Positive	Significantly less laundry generation, decreased frequency in soiling, and increase in VSMS social maturity quotient
Lancioni 1980	Self-directed daytime bladder control	NR	Teachers, caregivers, psychologist	Modified Azrin and Foxx: Azrin 1971	Modified Azrin and Foxx: used potty and pants alerts, increased liquids, food reduction, positive/negative reinforcement, limitation of environmental stimulation, and distance fading	Positive and punishment	Independent self-directed and executed urinary behavior without interruptions
Lancioni 1981a	Self-directed daytime bladder control	NR	Teachers, teacher assistants	Other: NR Other: NR	Other: increased liquids, regular toilet cues, positive and negative reinforcement; 25 potties placed throughout the room that were phased out as child progressed Other: increased liquids, regular toilet cues, positive and negative reinforcement	Positive and punishment	Directed to toilet, lowered pants, sat, voided, redressed, and returned unassisted
Lancioni 1981b	Self-directed daytime bladder control	NR	Teachers, teacher assistants	Other: NR Other: NR	Other: increased liquids, regular toilet cues, and positive reinforcement; 25 potties placed throughout the room that were phased out as child progressed Other: increased liquids, regular toilet cues, positive reinforcement	Positive and punishment	Directed to toilet, lowered pants, sat, voided, redressed, and returned unassisted

**Table D-3. Description of toilet training programs (observational studies) (continued)**

Author-Year	Toilet Training Objective	Readiness Screening	Trainers	Toilet Training Methods	Description of Toilet Training Methods	Reinforcement	Definition of Toilet Trained
<b>Mentally Handicapped Children</b>							
Mahoney 1971	Prompted daytime bladder control	NR	Caregivers	Operant conditioning: NR	Operant conditioning: response to auditory signal	Positive and punishment	Independent performance of total toileting sequence (walk to commode, pull down pants, urinate, pull pants up) without signal or prompt
Smith 1977	Daytime toilet training	NR	NR	Azrin and Foxx: Azrin 1973	Azrin and Foxx: increased fluids, use of urine-sensitive equipment, combination of operant techniques	Positive and punishment	NR
Spencer 1968	Daytime bladder and bowel control	NR	Attendants	Operant conditioning: NR	Operant conditioning: children placed on commode 3–7 times a day at usual voiding times Untrained subjects were rewarded for both sitting on the commode and again for voiding in it Subjects who were incontinent <50% of the time were only rewarded for voiding in the commode	Positive	NR
Tierney 1973	Self-directed daytime bladder and bowel control	NR	Nurses	Operant conditioning: NR Control: NR	Operant conditioning: all incontinence and toilet behavior was observed and recorded; all appropriate behavior was reinforced; all inappropriate behavior was ignored Control: toileted as before	Positive	Goes to toilet independently: removes clothing, sits on toilet, eliminated on toilet and otherwise continent
Van Wagenen 1969	Self-directed daytime bladder control	NR	Experimenter	Operant conditioning: Van Wagenen 1966	Operant conditioning: liquid was increased and child wore an auditory signal generator that sounded when the child voided. After the signal, the trainer said 'no', took child by hand to toilet and placed in appropriate position. If the child continued to void, he was rewarded. If successful, the signal device was replaced with training pants and the child was taught to remove and replace them to void	Positive and punishment	Independent daytime bladder control and autonomous toileting without prompts

**Table D-3. Description of toilet training programs (observational studies) (continued)**

Author-Year	Toilet Training Objective	Readiness Screening	Trainers	Toilet Training Methods	Description of Toilet Training Methods	Reinforcement	Definition of Toilet Trained
<b>Physically Handicapped Children</b>							
Forsythe 1970	Daytime bowel control	NR	NR	Other: Deaver 1953	Other: regular toileting post evening meal for 2 mo. If unsuccessful, daily enemas until empty then regular toileting resumed. If unsuccessful, enema plus daily suppository, and if still unsuccessful, enemas plus oral purgative	NR	NR
King 1994	Daytime and nighttime bowel control	NR	Psychiatrist, family members, child	Other: NR	Other: patient/family education and a regular, consistently timed, reflex-triggered bowel evacuation	No	One or fewer accidents (defecations not on toilet at desired time) per mo (excluding episodic, spontaneously resolving, presumed viral diarrhea illnesses) with less than 40 minutes required for each stool elimination

**Table D-3. Description of toilet training programs (observational studies) (continued)**

Author-Year	Toilet Training Objective	Readiness Screening	Trainers	Toilet Training Methods	Description of Toilet Training Methods	Reinforcement	Definition of Toilet Trained
<b>Physically Handicapped Children</b>							
Sullivan-Bolyai 1984	Self-directed and prompted bladder and bowel control anytime	NR	Parent/guardian	Other: Chapman 1979	Other: stool training method; < 3yr.1) timed, 2) suppository, 3)expansion enema, 4) diaper care; ≥ 4yr. 1) timed with digital stimulation, 2) suppository, 3) xpansion enema, 4) untimed diaper or pant insert, 5) infrequent enema. Bladder training method: < 6 yr.1) timed, 2) clean intermittent catheterization, 3) diaper/pant insert; ≥ 6yr.1) heat diversion, 2) timed, 3) clean intermittent catheterization, 4) diaper/pant insert, 5) penile collector OR Stool training included: diaper/insert care, infrequent enemas to disimpact, low-level enemas, suppositories, digital stimulations; Bladder training included diaper/insert care, penile collectors, urinary diversion, and timed bladder emptying ± medication, or clean intermittent catheterization ± medication	NR	Learn socially acceptable (independent or dependent) bowel and bladder management. Acceptable defined as lack of odor, presence of clear skin, free of rash and decubitus. Independent defined as totally capable of dressing, perineal cleansing, replacement and care of collection devices and transfers on and off toilet receptacle without reminders
van Kuyk 2000a	Daytime and nighttime bowel control	NR	Psychologist and/or parents and/or physiotherapist and/or surgeon	Other: van Kuyk 2000	Other: behavioral program to teach children and their parents adequate defecation behavior including an adequate straining technique	No	NR
van Kuyk 2000b	Self-directed daytime and nighttime bowel control	No	Child, psychologist, parents	Other: NR	Other: teaching the child bowel self-control, training of optimal defecation skills and, subsequently, toilet behavior	Positive	Child achieves self control and extinguishes reactions of fear and aversion to defecation; aim for school aged child to have independent in bowel function

**Table D-4. Description of the toilet training programs (trials)**

Author-Year	Location	Toilet Training Intervention 1	Toilet Training Intervention 2	Toilet Training Intervention 3	Description of Children	Source of Children
<b>Healthy Children</b>						
Candelor 1977	United States	Azrin and Foxx	Other: Spock's Baby and Childcare Handbook		Healthy	Community
Matson 1977	United States	Azrin and Foxx with supervision	Azrin and Foxx without supervision		Healthy	Community
Taubman 2003	United States	Child-oriented and handbook promoting praising defecation	Child-oriented		Healthy	Clinical practice
<b>Mentally Handicapped Children</b>						
Edgar 1975	United States	Other: relaxation-tension exercise regimen	Other: played with toys, given individual attention, and placed on toilet		Mentally handicapped: severely and profoundly	Special care facility
Hundziak 1965	United States	Operant conditioning	Other: toileted several times a day, scolded for soiling, praised for successful toileting	Control	Mentally handicapped: severely	Special care facility
Hyams 1992	United Kingdom	Individual-modified Azrin and Foxx	Group-modified Azrin and Foxx	Other: intensive individual training program where the child is prompted and rewarded for successful toileting	Mentally handicapped: severely and profoundly	Special care facility
Sadler 1977	United States	Azrin & Foxx	Other: toileted on a schedule	Control	Mentally handicapped: severely and profoundly	Special care facility
<b>Physically Handicapped Children</b>						
van Kuyk 2001	Netherlands	Operant conditioning	Other: standard medical treatment		Physically handicapped: Hirschprung's	Community

**Table D-5. Demographics of included children (trials)**

Author-Year	No. of Children who Completed the Study	Male N (%)	Chronological Age (months)	Developmental or Social Age (months)	Baseline Bladder Function	Baseline Bowel Function
<b>Healthy Children</b>						
Candelora 1977	71	44/71 (62)	26.11 (18-35) <sup>†</sup>	NR	Mean accidents/day/child: 4.59	NR
Matson 1977	9	7/10 (70)	20-26 (range)	NR	NR	NR
Taubman 2003	381	197/381 (completed) (52)	17-19 (range)	NR	Incontinent: 100%	Incontinent: 100%
<b>Mentally Handicapped Children</b>						
Edgar 1975	20	NR	48-144 (range)	19.5 (15-23) <sup>†</sup>	NR	NR
Hundziak 1965	26	26/26 (completed) (100)	NR	84-168 (range)	NR	NR
Hyams 1992	14	5/15 (33%)	135 (68- 224) <sup>†</sup>	22.3 (11-26) <sup>†</sup>	NR	NR
Sadler 1977	14	11/14 (79)	84-144 (range)	NR	Mean wets/child/day: 0.88-1.00 (range of group means)	NR
<b>Physically Handicapped Children</b>						
van Kuyk 2001	25	21/27 (78)	62.4 (24-132) <sup>†</sup>	NR	Parental judgment on Bowel Incontinence Scale: 17.4 (7.6) <sup>†</sup>	% feces in toilet 36.5 (35.3) <sup>†</sup>

NR indicates not reported; SD: standard deviation

\*mean, SD

<sup>†</sup>mean, range

**Table D-6. Description of the toilet training programs (trials)**

Author-Year	Toilet Training Objective	Readiness Screening	Toilet Trainers	Toilet Training Methods	Description of Toilet Training Methods	Reinforcement	Definition of Toilet Trained
<b>Healthy Children</b>							
Candelora 1977	Self-directed daytime bladder control	Yes	Parents	Azrin and Foxx: Azrin 1974 Other: Spock 1986	Azrin and Foxx: toilet training in less than a day Other: baby and childcare handbook that describes developmental highlights, readiness indications, specific training procedures, and expected problems associated with bladder and bowel training	NR	NR
Matson 1977	Daytime bladder control	Yes	Parents ± supervisors	Azrin and Foxx: Azrin 1974 Azrin and Foxx: Azrin 1974	Azrin and Foxx: toilet training in less than a day with mothers supervised by an experienced trainer Azrin and Foxx: toilet training in less than a day with mothers unsupervised	NR	NR
Taubman 2003	Self-directed daytime bladder and bowel control	NR	Parents	Child-oriented: AAP 1999; Stadtler 1999	Other: received handout describing child-oriented approach to TT, increased praise for defecating in diaper before TT begins, and not using negative terms for stool or defecating Child oriented: received handout describing child-oriented approach to TT	Positive	Child in underwear when awake with <4 bladder accidents/wk and ≤2 bowel accidents/wk

NR indicates not reported; TT: toilet training; wk: week

**Table D-6. Description of the toilet training programs (trials) (continued)**

Author-Year	Toilet Training Objective	Readiness Screening	Toilet Trainers	Toilet Training Methods	Description of Toilet Training Methods	Reinforcement	Definition of Toilet Trained
<b>Mentally Handicapped Children</b>							
Edgar 1975	Self-directed and when prompted daytime bladder control	No	Caregivers	Other: Kephart 1969 Other: NR	Other: all wore urinary training devices; experimental group: increased fluids followed by relaxation-tension exercise regimen 15 min later then placed on toilet (regeimen = massage, shaking, stretching) Other: all wore urinary alarm devices; controls played with toys, given individual attention, and placed on toilet	Positive and punishment	Must have only 1 accident in 2 days occurring on the first day; showing self-initiating toileting
Hundziak 1965	Daytime and nighttime bladder control	No	Caregivers	Operant conditioning: Ellis, 1963 Other: NR Control: NR	Operant conditioning: used a candy dispensing device to positively reward and reinforce eliminative responses Other: children taken to the bathroom several times a day, scolded for soiling and praised for successful use of bathroom facilities Control: no organized routine was maintained to subject the children to a toilet training program	Positive	Voiding in toilet will increase; toileting habits learned will transfer to original living unit

**Table D-6. Description of the toilet training programs (trials) (continued)**

Author-Year	Toilet Training Objective	Readiness Screening	Toilet Trainers	Toilet Training Methods	Description of Toilet Training Methods	Reinforcement	Definition of Toilet Trained
<b>Mentally Handicapped Children</b>							
Hyams 1992	Self-directed daytime bladder control	NR	Nurses	Modified Azrin and Foxx: Azrin 1971; Azrin 1973 Modified Azrin and Foxx: NR Other: Mahoney 1971; Van Wagenen 1969	Modified Azrin and Foxx: intensive, individual regular pottng training program where accidents resulted in a reprimand and timeout from reward for 10 minutes. All groups used pants and toilet alarms Modified Azrin and Fox: training procedures similar to above, but trained in a group Other: intensive individual training program where the child is prompted and rewarded after successful toileting	Positive and punishment	NR
Sadler 1977	Daytime bladder control	NR	Staff	Azrin& Foxx: Azrin 1971; Azrin 1973 Other: NR Control: NR	Azrin and Foxx: over correction and repeated positive practice Other: scheduling method where children are toileted 4 times a day Control: no training	Positive and punishment	Reducing number of accidental daytime wettings

**Table D-6. Description of the toilet training programs (trials) (continued)**

Author-Year	Toilet Training Objective	Readiness Screening	Toilet Trainers	Toilet Training Methods	Description of Toilet Training Methods	Reinforcement	Definition of Toilet Trained
<b>Physically Handicapped Children</b>							
van Kuyk 2001	Daytime and nighttime bladder control	NR	Child, parents, psychologist, and physiotherapist	Operant conditioning: van Kuyk 2000 Other: NR	Operant conditioning: biopsychosocial approach to extinguish defecation anxiety and avoidance behavior by teaching bowel self-control via optimal defecation skills and toilet behavior Other: put on a waiting list and received standard medical treatment consisting of laxatives, enemas, or bowel rinsing	Positive	NR

**Table D-7. Methodological quality of included studies (observational studies)**

Author-Year	Study Design	Downs and Black Score	Data Collection	Data Collection Methods	Funding
Ando 1977	Single cohort	16	Prospective	Clinical review	Government, foundation
Bakker 2002	Multiple cohort	21	Retrospective	Questionnaire	NR
Brazelton 1962	Single cohort	13	Retrospective	Chart review	NR
Butler 1976	Single cohort	11	Prospective	Other	NR
Colwell 1973	Single cohort	22	Unclear	Clinical review	NR
Connolly 1976	Single cohort	17	NR	Clinical review	NR
Didden 2001	Single cohort	17	Prospective	Clinical review	NR
Forsythe 1970	Single cohort	15	Retrospective	NR	Industry
Foxx 1973	Single cohort	18	Prospective	NR	Government
Giles 1966	Single cohort	15	Prospective	NR	NR
Holverstott-Cockrell 2002	Multiple cohort	19	Prospective	Questionnaire	NR
Kaffman 1972	Single cohort	16	Retrospective	Other	NR
Kimbrell 1967	Multiple cohort	17	Prospective	Clinical review	NR
King 1994	Single cohort	21	Retrospective	Chart review	NR
Lancioni 1980	Multiple cohort	16	Prospective	Clinical review	NR
Lancioni 1981a	Single cohort	16	Prospective	Other	Other
Lancioni 1981b	Single cohort	16	Prospective	Other	Other
Mahoney 1971	Single cohort	15	NR	Clinical review	NR
Smith 1977	Multiple cohort	18	Retrospective	Chart review	NR

NR indicates not reported

**Table D-7. Methodological quality of included studies (observational studies) (continued)**

<b>Author-Year</b>	<b>Study Design</b>	<b>Downs and Black Score</b>	<b>Data Collection</b>	<b>Data Collection Methods</b>	<b>Funding</b>
Spencer 1968	Single cohort	18	Prospective	Clinical review	NR
Sullivan-Bolyai 1984	Single cohort	18	Retrospective	Clinical review	Foundation
Taubman 1997	Single cohort	20	Prospective	Interview	NR
Tierney 1973	Multiple cohort	16	Prospective	Clinical review	NR
van Kuyk 2000a	Single cohort	22	Retrospective	Chart review	NR
van Kuyk 2000b	Single cohort	20	Retrospective	Questionnaire	NR
Van Wagenen 1969	Single cohort	13	Prospective	Clinical review	Other

**Table D-8. Methodological quality of included studies (trials)**

<b>Author-Year</b>	<b>Jadad Score</b>	<b>Allocation Concealment</b>	<b>Data Collection Method</b>	<b>Funding Source</b>
Candelora 1977	2	Unclear	Questionnaire	NR
Edgar 1975	2	Unclear	Clinical review	Government
Hundziak 1965	2	Unclear	Clinical review	Government
Hyams 1992	2	Unclear	Interview	NR
Matson 1977	2	Unclear	Clinical review	Internal
Sadler 1977	2	Unclear	Other	NR
Taubman 2003	2	Unclear	Interview	Government
van Kuyk 2001	1	Unclear	Clinical review	Government

NR indicates not reported

**Table D-9. Outcomes and results of included studies (observational studies)**

Author-Year	Toilet Training Method(s)	Study Design	Primary Outcome	Other Outcomes or Effect Modifiers	Results	Conclusions
Bakker 2002	Other: Increased prompting v. less prompting	Retrospective cohort	Residual lower urinary tract symptoms (LUTS) at ≥10 yr	Comparisons based on sex, family structure, number of bedwetting-relatives, school performance, self-management, daily hygiene, age TT begun, parent attitudes	<p>Healthy children</p> <p>N=4332 928/4332 (21%) symptomatic at 10 to 14 yr. Symptom group v. control: significant difference in:</p> <ol style="list-style-type: none"> <li>1. Proportion female (62.1% v. 45.2%)</li> <li>2. Fewer from stable first marriage (82% v. 86%)</li> <li>3. Bedwetting relatives (37% v. 25%)</li> <li>4. Poorer school performance (12% v. 8%)</li> <li>5. Less ability to manage homework and appointments independently (73% v. 68%)</li> <li>6. Less capacity to manage daily hygiene (37% v. 31%)</li> <li>7. Began TT at older age (22% v. 32% began TT before 18 mo)</li> <li>8. Parents in symptom group used less prompting, were more liberal, rewarded and punished more, and exerted more pressure if attempt to void failed</li> </ol>	Data show significant differences between children with lasting problems with bladder control and those without. Beginning TT >18 mo and using certain methods to provoke voiding if attempt failed increased the risk of LUTS.
Brazelton 1962	Child-oriented	Retrospective cohort	Age, day, and nighttime bladder continence	Comparisons based on sex	<p>N=1170</p> <p>Day training achieved 1–2 mo later and nighttime 1–7 mo longer in 1st child</p> <p>54.7% began TT at 24 mo</p> <p>12.3% achieved bowel training first</p> <p>8.2% bladder, and 79.5 % simultaneous training</p> <p>80.7% daytime trained by average 28.5 mo and 80.3% night trained by 3 yr. Average age to complete all training was 33.3 mo; males took 2.3 mo longer to complete</p> <p>1.4% had residual problems &gt;5 yr</p>	Day and nighttime training effected later in first child than subsequent siblings. Boys took longer to be night trained. A child-orientated program helps prevent residual symptoms.

CG indicates conventional group; CIC: clean intermittent catheterization; LUTS: lower urinary tract symptoms; MC: mentally handicapped children; mos: months; OC: operant conditioning; RT: regular toileting; SA: social age; SI: self-initiated; SIE: self-initiated elimination; STR: stool toileting refusal; TT: toilet training; tx: treatment; VSMS: Vineland social maturity scale; wk: week; yr: year; ↑: increased; ↓: decreased

**Table D-9. Outcomes and results of included studies (observational studies) (continued)**

Author-Year	Toilet Training Method(s)	Study Design	Primary Outcome	Other Outcomes or Effect Modifiers	Results	Conclusions
Butler 1976	Azrin and Foxx	Prospective cohort	Bowel and bladder accidents	Comparisons based on sex and age <b>Healthy Children</b>	N=49 End 1st intensive training session <25 mos: 25/34 (74%) success >25 mos: 14/15 (93%) success Mean intensive training time: all =4.5 hr (range 1.25–10) <25 mo.= 5.15 hr >25 mo.= 4.08 hr 2 wk post training: mean # accidents bladder ↓ 6.03 to 0.60/day (p<0.001) bowel ↓ 1.23 to 0.07/day 3 failures: 2 male, 1 female 8 wk post training: mean # accidents bladder = 0.58/day bowel = 0.11/day 2 failures: 1 male, 1 female	Males and all children >25 mo. trained faster. 20% stopped wetting at night. Some children reacted negatively to positive practice-sessions following an accident, and some parents found it difficult not to prompt at signs of self-initiation.
Foxx 1973	Azrin and Foxx	Prospective cohort	Self toileting without reminders	Bowel and bladder accidents, training time	N=34 (results at 1–4 mos) 33/34 (97%) success Mean no. accidents/day: pre-training / 1 day post- training / 4 mo. post training Bladder: ~6 / ~0.5 (↓ of 97%) / ~0 Mean training time: 3.9 hr (range 0.5–14) 26–36 mo. = 2.25 hr 20–25 mo. = 5 hr 1/34 regressed at 3 mo. followup	Virtually all healthy children >20 mo. were daytime TT in a few hours and 26–36 mo. old train faster. Nighttime dryness often resulted as well. Children reacted favorably to trainer and early tantrums were short-lived.
Kaffman 1972	Child-oriented	Retrospective cohort	Enuresis	Comparisons by age and sex	N=1376 TT begun at 15–26 mo. Proportion enuretic: 4–15 yr: 13.9%; M/F = 14.9/12.8% 4–7 yr: 133/508 (26%); M/F = 13/13% 7–15 yr: 59/868 (7%) M/F = 5/2%	Up to 6–7 yr, kibbutz raised children had higher incidence of enuresis and by > 10 yr, it was lower than non-kibbutz raised children. Regressive enuresis was rare.

**Table D-9. Outcomes and results of included studies (observational studies) (continued)**

Author-Year	Toilet Training Method(s)	Study Design	Primary Outcome	Other Outcomes or Effect Modifiers	Results	Conclusions
<b>Healthy and Mentally Handicapped Children</b>						
Mahoney 1971	Operant conditioning	Prospective cohort	Level of performance from 1–10 where Level 10 = independent toileting	Number of training hours Number of trials	Healthy: n=3; MC n=5 (results after 29 hrs of training) Healthy: 3/3 (100%) attained Level 10 over average of 29 hr and 118 trials. MC: 4/5 (80%) attained Level 10 over average 29 hrs and 262 trials 1 failure	Complete toileting behavior includes complex chain of behaviors and other behaviors should be taught prior to elimination.
Taubman 1997	Child-orientated	Prospective cohort	Stool toileting refusal (STR)	Associated factors	N=482 ≤ 3 yr: 292/482 (61%) trained 4 yr: 471/482 (98%) trained 22% experienced ≥ 1 mo of STR, 73% resolved without intervention STR significantly associated with presence of younger siblings, parental inability to set limits, and later age (>42 mo.) to complete TT Overall: 48% males and 30% females trained by 3 yr. (p=0.0004) 48% began TT < 24 mo. and 32% not trained until >3 yr 52% begun TT > 24 mo. and 46% not trained until > 3yr No association between age of TT with mother's work status, attending daycare, behavior scores, or presence of siblings STR group Age STR began: 73% between 24–36 mos Siblings: 33% had younger and 17% had older Behavior scores: ≤ 2 = 32% with STR, > 2 = 20% with STR	Two behaviors associated with STR may need intervention: withholding causing constipation and unsuccessful training by 42 mo.

**Table D-9. Outcomes and results of included studies (observational studies) (continued)**

Author-Year	Toilet Training Method(s)	Study Design	Primary Outcome	Other Outcomes or Effect Modifiers	Results	Conclusions
<b>Physically Handicapped Children</b>						
Forsythe 1970	Other: progressive intervention if unsuccessful bowel control	Prospective cohort	Independent bowel control	N=47	<p>Bowel control obtained:</p> <ol style="list-style-type: none"> <li>1. Regular toileting (RT) 8/47 (17%) maintained &gt;2 yr 8 others relapsed at 8–15 mo.</li> <li>2. Enemas + RT 7/39 (18%) maintained &gt;2 yr 2 others relapsed at 6–8 mo.</li> <li>1 &amp; 2 combined 15/47 (32%) success 10/47 (21%) temporary improvement 22/47 (47%) unchanged</li> <li>3. Enemas + RT + suppositories Glycerin: 0/25 (0%) success Dulcolax: 3/25 (12%) Stopped dulcolax at 6 mo. Maintained for 2 yr. 18/25 (72%) relapsed 3 mo. after enemas stopped Miralax micro-enemas 2/22 (8%) success Stopped tx at 6 mo. Maintained &gt;2 yr 20/25 (80%) unchanged</li> <li>4. Enemas + RT + purgatives Dulcodos: 8/16 (50%) Maintained &gt;9 mo. Senokot syrup: 15 /15 (100%) Maintained &gt;6 mo.</li> </ol>	A combination of regular toileting, initial enemas, and Senokot was the most satisfactory to bowel train children with spina bifida. Dulcodos tablets were almost as effective in those >6 yr. Manual evacuation and repeated enemas were unsatisfactory due to social reasons and creating dependence on others.

**Table D-9. Outcomes and results of included studies (observational studies) (continued)**

Author-Year	Toilet Training Method(s)	Study Design	Primary Outcome	Other Outcomes or Effect Modifiers	Results	Conclusions
<b>Physically Handicapped Children</b>						
King 1994	Other: patient and family education and regular reflex-triggered bowel evacuation	Retrospective cohort	Bowel continence	Comparisons based on age, compliance, and reflexes present	N=35 Bowel continence ↑ from 0 to 54.3% 24/35 (68.6%) were compliant; 19/24 (79%) of these became continent Reflexes present Anocutaneous reflex: 8/8 (100%) with reflex became continent 10/25 (40%) without reflex did not Bulbocavernosus reflex: 13/19 (68%) with reflex became continent 5/14 (36%) without reflex did not Age ≤ 6 yr: 11/17 (65) became continent >6 yr: 8/18 (44%) became continent	Continence more likely achieved if ≤ 6 yr, were compliant, and if had intact bulbocavernosus or anocutaneous reflex or both.
Sullivan-Bolyal 1984	Other: bowel training 1. untimed random collection with diaper or insert 2. infrequent enema 3. small rapid low level enema 4. suppositories 5. timed evacuation ± digital stimulation bladder training 1. diaper/pant insert + periodic cleansing. 2. penile collector 3. urinary diversion 4. timed emptying ± medication 5. clean intermittent catheterization (CIC) ± medication	Retrospective cohort	Dependent and independent toileting Socially acceptable and unacceptable toileting	Comparisons based on sex, IQ, and training method	N=525 High lumbar/thoracic lesions: 80% became socially acceptable by 16–17 yr; 50% were dependent Low lumbar/sacral lesions: 80% became socially acceptable by 10–11yr 50% were dependent All levels: 50% became socially acceptable between 7–9 yr 70% were dependent No differences based on age, sex, or time TT begun IQ <69: 1/30 successful Bowels: <3 yr: n=41 Socially acceptable/dependent: 39/41 (95%) 7/41 (17%) timed evacuation 14/41 (35%) Bisacodyl suppository 3/41 (7%) expansion enema 15/41 (41%) diapers	Individuals with higher-level lesions may experience delay in achieving successful skill. Those with ileal diversions gained independence at a later age and experienced ammonia odor, persistent infection, recurrent obstruction, and renal stones. Penile collectors caused odor and penile ulcers. Problems with CIC and timed voiding included leakage with Valsalva maneuver. A general set of toilet training predictor guidelines can assist parents and children, avoid frustration, discouragement and psychological problems. Close clinic followup is required.

**Table D-9. Outcomes and results of included studies (observational studies) (continued)**

Author- Year	Toilet Training Method(s)	Study Design	Primary Outcome	Other Outcomes or Effect Modifiers	Results	Conclusions
<b>Physically Handicapped Children</b>						
Sullivan- Bolyai 1984					<p>Socially unacceptable/dependent: 2/41 (5%)                      &gt; 4 yr: n=184                      Socially acceptable/independent: 84/184 (46%)                      55/184 (30%) timed evacuation                      24/184 (13%) bisacodyl suppository                      3/184 (2%) small expansion enemas                      1/184 (.005%) diaper/pant insert                      1/184 (.005%) infrequent enema                      Socially acceptable/dependent: 57/184 (31%)                      18/184 (10%) timed evacuation                      (3/18 (17%) with digital stimulation)                      24/184 (13%) bisacodyl suppository                      12/184 (7%) expansion enemas                      2/184 (1%) diaper/pant insert                      1/184 (0.005%) infrequent enema                      Socially unacceptable/dependent:                      23/184 (13%)                      Socially unacceptable/independent:                      19/184 (10%)                      Bladder:                      &lt; 6yr: n=57                      Socially acceptable/dependent: 45/57 (79%)                      3/57 (5%) timed                      10/57 (18%) CIC                      32/57 (56%) diaper/pant insert                      Socially acceptable/independent:                      1/57 (2%)                      1/57 (2%) CIC                      Socially unacceptable/dependent:                      11/57 (19%)                      &gt; 6 yr: n=158</p>	

**Table D-9. Outcomes and results of included studies (observational studies) (continued)**

Author-Year	Toilet Training Method(s)	Study Design	Primary Outcome	Other Outcomes or Effect Modifiers	Results	Conclusions
<b>Physically Handicapped Children</b>						
Sullivan-Bolyai 1984					Socially acceptable/dependent: 52/158 (33%) 23/158 (15%) heat diversion 4/158 (3%) timed evacuation 12/158 (8%) CIC 2/158 (0.01%) diaper/pant insert 11/158 (7%) penile collectors Socially acceptable/independent: 55/158 (35%): 27/158 (17%) heat diversion 8/158 (5%) timed evacuation 10/158 (6%) CIC 1/158 (0.01%) diaper/pant insert 9/158 (6%) penile collectors Socially unacceptable/dependent: 36/158 (23%) Socially unacceptable/independent: 51/158 (32%)	
van Kuyk, 2000a	Operant conditioning	Retrospective cohort	Bowel continence (Templeton and Wingspread scores) Constipation Defecation behavior	Comparisons based on age	N=16 14/16 (88%) achieved good continence 12/16 (75%) were clean 8/12 (67%) recovered from constipation Templeton score: ↓ from 2.7 ± 0.48 to 1.1 ± 0.34 (p=0.00) Wingspread score: ↓ from 3.5 ± 0.52 to 1.3 ± 0.60 (p=0.00) Constipation: ↓ from 1.8 ± 0.45 to 1.3 ± 0.45 (p=0.01) Defecation behavior: ↓ from 2.9 ± 0.34 to 1.1 ± 0.34 (p=0.00) No difference based on age	Multidisciplinary intervention effective in treatment of constipation and incontinence in children with Hirschsprung's disease. The children improved in all aspects.

**Table D-9. Outcomes and results of included studies (observational studies) (continued)**

Author-Year	Toilet Training Method(s)	Study Design	Primary Outcome	Other Outcomes or Effect Modifiers	Results	Conclusions
<b>Physically Handicapped Children</b>						
van Kuyk 2000b	Operant conditioning	Retrospective cohort	Feces in toilet Number of days without soiling Templeton score Wingspread score Constipation score Parental judgment incontinence scales	Comparisons based on age and high v. lower anal atresia	N=43 17/43 (40%) achieved good continence 21/43 (49%) achieved fair continence 51% were clean 40% only staining 10/18 (55%) recovered from constipation Templeton score: ↓ from 2.7 ± 0.45 to 1.6 ± 0.59 (p=0.00) Wingspread score: ↓ from 3.4 ± 0.85 to 2.2 ± 0.80 (p=0.00) Constipation: ↓ from 1.5 ± 0.51 to 1.2 ± 0.41 (p=0.01) Defecation behavior: ↓ from 2.8 ± 0.39 to 1.4 ± 0.55 (p=0.00) Straining technique: ↓ from 2.5 ± 0.67 to 1.2 ± 0.43 (p=0.00) No difference based on age	The intervention was effective and there were no differences based on age. Both somatic and behavioral factors affect persistence of defecation problems, therefore treatment should include behavioral modification techniques.
<b>Mentally Handicapped Children</b>						
Ando 1977	Operant conditioning	Prospective cohort	Self-initiated elimination		N=5 4/5 (80%) achieved improved self-initiated elimination (SIE): 1 improved SIE by 50% in 11 mos 1 improved SIE by 60% in 3 mos 1 improved SIE by 32% in 3 mos 1 improved SIE by 18% in 12 mos 1 made no progress None completely eliminated inappropriate urination Better result in those with some receptive language skills	One should not expect the same dramatic results in TT autistic children that have been shown in the profoundly retarded. Suggest a long baseline record of elimination and a long treatment period plus individual study to determine positive and negative reinforcers.

**Table D-9. Outcomes and results of included studies (observational studies) (continued)**

Author-Year	Toilet Training Method(s)	Study Design	Primary Outcome	Other Outcomes or Effect Modifiers	Results	Conclusions
<b>Mentally Handicapped Children</b>						
Colwell 1973	Operant conditioning	Prospective cohort	Toileting skills under verbal control (top score 18)	Dressing skills Feeding skills Mental age	N=47 (results achieved in ~ 7.1 mos) Mean toileting score ↑ from 6.0 ± 4.7 to 10.0 ± 4.7 (p<0.001) 33/47 (70%) made gains 8/47 (17%) made no gains 3/47 (6%) regressed from baseline	The majority made significant gains in toileting, dressing, and feeding skills and also improved mental age score.
Connolly 1976	Operant conditioning	Prospective cohort	Wetting incidents Soiling incidents Successful toileting following accident free period		N=9 (results at 7 wk followup) Wetting accidents ↓ 14% and soiling accidents ↓ 25% 2/9 (22%) were successfully trained Successful toileting following accident free period periods continued to decrease	Positive use of operant conditioning can help toilet train the severely mentally handicapped.
Didden 2001	Azrin and Foxx (modified)	Prospective cohort	Accidents and correct toileting/day and at 2.5 yr.post training followup	Time spent training	N=6 (results at 2.5 yr.followup) Mean incorrect toileting/day ↓ from 1.65 ± 1.76 to 0.12 ± 0.29 at followup (p=0.07) Mean correct toileting/day ↑ from 0.80 ± 0.95 to 3.1 ± 1.57 (p=0.02) Mean TT time was 17.2 days (range 12–25) and 108 ± 31 hrs	Azrin and Foxx TT significantly increased correct prompted toileting that was sustained at followup. It somewhat decreased accidents.
Giles 1966	Operant conditioning	Prospective cohort	Consistent self-initiated (SI) bowel and bladder elimination in the toilet		N=5 5/5 (100%) success Individual results: 1 achieved consistent SI bowel & urine elimination at 3 wks; night soiling ended at 5 wks 1 achieved consistent SI bowel & urine elimination at 7 wks 2 achieved consistent SI bowel & urine elimination at 8 wks 1 achieved consistent 'other' initiated bowel elimination at 3 wks; urine at 8 wks with some SI	Operant conditioning can be an effective means of establishing self-care behavior in institutionalized retardates. Reinforcement must be tailored individually.

**Table D-9. Outcomes and results of included studies (observational studies) (continued)**

Author-Year	Toilet Training Method(s)	Study Design	Primary Outcome	Other Outcomes or Effect Modifiers	Results	Conclusions
<b>Mentally Handicapped Children</b>						
Holverstott-Cockrell 2002	Azrin and Foxx Study takes place in 4 special education preschool classrooms in the same school district. Children attended ½ days.	Prospective cohort	Bowel and bladder successes and accidents	Intervention acceptability Parent participation	N=10; 9 completed (results at 6 wk) Classroom A: n=4 Trend of successes ↑ from 0.6 (0–1) to 4.0 (0–8)/day, accidents ↓ from 2.2 (1–3) to 1.2 (0–3)/day Classroom B: n=2 Trend of successes remained stable (from 2.4 (1–4) to 4.3 (1–8)/day), accidents ↓ from 1.1 (0–3) to 0.7 (0–3)/day Classroom C: n=2 Trend of successes remained stable (from 2.2 (1–3) to 3.2 (0–6)/day), accidents ↓ 1.2 (0–2) to 0.3 (0–2)/day Classroom D: n=2 Trend of successes ↑ from 0.07 (0–1) to 2.1 (0–4)/day, accidents ↓ from 1.5 (0–2) to 0.6 (0–2)/day	Postprogram, there was a significant increase in successes and fewer accidents across all classrooms (4 children continued to have accidents). The intervention was highly acceptable but not carried out consistently by teachers (did not like dry pants checks and positive reinforcement for being dry) and, thus, possibly decreased effectiveness of the intervention. Only a few parents returned data indicating low parental participation.
Kimbrell 1967	Operant conditioning v. conventional group	Prospective cohort	Vineland social maturity scale (VSMS) scores (social age, social quotient) Frequency of soiling	Comparisons based on age Laundry use Change in social age and social maturation	N=40 (results at 7 mos) VSMS scores (post test) Social age: OC: ↑ 0.42 v. CG: ↑ 0.10 (p<0.05) Social quotient: OC ↑ 3.30 v. CG ↓ -0.15 (p=ns) Toilet Training: OC ↑ 4.10 v. CG ↑ 0.30 (p<0.001) No significant developmental gains No differences based on age Experimental group laundry use cut in half	Improved scores on VSMS for social age and social quotient. Soiling decreased and laundry use was cut in half.

**Table D-9. Outcomes and results of included studies (observational studies and trials) (continued)**

Author-Year	Toilet Training Method(s)	Study Design	Primary Outcome	Other Outcomes or Effect Modifiers	Results	Conclusions
<b>Mentally Handicapped Children</b>						
Lancioni 1980	Azrin and Foxx (modified)	Prospective cohort	Independent toileting for urination	Partially-independent, incomplete, and assisted toileting Urinary accidents Comparisons based on age, sex, sensory condition, and degree of self stimulation	N=9 (results at 44 day followup) 9/9 (100%) achieved daytime independence and accidents ↓ to zero Partial and incomplete toileting not present 1/9 (11%) continued to have occasional accidents	Comparisons based on age, sex, sensory condition, and degree of self-stimulation were not significant. Suggest punishment may or may not have played a useful role. Some achieved bowel control as well.
Lancioni 1981	Other: Intervention A: 25 potties in training setting v. Intervention B: no potties displayed Punishment used	Prospective cohort	Independent toileting	Partially-independent, incomplete, and assisted toileting Urinary accidents	N=5 (results at 60 day followup) Intervention A: 5/5 (100%) achieved independent toileting that continued at 60-day followup Mean successes: 6.8 actions/day 2 had no accidents 3 had the odd accident Intervention B was not effective: when switched to Intervention A with potties improvement began	Intervention A: All increased independent toileting and decreased accidents while continuing normal programs unaltered. The immediate presence of potties may be crucial for developing independence.
Lancioni 1981	Other: Intervention A: 25 potties in training setting v. Intervention B: no potties displayed No punishment used	Prospective cohort	Independent toileting	Partially-independent, incomplete, and assisted toileting Urinary accidents	N=4 (results at 60 day followup) Intervention A: 4/4 (100%) achieved independent toileting that continued at 60-day followup Mean successes: 6.5 actions/day 1 accident occurred Intervention B was not effective: when switched to Intervention A with potties improvement began	Intervention A: All increased independent toileting and decreased accidents; results continued at followup. Suggest punishment useful in those who have history of accidents, but not necessary in those who toilet when prompted or assisted.

**Table D-9. Outcomes and results of included studies (observational studies) (continued)**

Author-Year	Toilet Training Method(s)	Study Design	Primary Outcome	Other Outcomes or Effect Modifiers	Results	Conclusions
<b>Mentally Handicapped Children</b>						
Spencer 1973	Operant conditioning	Prospective cohort	Index of bowel control		N=38 (results at 6 wk) Accidents ↓ by 17% Spontaneous toileting ↑ 9% Those who had greater initial bowel control did not improve, those totally incontinent showed considerable progress	Operant conditioning can improve toileting behaviors in the profoundly retarded.
Smith 1977	Azrin and Foxx	Retrospective cohort	Wetting accidents/wk		N=8 (results at 10 wk) Wetting accidents: Younger, low social age (SA): 2/5 (40%) averaged 1 accident/wk Younger, high SA: 3/3 (100%) zero accidents	Significant drop in wetting accidents. Those <20 yr. trained faster; those with SA 2–2.5 yr. progressed faster than those with SA 1.5–2 yr.
Tierney 1973	Operant conditioning v. control	Controlled clinical trial	Reduced incontinence Successful continence of urine and feces on 16-level scale where 16=independent	Soiled linen Staff workload Number in nappies	N=36 (results on 18 experimental patients at 30 day followup) OC: 14/18 (78%) improved and were removed from diapers 7/18 (39%) achieved level 4 5/18 (28%) achieved level 3 2/18 (11%) achieved level 2 6/18 (33%) achieved nocturnal continence 4/18 (22%) showed no improvement Behavior relating to 'sitting' levels (5–8) more easily achieved than behavior relating dressing (9–12) and 'going to the toilet' (13–16) levels Control: showed minimal improvement	Operant conditioning led to improvement. A significant reduction in use of nappies, laundry and staff time to manage incontinence was attributed to operant conditioning. Also noticed general functional improvement among the operant conditioning group.
Van Wagenen 1969	Other: auditory signal followed by rapid forward moving series of training events	Prospective cohort	Criterion levels 1–6 where 6= self-initiated urination with no prompts		N=9 (results at 19.5 hr to 22 days) 9/9 (100%) achieved level 6	This procedure successfully trained the profoundly retarded subjects and the training transferred to other environments.

**Table D-10. Outcomes and results of included studies (trials)**

Author-Year	Toilet Training Method(s)	Study Design	Primary Outcome	Other Outcomes or Effect Modifiers	Results	Conclusions
Candelora 1977	Azrin and Foxx (TTLD) v. Dr. Spock	RCT	Mean bowel and bladder accidents/day	Successes Wet or soiled mornings <b>Healthy children</b>	<p>N=71 (results at 3 wk) Mean accidents/day/child: post training/followup TTLD: 2.28/1.59 Dr. Spock: 3.02/2.50 Mean successes /day/child: post training/followup TTLD: 2.84/3.71 Dr. Spock: 1.3/2.09 Mean wet mornings: post training/followup TTLD: 73/63 Dr. Spock: 81/73 Mean change from baseline in accidents (p=0.007) TTLD: 2.48 Dr. Spock: 1.37 Mean change from baseline in successes (p=0.003) TTLD: 2.50 Dr. Spock: 1.12 Mean difference in proportion of mornings children were wet (p=0.011) TTLD: 21% Dr. Spock: 6% Followup results for TTLD v. Dr. Spock were not significant 24–35 mo. performed better than 18–23 mos</p>	<p>The TTLD approach was significantly more effective: accidents decreased, successes increased, and there was significantly less morning wetness at pre and posttreatment. Both continued to improve at same rate on followup. Both encountered similar problems during training (refusal to comply, tantrums, loss of parental interest due to failure, and miscellaneous others). Parents found TTLD more helpful.</p>

CCT indicates controlled clinical trial; GTRP: group training regular potting; IIRP: intensive/individual regular potting; IITP: intensive/individual timed potting; mos: months; NS: not significant; OC: operant conditioning; RCT: randomized controlled trial; SCH: scheduled; STR: stool toileting refusal; TTLD: toilet training in less than a day

**Table D-10. Outcomes and results of included studies (trials) (continued)**

Author-Year	Toilet Training Method(s)	Study Design	Primary Outcome	Other Outcomes or Effect Modifiers	Results	Conclusions
<b>Healthy Children</b>						
Matson 1977	Azrin and Foxx (book + supervision) v. Azrin and Foxx (book only)	RCT	Number of accidents	Emotional side effects	<p>N=10 (results at 10 wk)</p> <p>Book + supervision 4/5 (80%) trained in 5 sessions (4–18 hr) 1/5 (20%) continued to have accidents 1/5 (20%) dropped out</p> <p>Book 1/5 (20%) trained in 1.5 sessions (6 hr) 1/5 (20%) partially trained in 5 sessions (20 hr)</p> <p>3/5 (60%) failures 3/10 (30%) of children trained also stopped nighttime wetting</p>	Training was more effective and emotional side effects (tantrums & avoidance) were more easily overcome for mothers and children in supervised group. Children <24 mo. took longer to train.
Taubman 2003	Child-orientated approach with handbook, pre-training praise and no negative terminology v. child-orientated approach with handbook	RCT	Stool toileting refusal (STR)	Hiding while defecating Effect of age begun TT on duration Age at completion	<p>N=381 381/381 (100%) trained by 3.5 ± 0.5 yr</p> <p>During training: Incidence STR (p&gt;0.10) Handbook plus: 26% Handbook: 23%</p> <p>Duration STR (p=0.03) Handbook plus: 5.1 ± 3.2 mo. Handbook: 7.3 ± 6.0 mos</p> <p>Incidence stool withholding (p&gt;0.10) Handbook plus: 55% Handbook 2: 52%</p> <p>Incidence of hiding (p&gt;0.10) Handbook plus: 70% Handbook 68%</p> <p>Age TT completed Handbook plus: 43 ± 6.5 mos Handbook: 40 ± 6.4 mos</p>	Intervention had no effect on (1) incidence of STR but shortened its duration therefore earlier completion of TT or (2) incidence of hiding while defecating. Early initiation of TT correlated with longer duration but earlier completion, but was not associated with constipation, stool withholding, or STR. Little benefit in intensive TT < 27 mo. STR preceded by constipation, painful movements, and may be associated with late TT initiation. Hiding behavior was associated with STR, constipation, and stool withholding.

**Table D-10. Outcomes and results of included studies (trials) (continued)**

Author-Year	Toilet Training Method(s)	Study Design	Primary Outcome	Other Outcomes or Effect Modifiers	Results	Conclusions
<b>Mentally Handicapped Children</b>						
Edgar 1975	Operant conditioning: relaxation-tension exercise regimen v. control	RCT	Frequency of accident Appropriate urination		N=20 (results at 2 wks) Mean adjusted accident score/8hr (p<0.05) OC: 0.37 Control: 2.13 Mean adjusted appropriate score/8hrs (p<0.05) OC: 8.1 Control: 3.9 No change: OC: 2/10 (20%) Control: 8/10 (80%)	Operant conditioning is an adjunct to promoting appropriate behavior but self-initiation might be too stringent a criterion for severely/profoundly retarded. It worked well in those who showed a tendency to hold fluids and those who constantly dribbled with no control of muscles involved in urination.
Hundziak 1965	Operant conditioning v. conventional v. control	RCT	Use of toilet for bowel and bladder elimination	Transfer of behavior to other settings	N=29 (results at 27 days) Median (IQ range) difference pre/post scores for defecation in toilet OC: 1 (0,3) (p=0.032) Conventional: 0 (0, 0.5) (p=NS) Control: 0 (0,1) (p=NS) Median (IQ range) difference pre/post scores for urination in toilet OC: 9 (2,10) (p=0.016) Conventional: 1 (-0.5, 2.5) (p=NS) Control: 1 (0,3) (p=0.032)	Operant conditioning showed significant increase in use of bathroom for bowel and bladder elimination. Conventional group showed no change and control group improved for urination only. Abilities were transferred to original living unit.

**Table D-10. Outcomes and results of included studies (observational studies and trials) (continued)**

Author-Year	Toilet Training Method(s)	Study Design	Primary Outcome	Other Outcomes or Effect Modifiers	Results	Conclusions
<b>Mentally Handicapped Children</b>						
Hyams 1992	Intensive/individual regular potting (IIRP) v. group training regular potting (GTRP) v. Intensive/individual timed potting (IITP)	RCT	Decreased incontinence Increased independence	Cost effectiveness Training time	N=15;5 / group (results at end training/10 yr.followup) Independent IIRP: 5/5 (100%) / 1/5 (20%) GTRP: 1/5 (20%) / 0 (0%) IITP: 4/5 (80%) / 0/5 (0%) No. of incontinent episodes/wk (% reduction from baseline) at 12 wk / 10 yr IIRP: 1 (99%) / 8 (88%) GTRP: 52 (39%) / 41 (52%) IITP: 23 (80%) / 30 (74%) Nurse training hours IIRP: 2330 GTRP: 1260 IITP: 2079	Intensive/individual regular training was the most successful and cost effective followed by timed training. GTRP was the least successful. Equipment was problematic and the prompt and fade procedure complex. On followup, there was complete independent toileting not maintained but prompting was considerably less than in pre-training.
Sadler 1977	Azrin and Foxx v. scheduled (SCH) v. control	RCT	Urine accidents/day	Staff preference Training time	N=14 (results at 3 mos/4 mos) Mean wets/day AF: ↓ from 1 to 0.20 / 0.11 (p<0.01) SCH: ↓ from 0.95 to 0.77 / 0.57 Control: ↓ from 0.88 to 1.07 / 0.63 Median time required in hours AF: 35 SCH: 5.3 Control: 2.9	Azrin and Foxx virtually ended daytime wetting in school setting with considerable generalization to the home. Azrin and Foxx required much more time and energy than the other programs. Scheduling somewhat reduced accidents.

**Table D-10. Outcomes and results of included studies (observational studies and trials) (continued)**

Author-Year	Toilet Training Method(s)	Study Design	Primary Outcome	Other Outcomes or Effect Modifiers	Results	Conclusions
<b>Physically Handicapped Children</b>						
van Kuyk 2001	Operant conditioning v. waiting list control	CCT	Bowel continence (Templeton, Wingspread, and constipation scores) Feces in the toilet Days without soiling Scale parental judgment incontinence	Comparisons based on age	N=27 (results at 9 mo.) Templeton score (p<0.001) OC: 1.3 ± 0.4 Waiting list: 2.2 ± 0.8 Wingspread score (p<0.001) OC: 1.8 ± 0.6 Waiting list: 2.9 ± 1.1 Constipation (p<0.05) OC: 1.1 ± 0.4 Waiting list: 1.7 ± 0.6 Feces in the toilet (p<0.001) OC: 82.7% Waiting list: 40.2% Days without soiling (p<0.001) OC: 10.8 ± 3.0 Waiting list: 5.9 ± 5.4 Parental judgment incontinence scale (p<0.05) OC: 12.4 ± 5.2 Waiting list: 16.4 ± 7.1	OC group exhibited significant change on all outcomes over waiting list group. Multidisciplinary behavioral intervention effective in treatment of constipation and incontinence in children with Hirschsprung's disease. There was no difference based on age. Success was maintained at followup.

# Appendix E: List of Excluded Studies

## Inappropriate Study Design

1. Abidari JM, Shortliffe LMD. Urinary incontinence in girls. *Urol Clin North Am* 2002;29(3):661.
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## Appendix G: Abbreviations

AAP	American Academy of Pediatrics
ADHD	attention deficit and hyperactivity disorder
CCT	controlled clinical trial
CG	conventional group
CIC	clean intermittent catheterization
CPS	Canadian Paediatric Society
DSM IV-TR	Diagnosis and Statistical Manual IV - Text Revised
LUTS	lower urinary tract symptoms
MC	mentally handicapped children
NR	not reported
OC	operant conditioning
RCT	randomized controlled trial
RT	regular toileting
SA	social age
SCH	scheduled
SD	standard deviation
SI	self-initiated
SIE	self-initiated elimination
STR	stool toileting refusal
TEP	technical expert panel
TT	toilet training
UK	United Kingdom
VSMS	Vineland Social Maturity Scale

## **Appendix H: Toilet Training Methods**

- H-1. Child-Oriented Toilet Training Method
- H-2. Azrin and Foxx Toilet Training in Less Than a Day Method
- H-3. Early Elimination Toilet Training Method
- H-4. Dr. Spock's Toilet Training Method

## H-1. Child-Oriented Toilet Training Method

### Objective

To prevent problems for a child in learning bowel and bladder control. Learning this control is a major developmental task and proper timing may enable a child to master the acts for him or herself. Training must proceed slowly to allow for periods of negativity that are common in this age group. If there is a breakdown at any time during training, parents are advised to stop and to reassure the child that he or she is not bad, but will learn when ready.

### Readiness

- Child must be able to sit and walk.
- Child must have some understanding of verbal commands.
- Child displays psychological readiness:
  - has a desire to develop autonomy and self mastery,
  - feels secure with parent figures and has a desire to please them, and
  - has a wish to identify with and imitate important people in the child's life.
- Parents must ready themselves and deal with outside pressures and anxieties about toilet training, aiming for a relaxed, pressure-free approach.

### Method

1. Around 18 months of age, introduce a potty chair as the child's "own chair". Allow the child to get familiar with it and verbally associate it with the parents' toilet.
2. Daily, have the child sit on the chair fully clothed when the parent uses the toilet. Parents may read or offer treats to the child while he or she sits but allow the child to leave at will.
3. After 1 to 2 weeks cooperation, remove the child's diaper and have him or her sit on the potty. Make no demands nor attempts to catch anything.
4. When the child is comfortable with the potty and eliminates in his or her diaper, take the child to the potty, empty the diaper into it and explain that this is where bowel movements go.
5. If the child appears to understand, take the child to the potty several times a day.
6. As interest grows, remove diapers and pants for short periods, place potty nearby and encourage the child to use it at will and independently. Periodic reminders may be given.
7. If child is progressing then put into training pants and instruct how to raise and lower them.

After bowel control is obtained, boys can learn to urinate while standing by imitating other males. Nap and night training is left until later if it does not occur simultaneously with daytime control.

## H-2. Azrin and Foxx Toilet Training in Less Than a Day Method

### Objective

To teach child to toilet him/herself without reminders or assistance.

Training begins at about 20 months of age. Assess bladder control, physical development and ability to follow instructions to see if child has developed sufficiently to acquire toilet training skills. A child is ready to be trained if he or she:

- has bladder control, that is, the child urinates all at one time (not constant dribbling), stays dry for several hours and appears to know when he or she is about to urinate, e.g., facial expression or posture changes];
- is physically ready, i.e., picks up objects easily and walks without assistance; and
- can follow 10 instructions: point to nose, eyes, mouth, hair, sit on a chair, stand up, walk with parent to another room, imitate simple tasks, fetch a particular object, and place one object inside another.

### Pre-training experiences

- Teach the child to assist in own dressing and undressing, especially raising and lowering pants.
- Allow the child to watch others toilet and explain the steps they are following.
- Teach the toileting words to be used during training.
- Teach the child to cooperate when given instructions; do not allow an instruction of which the child is capable to go unfulfilled; do not allow temper tantrums to discourage progress.

### Training supplies and setup

- Conduct training in one room.
- Eliminate or minimize all interruptions and distractions, e.g., toys.
- Have a ready supply of child's favorite drinks, snacks, and treats.
- Use a potty chair designed so a child can easily remove the pot from the chair and replace it.
- Have a doll that wets to demonstrate to the child the urination process.
- Make up a list of the persons and characters (real or fictional) the child admires to use to praise the child and indicate how pleased they will be to hear of the child's success.
- Have at least eight pairs of training pants large enough for the child to easily lower and raise.
- Have child wear a short T-shirt that will not interfere with lowering and raising training pants. Teach child to grasp pants in the middle of the back, palm facing backward, and mid-front for easier lowering and raising.

### Method

Provide immediate, varied (juices, edibles, treats, hugs, etc.), positive reinforcement at every instance of correct toileting skill, e.g., approaching potty, grasping pants, sitting on potty, etc. Do

not reinforce non-toileting acts. Tell the child how happy [name significant other] will be that the child is learning to use the potty and to keep pants dry.

Accidents: Verbal reprimand, omit reinforcement, have child change wet pants to dry ones by him or herself, conduct 10 rapid “positive practice” sessions as follows:

1. Use the doll that wets to imitate the processes of toileting and teach specific actions. Manually guide child through the proper actions, then let the child guide the doll through the process.
2. When the doll urinates in the potty, teach the child to remove the pot, empty it into the toilet, flush and return the pot to the chair. Once this is learned, begin training child.
3. Teach the child to check and identify dry pants from wet pants. Reward/praise dry pants. Perform checks every 3 to 5 minutes and keep track using a training reminder sheet.
4. Give child as much to drink as desired to create a strong, frequent desire to toilet (at least 8oz/hr). Use as a positive reinforcement.
5. Instruct child to walk to the potty, lower pants, sit down quietly for several minutes, stand up, and raise pants. Watch to see if urination begins and praise/ reward immediately.
6. After urination takes place, the have child wipe him or herself, and empty and replace pot as in 2 above.
7. Increased number of trials: give prompted potty trials every 15 minutes in the beginning, decrease frequency as child acquires skill.
8. Conduct “dry pants” checks every 5 minutes, have child do it as well.
9. At first, have child sit on the potty about 10 minutes; after two to three successful urinations into the potty and much praise, the child will begin to understand and prompting and sit time can be reduced.
10. Gradually change from directing child to “go potty” to asking child if he or she has to “go potty” to general questions such as “Where do you go potty?” and “Are your pants dry?”. Once child goes potty after a general question, only comment on dry pants.
11. As child acquires skills and performs actions correctly, give approval only at the end of an action rather than during it. Eventually reduce to praising only dry pants.
12. For next several days, do dry pants checks at meals, naps, bedtimes, etc., and praise each time pants are dry. If there is an accident, reprimand the child, have the child change by him or herself, and perform more practice sessions. No reminders to toilet are given.

### H-3. Early Elimination Toilet Training Method

#### Objective

At one year old, child is expected to control elimination, walk, and verbalize simple needs.

#### Method

1. Bowel and bladder training begin simultaneously at 2 to 3 weeks of age.
2. Initially, the mother assumes all responsibility by placing child in a special training position outside the house when she senses the child needs to eliminate (e.g., after feeding and waking).
  - a. For voiding, mother sits with legs extended straight out, places the child in a sitting position between them facing away from her and supported by her body. She then makes a “shuus” sound so child learns to associate it with voiding. This is done many times over 24 hours. If successful, the child is rewarded with feeding, close contact or other pleasurable activity.

The child is expected to gain competence in communicating his or her need to void and climb into the assumed position and urinate by 4 to 5 months.

- b. For bowel movements, mother sits on the floor with knees bent, infant facing her, supported by her lower legs. Child’s legs are placed over hers. The mother’s feet provide a kind of potty. No sound is made. If elimination occurs, the child is rewarded by pleasurable activity; if not, the child is returned matter-of-factly back to previous activity.

During elimination, social activity carries on; elimination is not regarded as private or unclean.

The mothers claim to learn to read infants’ movements, skin and muscle tension, and also distinguish a language of grimaces, grunts and cries to signal need. When specific pushes and shoves are detected while carrying a child on her back she may occasionally stimulate a sphincter reflex with a gentle pat to the rear.

3. At 3 to 5 months, young girls 5 to 12 years old also learn the child’s signals and participate in further training by assuming elimination positions at appropriate times. Helpers are scolded or punished if they are not responsive or sensitive to infant’s needs.
4. Occasional accidents are expected and handled casually; caregiver cleans up immediately.
5. At one year, when infant begins walking, he or she is expected to eliminate away from the living area of the house. Accidents in the living area or courtyard first attract warnings and later physical punishment.

## H-4. Dr. Spock's Toilet Training Method

### Objective

To train without force. Most children are ready between 2 and 2.5 years of age. If parents wait until a child is ready, the child will learn without being forced, and the process will be more relaxed and pleasant with fewer power struggles. The child must decide to gain control of bowel and bladder to be more grown-up. Parents must trust the child's desire and be patient. Once training begins, parents must be consistent and convey the expectation that the child will toilet as older people do by praising and encouraging success, and avoiding criticism and anger in the event of accidents and refusal.

### Pre-training experiences

Allow the child into the bathroom with other family members to learn about potting, but without the pressure to perform. Teach the child to wash his or her hands afterwards. Talk about what is happening so the child learns the words and also that toileting is a straight forward fact of life and not dirty, shameful, secret, or mysterious. Avoid commenting on how smelly or messy "poop" is so the child does not confuse criticism of evacuation with criticism of him or herself.

### Training supplies and set-up

- small plastic child-size potty chair with the urine guard removed (boys and girls should learn to eliminate in the sitting position),
- step stool and small bar of soap so the child can learn handwashing, and
- books or toys near the potty to entertain the child.

### Method

1. Get the child used to the potty chair. Have the child sit on the potty fully clothed for as long or short as child chooses.
2. Once the child has accepted the seat, suggest the child use it for bowel movements the way the parents do. Let the child leave the seat whenever the child chooses so he or she does not associate potting with punishment or imprisonment. They ought to think of it as a voluntary act carried out with pride; do not urge or pressure the child if the child is unwilling. If movement occurs in diaper, show the child how to deposit it in the potty and say that is where he or she will do it soon, too. Do not empty the potty into the toilet and flush it while the child is watching.
3. Once the child shows interest, take the child to the potty two to three times per day, especially if signals of impending elimination are detected. Praise the child for being dry for long periods just like "parent or favorite character." Do not over-praise, as this age group does not like to be too compliant. When the child appears ready to be more independent, remove all lower clothing and place the potty nearby explaining to the child that he or she can use it whenever they need to by him or herself. The parent may give occasional reminders. Put the child back in diapers if the child resists or has an accident.

Children usually achieve bowel and bladder control at the same time. Once this control is obtained, switch the child to training pants. Do not scold the child for the occasional accident. Boys will learn to stand and pee sooner or later from imitation.

Once control is achieved, teach proper wiping and handwashing. Teach the child to wipe from front to back; the parent may have to complete the job at first.