Enuresis and Encopresis: The Elimination Disorders

Janet E. Fischel and Kate E. Wallis

The childhood elimination disorders have been written about extensively in the psychological, medical, child developmental, urological, and pediatrics literature. In fact, the Winter 1976 issue of the Journal of Pediatric Psychology was entirely devoted to this topic. Nearly four decades later, there is still abundant ongoing research addressing etiological frameworks as well as risk factors, comorbidities, and treatment strategies.

Toilet training has as its goal the individual’s continence of urine and feces, with elimination occurring in socially acceptable places. None of us began life with this skill in place; instead we learned it with the help of parents and other adults who taught us when to eliminate and when to withhold urine and feces. In their classic study of 22 cultures, Whiting and Child (1953) described that achieving continence is among the most basic and universal targets of socialization everywhere. Furthermore, virtually every culture appears to succeed in toilet training between 80 and 90% of its new members within the expected time limit. The few who remain untrained, or who do train and then relapse, are said to have an elimination disorder.

Our goal in this chapter is to summarize what is known about the etiology, diagnosis, and treatment of elimination disorders in children who do not achieve continence at the culturally expected time or who revert to incontinence after a period of continence has been achieved. We rely on the diverse current literature as well as clinical experience to gain a comprehensive understanding of these important childhood disorders.

Physiology of Urination and Defecation

The Physiology of Urination

The human bladder is a hollow organ made up of an inner epithelial layer (uroepithelium), a muscular layer (detrusor vesicae), and connective tissue. Urine is continuously collected as the ureters allow the passage of urine from the kidneys into the posterior portion of the bladder. As urine accumulates, the bladder stretches while the detrusor muscle relaxes, and the bladder neck and sphincter muscle contract to prevent the passage of urine into the urethra. As this occurs, an initial urge to urinate must be voluntarily suppressed until reaching a toilet.

Casey (2011) provides an excellent review of both healthy and atypical bladder function. The bladder has input from three different nervous system pathways: somatic, parasympathetic, and sympathetic. When controlling the urge to urinate, the somatic nervous system pathway is
stimulated, leading to contraction of the sphincter muscle to maintain continence. During this filling phase, the sympathetic nervous system assists by causing active relaxation of the detrusor muscle. Through this mechanism, the bladder can increase its volume without increasing its pressure.

When a conscious decision to urinate is made, or when the bladder reaches its capacity, the somatic pathway is inhibited, leading to sphincter relaxation. The parasympathetic nervous system pathway overcomes the sympathetic signals, causing contraction of the detrusor muscle. This increases the pressure within the bladder to exceed the pressure of the bladder outlet, allowing urination to occur (Casey, 2011).

Bladder control relies on careful coordination of the various neurological inputs. To achieve successful toilet training, a child must be trained to sense bladder filling, to coordinate the suppression of urination, and to release urine upon reaching a toilet. The inability to reach this developmental milestone is known as urination incontinence or, also termed, enuresis. Successful toilet training is presumed to involve increasing the individual’s sensitivity to appropriate body signals and/or increasing voluntary control over the relevant muscles.

The Physiology of Defecation

The digestive tract is a long, hollow tube, with the colon (large intestines) and rectum at the distal end. After food is digested in the stomach and small intestine, the remaining waste products move through the colon and gradually shift from a liquid state to a semisolid state as water is reabsorbed. When sufficient waste accumulates, muscle contractions move that waste down the colon and into the rectum. The resultant stretching of the walls of the rectum leads to the urge to defecate, prompting the automatic relaxation of the internal anal sphincter. If convenient, voluntary actions allow for defecation to take place by relaxing the external anal sphincter and the puborectalis muscle. As this occurs, diaphragmatic contraction raises the intra-abdominal pressure to allow for the passage of stool (Bharucha, 2008). The urge to defecate can be controlled until a toilet is available by the voluntary contraction of the external anal sphincter and the levator ani muscles. Alternately, the inability to exhibit control over these mechanisms is known as encopresis, defined as passing feces anywhere but into a toilet.

Developmental Considerations

Readiness in Typically Developing Children

Most parents in the USA focus on the task of toilet training between 2 and 3 years of age, and most children complete toilet training before their fourth birthdays. In other cultures, the timing of this active training phase may be older or indeed younger. Societal expectations about continence and parental methods to achieve that goal differ widely as well (Whiting & Child, 1953). In western cultures, where the active phase of toilet training typically occurs between 2 and 3 years of age, there are “readiness” skills that afford caregivers the opportunity to lay the groundwork for training. Usually, parents or caregivers recognize a child’s adoption of regular routines for feeding and sleeping and note that the child has the communication skills and motivation to step up to the active training phase.

There are several important skills children need to acquire in order to succeed in toilet training. These can be framed in five domains: communication skills, social and emotional skills, fine motor skills, gross motor skills, and cognitive skills. In the communication realm, a child needs to convey to caretakers that the need to eliminate is imminent. The child’s social-emotional development must be at a level to understand the parental or caretaker expectations of appropriate toilet use. Fine motor skills are required to manipulate such items as clothing or toilet paper, while gross motor skills are necessary to achieve the posture/positions for defecation and urination into a toilet. The cognitive requirements in toilet learning are several. Cognitive monitoring is required in the form of
planfulness, self-control, and understanding the meaning of relevant bodily sensations. Parents and caretakers are helpful in this regard during the active training period, engaging in frequent prompting, inviting, reminding, or other close monitoring, and these efforts afford the child guidance to facilitate success.

Transient Regression

Once toilet learning is achieved, parental prompting generally continues for several months more, focused mostly on high-risk times when the child’s motivation or attention might be challenged (e.g., before attending a birthday party and before car, train, or airplane journeys). Events involving major changes, whether stressful or joyous, such as moving to a new family home or the birth of a sibling, should be viewed as risks for relapse or regression with newly acquired toileting skills. Such regression is typically transient if managed appropriately and promptly, helping the child return to continent status. Importantly, these relapses, if short lived, do not merit a diagnosis of an elimination disorder.

Challenges in Children with Developmental Atypicalities

Children with developmental delays or atypicalities that impact communication skills, social and emotional development, fine or gross motor abilities, or more global cognitive skills face unusual challenges in toilet learning. For some, delaying toilet training affords the child more time to mature in developmental areas called into play in the training process. For others, modifications in communication, such as employing nonverbal signals or signs or training programs that enhance motivation to use the toilet or careful attention to clothing that does not require the more complex fine motor skills of unbuttoning or unzipping, may help to structure successful toilet learning. For others, parents and caretakers might shift to time training, a method of scheduled toilet visits, often after meals or snacks, or perhaps even hourly, in lieu of the more typical combination of parental prompts and child recognition of bodily cues.

The challenges for children with significant developmental difficulties are several. Among them are managing such problems as fear of toilets, “pot phobia,” poor engagement with parental/societal expectations, difficulty in identifying appropriate motivators or small rewards to strengthen appropriate behaviors in child training, or poor generalization of training success from one toilet or locale to others. Of note, quality of life for children with significant developmental disabilities and their families is certainly enhanced if continence can be achieved. Such children can participate in school excursions and a wider range of activities and will likely have more social options than children who remain untrained and require diaper changes and caretakers willing to attend to their cleanliness.

Nomenclature

Terminology

The terminology to define variations in types of childhood elimination disorders has not enjoyed firm standardization. In fact, the nomenclature of these disorders is frequently difficult or elusive, with terms that are seemingly interchangeable and with conditions that can be both a symptom and a disorder. Diagnosis is, in part, dependent on age or developmental status and impacted by functional or organic factors, further complicating the diagnostic schema. In this section, terminology is offered according to current literature preferences, and those labels will be used throughout this work as consistently as possible. Figures 32.1 and 32.2 reflect current terminology and distinctions of importance in urinary incontinence (continuous vs. intermittent, daytime vs. nocturnal) and fecal incontinence or encopresis.
It is important to have any child with an elimination disorder checked by a physician to evaluate for possible organic contributions.

**Urinary Incontinence**

Work done in the fields of urology, general pediatrics, gastroenterology, and neurology sometimes utilizes nomenclature different from the Diagnostic and Statistical Manual of Mental Disorders (DSM-5). One such classification system that has been discussed and adopted in several research protocols is that proposed by the International Children’s Continence Society in 2006 (Nevéus et al., 2006). Researchers had advocated for its inclusion (von Gontard, 2011), but this nomenclature was not adopted in DSM-5. Nonetheless, the terminology is utilized below because it provides for important clinical distinctions.

**Continuous Incontinence vs. Intermittent Incontinence.** Continuous incontinence means constant urine leakage and is associated with anatomic abnormalities. Intermittent incontinence is urine leakage that occurs in discrete amounts alternating with maintenance of urinary continence (Nevéus et al., 2006).

**Nocturnal vs. Daytime Incontinence.** The 2006 recommendations differentiate nocturnal incontinence, defined as enuresis, from daytime incontinence. Children who wet themselves...
during both the day- and nighttime have dual diagnoses, both daytime incontinence and enuresis. Daytime incontinence is characterized based on the frequency of incontinence, the voiding frequency in a 24-h period, voided volumes, and fluid intake. Children who suffer from urinary urgency are considered to have an overactive bladder (Nevéus et al., 2006).

Of note, the American Sleep Disorders Association has its own Classification Manual that describes the diagnostic criteria for “Sleep Enuresis,” which is “characterized by recurrent involuntary micturition that occurs during sleep” (Diagnostic Classification Steering Committee, 1991, p. 101).

Monosymptomatic vs. Nonmonosymptomatic Enuresis. Children who present with enuresis (nighttime incontinence) alone without bladder dysfunction are considered to have monosymptomatic enuresis. Children with enuresis and other lower urinary tract symptoms are considered to have nonmonosymptomatic enuresis. These additional symptoms can include abnormal voiding frequency (considered fewer than or equal to three voids or more than or equal to eight voids daily), daytime incontinence, urgency, hesitancy at initiation of micturition, pain, or abnormal urine stream (including a weak stream, intermittency, or straining) (Nevéus et al., 2006).

Fecal Incontinence

Retentive vs. Nonretentive Encopresis. "The Diagnostic and Statistical Manual of Mental Disorders, 5th Edition, makes a distinction between encopresis with constipation and overflow incontinence and encopresis without these features (American Psychiatric Association, 2013). Fecal incontinence in children with evidence of constipation on physical exam or by history occurs as a result of leakage of generally poorly formed stool. This more common cause of encopresis is referred to as retentive constipation and overflow incontinence. In fact, Loening-Baucke (2007) reports that among a cohort of children with constipation, 18.3 % had functional fecal incontinence, but among children without constipation, only 0.3 % had functional fecal incontinence.

Retentive encopresis can become a vicious cycle. In its normal state, the rectal vault is empty. However, when a person holds back stool voluntarily, the rectum and lower colon become filled with fecal material. If withholding continues, a large quantity of stool will accumulate, and, as a result, the lower colon will become very distended. Concurrently, the body will absorb almost all of the water from the fecal mass, leaving hard, impacted stool. In this condition, passing stool is extremely painful or impossible, compounding the problem and causing the child to withhold to avoid the pain. The urge and ability to defecate are therefore significantly reduced. Fluid-containing stool from the upper colon now can no longer be passed due to obstruction of the rectum. But liquid stool will almost invariably leak around the impacted fecal mass, producing soiled underwear.

Accompanying the retentive pattern may also be inappropriate closure of the external anal sphincter precisely at times when its relaxation is necessary for proper defecation. This "paradoxical constriction" of the sphincter can delay defecation or truncate the experience, yielding only partial defecation, further compounding the child’s constipation. It is therefore not surprising that a history of painful and effortful defecation is present in the majority of children who suffer from fecal soiling (Partin, Hamill, Fischel, & Partin, 1992). Children who suffer from encopresis without constipation or overflow incontinence tend to have encopretic feces that are “of normal form and consistency” (American Psychiatric Association, 2013, p. 358).

These distinctions are adopted into the literature using the following terms: retentive encopresis to describe fecal incontinence with constipation and nonretentive encopresis to describe fecal incontinence without constipation. Literature in the last decade, however, sometimes refers to soiling and overflow soiling to describe the retentive pattern more specifically (Dobson & Rogers, 2009; Murphy & Carney, 2004), while researchers and practitioners also utilize the term soiling as a simple descriptor of fecal incontinence.
Prevalence

The prevalence of the childhood elimination disorders is difficult to quantify, both because of the various methodologies used to estimate prevalence and the definitional issues described above that have been modified over time. It is clear that prevalence estimates for both urinary and fecal incontinence decrease with increasing age, and the prevalence of urinary incontinence outweighs that of fecal incontinence by a factor of about three or more. Approximately 5–10% of 5-year-olds, 3–5% of 10-year-olds, and about 1% of 15-year-olds or beyond meet the definition for urinary incontinence (American Psychiatric Association, 2013). Some authors have found substantially higher prevalence rates, especially when looking at enuresis alone (Joinson et al., 2007; von Gontard, Heron, & Joinson, 2011). The prevalence of fecal incontinence at age 5 years has been estimated at 1–2.2% (American Psychiatric Association, 2013; Bellman, 1966) and at age 6 years at 1.4–1.9% (Bellman, 1966; von Gontard, Moritz, Thome-Granz, & Freitag, 2011).

Etiological Considerations

A number of broad models have been put forth as general explanations of functional (nonorganic) elimination disorders. These may be structured along parallel paths for enuresis and encopresis. Additionally, two models have emerged with a focus on the etiology of nocturnal enuresis, or monosymptomatic nocturnal enuresis, the most prevalent of the elimination disorders. One provides a predominantly physiologically based conceptual framework, and one highlights potential neurodevelopmental underpinnings of the disorder. While there are variations within each of the following approaches, no causal model of the elimination disorders is complete without acknowledgment of the familial nature of the disorders, that is, the disorders tend to run in families (Bellman, 1966; von Gontard, Heron, et al., 2011). Evidence to that effect suggests that a genetic etiological picture deserves continued exploration.

The Psychodynamic Model

According to a psychodynamic formulation, toilet training reflects a psychological conflict between child and parents, one that must be resolved in the child’s psyche before full continence is attained. In this perspective, achievement of bladder and bowel control occurs during the anal stage of psychosexual development. Inspired by psychodynamic views that parent–child conflict or poor parent–child dynamics may be characteristic of the family with an incontinent child (e.g., Stein, 1998), one might interpret the correlation between parent–child conflict and elimination disorders by assuming that the interpersonal conflicts cause the elimination disorders. In contrast, such conflicts are interpretable as the effects rather than the cause of incontinence (Vivian, Fischel, & Liebert, 1986). In their discussion of enuresis from a biopsychosocial perspective, Bischof and Benson (2004) provide an interesting discussion of family characteristics, acknowledging the difficulty in determining causal pathways of impact.

The Learning or Skills Deficit Model

According to the learning/skills deficit model, individuals with elimination disorders have not received the amount or kind of training necessary to become continent. A child’s failure to become continent may occur because caregivers or parents used inadequate teaching methods or perhaps because the child was an unusually slow learner or learned faulty elimination skills. In sum, the child is presumed to have not yet learned to attend and respond appropriately to bodily cues indicating the need to eliminate.

When applied to the case of nocturnal enuresis, the learning or skills deficit model might suggest that the child has not developed adequate learned arousal from sleep in response to cues of a full bladder (Moffatt, 1997). When applied to retentive encopresis, the learning or skills deficit model might be exemplified by escape and avoidance learning. Whether initial toilet training was
"complete" or not, a child who experiences highly effortful or uncomfortable stool passage gradually learns to avoid defecating. Whatever the cause of painful defecation may have been initially, the acquired tendency to inappropriately suppress the urge to defecate by stopping the necessary sphincter relaxation eventually leads to stool retention, overdistention of the rectal vault, and inordinately hard and large fecal matter retained instead of released. Subsequent attempts to defecate will prove uncomfortable, which the child avoids or escapes by further stool retention, compounding the problem.

The Improper Diet Hypothesis

A third etiological model of elimination disorders is the improper diet hypothesis. According to this view, dietary excesses or deficits cause problems with voiding or defecating. In the case of retentive encopresis, diets with inadequate roughage are considered to potentiate constipation and effortful, painful stools with the eventual development of withholding. In parallel fashion, enuresis is sometimes blamed on excess fluid intake during the hours just before bedtime.

Neurodevelopmental Immaturity or Delay

Bed-wetting beyond the age of 5 years and without other clear organic or pathological findings is the most prevalent of the elimination disorders and has spawned interest in etiological considerations. Subtle developmental delay, subtle maturational delay, or difficult temperament are raised in considerations of etiological or concomitant factors associated with bed-wetting, day wetting, or soiling problems (Joinson, Heron, Butler, & von Gontard, 2006; Joinson et al., 2008; Sethi, Bhargava, & Shipra, 2005). Speculation of neurodevelopmental atypicalities or immaturity, sometimes focused on bladder control, but more recently viewed in a broader framework, has received research attention in a number of studies. For example, an increased frequency of bed-wetting in children with, compared to children without, minor neurological dysfunction has been noted (Lunsing, Hadders-Algra, Touwen, & Huisjes, 1991). Further support for maturational deficits in motor performance is found in work focusing on the brain stem in an extensive assessment of the motor function of children with, and comparison children without, nocturnal enuresis (Freitag, Rohling, Seifen, Pukrop, & von Gontard, 2006). These studies suggest that maturational deficits in motor cortex circuitry may play a role in the development of enuresis (von Gontard, Freitag, Seifen, Pukrop, & Rohling, 2006). Support for a neurodevelopmental model can be found in the expectation that prevalence rates of intermittent urinary incontinence diminish with age.

A Three-Systems View of Enuresis

Butler and Holland (2000) and Butler (2004) have proposed a "three systems" model of children's nocturnal enuresis, with supporting evidence from the literature to assert that one or more physiologic/biochemical/psychologic systems is functioning inadequately in enuretic children. The model includes (a) excessive nocturnal urine production (because of a lack of circadian rhythmicity and inadequate production of vasoressin during sleep), (b) bladder overactivity, and (c) the inability to awaken from sleep when the bladder is full. Importantly, the model does not implicate "deep sleep," as enuresis appears to be uncorrelated with sleep stage, but rather the inability to arouse in response to important bladder capacity cues. The model provides guidance for considering treatment options such as the urine alarm and anticholinergic medication (Butler, 2004) or perhaps the use of focused training exercises such as the holding exercise (Van Hoeck et al., 2007) by identifying the probable etiologic cause among the three described above and selecting a therapy considered to be most appropriate for that causal pathway.
**Risk Factors and Concomitant Problems**

A number of concomitant conditions have been considered as contributors to, correlates of, or risk factors for the elimination disorders. Several of these are reviewed here. Note, however, that consensus is missing on four key issues: (1) prioritizing the relative importance of each, (2) careful attention to the prevalence of each, (3) evidence base for a singular or unique model of contribution vs. a multifaceted one, and (4) evidence for causal vs. correlate relationships between elimination disorders and concomitant conditions.

**Concomitant Problems with Affective, Behavioral, and Social Characteristics**

Psychological and behavioral problems often co-occur with elimination disorders. Understanding these relationships is challenging, but the co-occurrence affirms the importance of appropriate screening for affective, behavioral, academic, or social concerns. Further, treatment success may be impacted by concomitant difficulties (Stark, Spirito, Lewis, & Hart, 1990), whether eventually viewed as causal or correlate characteristics.

**Enuresis and Self-Esteem, Attachment, and Prosocial Skills.** Studies with relatively small samples have explored the psychological correlates of enuresis from a variety of perspectives. For example, a Brazilian study embedded in the Rorschach method found that a sample of children with enuresis (not of organic origin, predominantly primary enuresis) demonstrated characteristics of lower self-esteem than controls (Semer & Yezigi, 2009). An Italian study in which enuretics and nonenuretics were matched on gender and age also found significantly lower self-esteem, as well as lower incidence of secure attachment, and higher rates of behavioral difficulties for the enuretic sample, with no differences in six dimensions of temperament studied between groups. Of note, the behavior difficulties spanned a wide range of characteristics, including conduct and emotional problems, hyperactivity, diminished prosocial behaviors, and difficulty with peers (Coppola, Costantini, et al. 2011). Zink, Freitag, and von Gontard (2008) reported that in their sample of children between 5 and 16 years of age with day and night wetting disorders referred to a tertiary care center for evaluation of behavioral concerns, the Achenbach Child Behavior Checklist (CBCL) completed by parents demonstrated that externalizing disorders were more than twice as likely to be present than internalizing disorders. Within the subset of children with monosymptomatic nocturnal enuresis, both internalizing disorders and the frequency of occurrence of at least one ICD-10 psychiatric diagnosis were diminished compared with children for whom nonmonosymptomatic nocturnal enuresis or urge incontinence or voiding postponement were diagnosed. Again employing the parent completed CBCL in an evaluation of over 300 5- to 7-year-olds in Istanbul, Erdogan et al. (2008) found that children with enuresis had elevated total problem scores and elevated social problem scale scores compared with nonenuretics, but the percentage of children with elevated scores that reached the clinically significant range of the CBCL did not differ between the two groups.

**Enuresis and Attentional Problems.** Particular focus has been given to the prevalence of attention-deficit/hyperactivity disorder (ADHD) as an associated finding for children with enuresis. This is an interesting association, as ADHD is among the most prevalent of childhood psychological problems and the co-occurrence of ADHD and elimination disorders stimulate consideration of immaturity or delays in central nervous system function in the context of etiological hypotheses (Shreeram, He, Kalaydjian, Brothers, & Merikangas, 2009), von Gontard, Moritz, and colleagues (2011) identified an association between attention-deficit/hyperactivity disorder and enuresis, particularly daytime urinary incontinence. Baeyens et al. (2004) found an impressively increased occurrence of attention-deficit/
hyperactivity disorder associated with enuresis (based on a mostly nonmonosymptomatic nocturnal enuretic sample) in their university hospital setting in Belgium. And their 2-year follow-up study suggested that the presence of ADHD increased the probability of continuing with difficult-to-cure enuresis. Specifically, enuretics with ADHD were over three times more likely to have continued enuresis than children without ADHD (Baeyens et al., 2005). The authors provided a further 4-year follow-up report, in which 64% of the baseline attention-deficit/hyperactivity disorder diagnoses were reconfirmed. At that end point, the continued occurrence of enuresis had declined and did not differ between children with and children without an initial or a 4-year follow-up point diagnosis of attention-deficit/hyperactivity disorder (Baeyens, Roeyers, Van Erdeghem, Hoebeke, & Vandekerckhove, 2007). In other words, the early trajectory of the co-occurrence of the two disorders suggests delayed achievement of continence, while 4-year outcomes do not appear to differ between children with or without ADHD.

In a nationally representative sample of US children aged 8–11 years, attention-deficit/hyperactivity disorder was highly associated with nocturnal incontinence (Shreeram et al., 2009). As Shreeram et al. (2009) and others point out, it is clearly important to further disentangle subcategories of attentional disorders, elimination disorders, and the outcomes of interest in these data, when treatment is ongoing for enuresis, attention-deficit/hyperactivity disorder, or both.

Encopresis and Anxiety, Depression, and Attentional, School-Related and Disruptive, and Oppositional Problems. The associated behavioral problems and lower self-esteem suggested in studies of childhood enuresis are echoed in investigations of the concomitant difficulties of children with encopretic problems. However, there appears to be less specificity in identifying any one or set of consistent problems concomitant with fecal incontinence (von Gontard, Baeyens, Van Hoecke, Warzak, & Bachmann, 2011). Joinson and colleagues (2006) reported that a large population-based sample of children aged 7–8 years with soiling problems experienced significantly higher rates of anxiety disorders, depressive disorders, and attentional and oppositional disorders, with rates of most of these disorders increasing as a function of frequency of soiling. Cox, Morris, Borowiz, and Sutphen (2002) utilized an extensive set of psychometric evaluations to investigate differences between children with and without chronic encopresis. They found substantial evidence for the more likely presence of school achievement problems, anxiety and depressive symptoms, family environment difficulties, more attentional problems, social problems, and increased disruptive behavior for children with encopresis compared with those without the difficulty. Interestingly, the lower self-esteem sometimes reported as characteristic of these children did not reach significance in this sample.

While there remain a number of nuanced and perhaps tangled findings in our understanding of the possible affective, behavioral, and social problems associated with the elimination disorders, it is clear that psychological issues occur at disproportionately higher rates in children with vs. without elimination difficulties. Such considerations make the comprehensiveness of evaluation as well as the careful consideration of treatment of clinical symptoms beyond the elimination disorder all the more important in the effort to enhance both treatment adherence and success (von Gontard, Baeyens, et al., 2011).

Concomitant Problems with Biophysical Characteristics

Several variables have been explored from a biophysical context in the search for correlates or causes of the functional elimination disorders. For example, smaller bladder capacity, hormonal variations, or circadian rhythm disturbances have been explored in the study of urinary incontinence (Jackson, 2007; Van Hoecke et al., 2007) and hormonal variations, as well as motility issues have been explored in the study of fecal incontinence (e.g., Raghunath et al., 2011; Stern et al., 1995).
Sleep Apnea/Sleep Disturbances. Recent studies have documented a relationship between enuresis and sleep disordered breathing or obstructive sleep apnea (OSA). For example, Barone et al. (2009) found that 80% of children with monosymptomatic nocturnal enuresis had OSA, compared with 45.1% without monosymptomatic nocturnal enuresis. Bascom et al. (2011) found a statistically significant difference in sleep disordered breathing among children with enuresis and daytime incontinence compared to children with monosymptomatic enuresis alone.

The etiological mechanism thought to be responsible for this relationship is related to the increases in intrathoracic pressure from apneic episodes. In turn, this increased pressure transmitted to the right atrium of the heart may result in the release of natriuretic peptides, increasing the excretion of sodium and water, thus increasing urine volume. Therefore, a plausible biological mechanism may link the presence of OSA to the development of enuresis through the production of large urine volumes (Su et al., 2011).

Other studies have been unable to find a uniform association between OSA symptoms and the prevalence of enuresis. For example, Su et al. (2011) found that among males, there was no correlation between OSA and the enuresis prevalence. But among females, the prevalence of nocturnal enuresis increased with increasing severity of OSA symptoms as assessed by a sleep questionnaire. Utilizing home sleep studies, Bader, Nervous, Kruse, and Sillen (2002) found minor differences in the sleep of children with and without enuresis, namely, an increased number of shorter sleep cycles during the night in enuretic children, but their results lacked a correlation between OSA and enuresis. In conclusion, while sleep disordered breathing and OSA may provide a plausible biological mechanism for explaining enuresis, current data do not consistently demonstrate a relationship.

Breast-Feeding. Enuresis is thought to be related to developmental delay, and breast-feeding is thought to be a protective factor against developmental delay. Therefore, researchers have attempted to analyze the relationship between enuresis and breast-feeding. A study of 55 cases and 117 controls suggests that breast-feeding is protective against enuresis (Barone et al., 2006). While this single study suggests a correlation, the protective effects of breast-feeding on the development of enuresis must be confirmed.

Genetic Factors. Although specific genetic factors have not been fully elucidated, there is a clear family history associated with enuresis. It is estimated that about 75% of children with primary nocturnal enuresis (in other terminology, this is monosymptomatic primary enuresis) have a first-degree relative who also had the condition (Bayoumi et al., 2006). A family history of bed-wetting was associated more commonly with cases of enuretic children than nonenuretic controls (Barone et al., 2006). Results from twin studies provide further evidence of heritability; for example, in a large Finnish twin cohort, the concordance of enuresis was higher among monozygotic (identical) than dizygotic (fraternal) twins (Hublin, Kaprio, Partinen, & Koskenvuo, 1998). Because monozygotic twins share more genetic material than dizygotic twins, this lends further weight to the genetic implications of the development of enuresis. Specific genes have been investigated among families with multiple cases of enuresis (e.g., Bayoumi et al., 2006). However, clear linkage patterns have not been consistently observed across multiple populations, suggesting the need for additional research to find the genes responsible for the observed hereditary phenomena.

Hypercalciuria. It has been suggested that increased urinary calcium excretion, known as hypercalciuria, is related to nocturnal enuresis. Researchers have found that hypercalciuria is more common among children with nocturnal enuresis than among continent children (Rae et al., 2010). For example, when 24-h urine calcium was measured (a more accurate measurement technique than a random urine calcium level) in a study of 122 enuretic children and 110 continent children, 21.3% of the enuretic children...
had hypercalciuria compared with 4.5% of children without enuresis (Valavi, Ahmadzadeh, Hooman, & Aminzadeh, 2011).

Nocturnal hypercalciuria (higher quantities of calcium excreted at night in urine) has been identified as significantly more common in children with nocturnal enuresis than in children without nocturnal enuresis (Aceto et al., 2003). This suggests that the nighttime excretion of calcium in urine may create nocturnal diuresis of large urinary volumes, perhaps potentiating the development of enuresis.

**Demographic Variables.** Prevalence estimates of the elimination disorders vary markedly. In a population-based sample with a mean age of 7.3 years, the prevalence of daytime urinary incontinence among boys is 13.7% and among girls, 21.5%, when children with mild, moderate, and severe incontinence were included (Suresh Kumar, Jones, Cumming, & Craig, 2009). Additional data support the near equality of prevalence of daytime wetting at 8 years of age (7 and 8.7%, respectively, for boys and girls) (Joinson et al., 2007), while other research suggests a male predominance, with 4.1% of males and 3.0% of females in a geographically defined sample of children with mean age of 6.22 years suffering from daytime incontinence (von Gontard, Moritz, et al., 2011).

For nocturnal enuresis, there is a male predominance (Suresh Kumar, Jones, Caldwell, & Craig, 2009). At age 8, 21% of males and 10.8% of females were bed wetters (Joinson et al., 2007), and at age 7, the difference was 12.9% vs. 6.4%, respectively (von Gontard, Moritz, et al., 2011).

More males than females suffer from encopresis, in a ratio of approximately 3–6 boys for every girl affected (Bellman, 1966; Har & Croffie, 2010). Loening-Baucke (2007) cites a prevalence of fecal incontinence among boys at 7.3% and 1.3% among girls. Others find a less disparate ratio among 8-year-olds, with 8.8% males and 4.8% of females affected with soiling (Joinson et al., 2007), and still others find no difference in prevalence between boys and girls at age 7 (von Gontard, Moritz, et al., 2011). Of note, researchers have found no relationship between enuresis and socioeconomic status, family size, birth order, or parental age.

**Evaluation**

**Criteria for Diagnosis**

The diagnosis of each elimination disorder should emerge from a careful interview of parent(s) and, as appropriate, the child. It is our preference to use a highly structured initial consultation, including a thorough toileting history and a determination of whether parents or other family members have experienced similar problems. Clear information must be gathered about the age of onset, to help determine primary or secondary status; correlates of onset (e.g., important family changes, start of school); current frequency of wetting or soiling; and social, behavioral, or cognitive symptoms that might impact the problem or its treatment. Especially important to learn is whether the problem has been brought to the attention of a physician. A physical examination is always requested if the child has not had one recently that included discussion of this concern. It is also essential to learn what the family is doing about the problem right now and require discontinuation of treatments or practices that seem inappropriate.

Key to accurate diagnosis is the guideline provided by DSM criteria. For enuresis, DSM guidelines require a chronological or developmental level of 4 years and passage of feces into inappropriate places, whether involuntary or intentional, at least once monthly for at least 3 months, and not attributable to other medical conditions except the involvement of constipation (American Psychiatric Association, 2013, p. 357). For encopresis, DSM guidelines require that the child be voiding into the bed or clothing, whether involuntarily or intentionally, at least twice weekly for at least 3 consecutive months or must cause significant distress or impairment; the child must achieve a chronological or developmental age of 5 years (American Psychiatric Association, 2013, p. 355).
Treatment Considerations

A variety of treatment approaches to the elimination disorders have emerged from the work of researchers and clinicians in the several disciplines interested in these problems. There is no singular standard treatment for either the voiding or the defecation disorders. There is consensus, however, that a careful medical review of the child’s symptoms is warranted and that careful classification of the problem as primary vs. secondary may be important to illuminate fuller concern for organic problems or psychological considerations that deserve prompt attention (see McGrath, Mellon, and Murphy (2000) and Mellon and McGrath (2000) for a discussion of the importance of both medical and psychological assessment before intervention). In this section we will focus on what is known about management approaches for the elimination disorders.

Treatment for Monosymptomatic Primary Enuresis

Historical Treatments. Several writers have described cruel and barbarous methods of managing enuresis from ancient times to only hundreds of years ago. Mattresses with protruding metal spikes, penile tourniquets, and electrical currents are among the practices once touted as treatments (Bloom, 1993; Mishne, 1993).

Current Treatment Approaches. Present-day treatments range from pharmaceutical to behavioral methods, with exercises to alter bladder capacity and tone, and a number of combination strategies to address what is appreciated to be a challenging problem. The preponderance of behavioral methods includes a urine alarm as a key component of treatment, although verbal psychotherapies, counseling, simple reward programs, fluid restriction before bedtime, and hypnosis have been utilized. The urine alarm method, initially popularized by Mowrer and Mowrer (1938), relies on the initial drops of urine to initiate the alarm, expose the child to the alarm’s sound, and awaken the sleeping bed wetter. Sometimes the alarm is enhanced by adding an open intercom to the parental bedroom so that an adult can join and guide the child appropriately to address the supposed deep sleep characteristic of bed wetters. Eventually, with nightly use over several weeks, one learns to “avoid” being startled by the alarm by maintaining continence or awakening before the alarm signals in response to cues of bladder fullness so that voiding urine can occur into the toilet.

In the past several decades, urine alarm training has been combined with a number of other methods in the effort to enhance or speed its success and to diminish relapse once initial arrest of bed-wetting has been accomplished. The resulting “packages” of procedures and behavioral contingencies are favored by researchers (see Houts, Berman, & Abramson, 1994), although it is unclear whether or which additional procedures might enhance success rates, produce more rapid continence, or diminish relapse. Nonetheless, training times are generally at least 8 weeks, and relapse remains a concern of behavioral packages and pharmacological strategies alike.

Among the first such behavioral packages to be described was full-spectrum home training (FSHT) (Houts & Liebert, 1984; Houts, Liebert, & Padawer, 1983). An updated description of FSHT can be found in Houts (2003) which details the several components of the program: (1) urine alarm treatment; (2) a carefully executed family support agreement, with specific responsibilities for parent(s) and child; (3) a daily record to monitor wet and dry nights; (4) a daytime bladder training exercise initially described by Kimmel and Kimmel (1970), now known as retention control training, with the goal of expanding the child’s ability to hold urine comfortably; (5) overlearning, an adjunctive procedure pioneered by Young and Morgan (1972) to prevent relapse; and (6) an optional waking component based on the work of Azrin, Snead, and Foxx (1974) to facilitate achieving the initial goal of 14 consecutive dry nights.

Houts et al. (1994) provide an extensive and rigorous evaluation of the two current broad approaches to treatment, psychological and pharmacological interventions, as well as evaluation
of placebo or no-treatment controls. Their review examined 78 published reports in which data met specific criteria for inclusion in their effectiveness analysis. Among the most pertinent findings was the fact that cessation of bed-wetting at posttreatment favored children who received treatment—either psychological or pharmacological—over those receiving placebo or no treatment. This finding provides support for the view that recommending treatment is a prudent step, in contrast with a “wait and see” approach where the delay might impact social and affective spheres adversely (Houts et al., 1994). At follow-up in their review, Houts et al. found that children receiving psychological treatment modalities continued to show superior outcomes to controls, while those receiving pharmacological interventions no longer differed significantly from controls. In further analyses, which included a covariate marker of investigator “allegiance” to one method or another, two treatments, the alarm and desmopressin, had stronger outcomes by the end of treatment than three other treatment categories (psychological therapy without urine alarm, tricyclics, or other medications). And at follow-up, those utilizing the urine alarm in psychological treatment had more favorable outcomes than all other treatments.

**Daytime Incontinence and Secondary Incontinence.** Daytime intermittent incontinence and the onset of either day or night incontinence after a substantial period of continence has been achieved are much less frequent than monosymptomatic primary enuresis. These conditions have not received nearly as much research attention as the nighttime problem. Such conditions deserve careful medical review for infection, significant constipation, or other organic concerns and relevant psychological review for behavioral concerns and for significant stressors impacting the child’s health. Additionally, a careful inquiry into the child’s access to comfortable and clean school bathrooms or scheduled access to the nursing office bathroom may be warranted. Interestingly, a prospective investigation of the age of initiation of toilet training within the Avon Longitudinal Study of Parents and Children provides suggestive data on subsequent diurnal wetting difficulties when training has been delayed until after 2 years of age (Joinson et al., 2009). Treatments including timed voiding (Allen, Austin, Boyt, Hawtrey, & Cooper, 2007) have improved daytime incontinence, and the utilization of systematic retention control training as a bladder-toning exercise has sometimes joined into our treatment package as well.

### Treatment for Encopresis with Constipation or History of Constipation

A number of different treatments have been tried for encopresis. For review of the treatment spectrum, from psychotherapy and play therapy to hypnosis; biofeedback; holistic, integrative, or complementary/alternative medicine; Internet-enhanced intervention; and behavioral interventions, see Brooks et al. (2000), Culbert and Banez (2007), Howe and Walker (1992), McGrath et al. (2000), and Ritterband et al. (2008). Few treatments have been evaluated in rigorous and controlled methodological comparison studies, and samples in such research tend to be relatively small. Of additional concern to practitioners and researchers alike is the fact that sample selection is often of the convenience sort, with subjects who have failed medical management and recommended for psychological intervention (e.g., Stark, 2000); treatment components are often described without sufficient detail or fidelity evaluation (McGrath et al., 2000); varying procedures for initial constipation treatment and cleanout have not been rigorously compared; and outcomes of “improvement” are not provided in a consistent metric across studies (Brooks et al., 2000). Despite these methodological considerations, there is reasonable consensus that the most successful efforts to treat encopresis appear to be founded on behavioral management principles used in conjunction with laxative or stool softener and dietary prescriptions (e.g., Weissman & Bridgemoan, 2009). These are often referred to as mixed medical-behavioral (Brooks et al., 2000), combination, or package treatments. Such joint management approaches appear to receive
optimal attention in the recent literature, with behavioral management addressing a broad spectrum of skills, a training structure, schedules for toilet sitting, techniques for handling toilet refusal, and carefully planned positive reinforcement and with medical management addressing initial medical evaluation, pharmacologic aids, and dietary recommendations (Reimers, 1996; Weissman & Bridgemohan, 2009).

Treatment for the child with encopresis and current constipation or significant holding behavior usually includes (1) medical cleanout plan followed by the ongoing use of a stool softener or laxative under physician supervision; (2) a prescribed toilet-sitting schedule as a behavioral technique and as a caregiver-guided adjunct to medical management; (3) a dietary program to enhance fiber and assure adequate water intake; (4) education about the disorder and its management steps and expectations; and (5) behavioral management strategies to increase stooling frequency, increase toilet use, and decrease soiling. The behavioral strategies will be addressed more fully below.

While detailed training protocols may be found in the literature (e.g., Friman, Hofstadter, & Jones, 2006), studies on treatment often lack data on dosage of the intervention(s) and on their families’ fidelity to the intervention techniques (see McGrath et al., 2000). Further, we find that some degree of custom tailoring is often required for each family, because families have often tried, in sequential fashion, several strategies with varying consistency before seeking consultation, and every child has his or her individual training needs. For example, the child who is reluctant to sit on the toilet poses a challenge to the scheduled toileting requirement. This deserves evaluation to ascertain whether the interpersonal dynamics of caregiver and child are significantly problematic, whether the child is displaying phobic characteristics, or if the child is showing expected levels of anxiety or toilet refusal, perhaps related to earlier constipation and pain on stool passage. Caregivers need help in accomplishing toilet sitting when the child is somewhat oppositional or fearful. Some children are responsive to being “paid back” if cooperative, and we recommend payback in the form of time (minutes) back for the time spent on the toilet, often easing toilet-sitting struggles substantially.

Behavioral management strategies aimed at enhancing soft stools and regular defecation differ from one another in their particulars, but all seem to include a set of key components, namely, record keeping; scheduled toilet sitting; structured toilet-skills training with systematic reinforcement of appropriate behaviors; family education about the problem; and laxative, stool softener, and/or dietary intervention.

Ensuring Soft and Frequent Stool Passage
For children with retentive encopresis, the first goal is to clear the rectal vault, using enemas, suppositories, stool softeners, or laxatives per pediatrician or pediatric gastroenterologist advice. (Montgomery and Navarro (2008) and Weissman and Bridgemohan (2009) offer tables of the most common choices.) Stool passage in a timely manner is important, as it precludes the moisture reabsorption that would otherwise result in hard stools and painful defecation, and it better controls excessively large stools; timely stool passage also diminishes the need for behaviors and postures that exercise the child’s skills in holding back.

Record Keeping
Record keeping is instituted to help monitor the frequency of occurrence and the time of day of soiling incidents as well as the occurrence of successful toilet use, both prompted and spontaneous. Records are helpful to the clinician in reviewing frequency of soiling and in identifying times of day or days of the week that might be “high risk” for soiling incidents. With that knowledge, one might modify the toilet-sitting plan accordingly to be preventive. One expects prompted or scheduled toilet visits to be predominant at the start of training, but recognition of the bodily need and spontaneous toilet approach is essential to the eventual independence of successful toileting.

Scheduled Toilet Sitting
It is useful to establish a daily schedule of toileting times for the child or appropriate prompting to visit the toilet (Kuhn, Marcus, & Pitner, 1999;
Attention should be paid to relevant aspects of the child's routine and the timing of medication in selecting toilet-sitting times, as well as an opportunity to sit after meals or snacks to work with the gastrocolic reflex. The use of adaptor seats, potty-training chairs, or the standard toilet should be dependent on the child's age, preference, and convenience.

**Systematic Reinforcement**

A central behavioral technique for controlling encopresis and motivating proper toilet use is systematic reinforcement of appropriate behaviors. An important reward is immediate social praise, which is always given for successful stool passage on the toilet and for appropriate toilet sitting, including both scheduled and spontaneous sits. Along with social reward, small immediate rewards for defecation in the toilet can be helpful for younger children as a motivator both to work on this skill and perform at the toilet. For nonretentive encopretic children, days of "no soiling" deserve reward, but care must be taken not to reward "no soiling" without some link to proper defecation in the toilet, as retentive behavior might inadvertently be strengthened.

The initial goal for severely retentive young children with a history of fear or pain on defecation is to bring them to the status of soft, frequent stool, even when the toilet is not used and a diaper is used instead. Social praise and small rewards can be helpful in that regard. Once soiling is repeatedly experienced as both appropriately frequent and without pain, fear, or emotionality, the more active phase of toilet training may be started, with systematic reinforcement, record keeping, and scheduled toilet sits.

**Helpful Additions to Management**

It can be useful to end a day in which soiling has occurred with a warm bath, because soiling often signals incomplete evacuation of feces. A bath affords a young child a context of relaxation or play that might facilitate stool passage.

Parents should guide children's skill development in cleanliness training and appropriate removal of soiled undergarments. These skills are dependent upon the child's age, but the eventual goal of self-cleaning needs to be incorporated into the training plans as appropriate, so that the ultimate outcome is a child with healthy and relatively independent toileting skills.

There is often a dramatic initial reduction in soiling behavior in the early weeks after combination training for encopresis is initiated with the multiple components described above. This initial arrest has reasonable probability to be sustained when careful and continued monitoring for adherence to the plan's several components is a priority. Caregivers sometimes take initial improvement over a first few weeks as a signal to pull away from close monitoring; this is not recommended because the self-regulation required of the child may be inadequately established early on, and the supports of a multipronged behavioral management plan are important to shifting the child's stooling interest, skills, and habits. Treatment failure and relapse are difficult realities deserving of best efforts to identify and rectify whatever the problematic issues may be.

**Treatment Challenges**

*Secondary Disorders.* The most encouraging fact about the functional elimination disorders is that successful treatments exist for the most common forms, especially those that fit one of the specific learning models. Of concern and deserving of very careful evaluation and review are cases involving the functional enuretic or encopretic disorders after initial continence has been achieved for several months or years or those that appear to be unresponsive to reasonable treatment modalities and excellent family adherence.

*Children with Special Needs.* Children with a variety of developmental disorders can bring challenging variations in motivation; behavioral repertoire; fine and gross motor coordination; and intellectual, language, and social interactional skills to the development of their self-help skills. Even typical toilet training, whether initiated at the typical age range for training or somewhat later, might require modifications for children with specific developmental problems.
Identifying developmental readiness in the child with a developmental disability can be problematic and sometimes requires explicit training of language or gestures to cue or announce toileting needs. For some, readiness skills or motivation may be lacking, but frequent toilet visits can be an optimal way to achieve continence in between toilet visits, or skills may best be introduced and discretely taught in small steps (Weissman & Bridgemohan, 2009). Appropriate rewards need to be identified carefully if they are to serve, in fact, as positive reinforcers of the toileting behaviors being trained. Achieving reliable toileting skill is an important, albeit challenging goal for those guiding the educational, social, recreational, and family participations of children with developmental problems.

**In Sum**

The elimination disorders are a set of prominent and important childhood disorders that enjoy active theorizing about etiologies with abundant research on correlates and comorbidities as well as strong research interest in the effectiveness of a variety of treatment approaches. Nonetheless, there are important gaps in our understanding of these disorders and in the evidence base for their optimal management. Developing the toileting skills to achieve reliable continence is a significant milestone of early childhood. Disorders of elimination that delay, challenge, or interfere with this accomplishment deserve careful and timely professional evaluation and prudent management so that a repertoire of skills supporting a healthy elimination pattern can be achieved.

**References**


Enuresis and Encopresis: The Elimination Disorders


