CHAPTER 12

Urinary Incontinence in Children

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INTRODUCTION

Most of the healthcare for pediatric urinary incontinence is delivered in the outpatient setting. During the 1990s, approximately 417,000 visits were made per year to physicians' offices and hospital outpatient departments by children with urinary incontinence listed as any diagnosis. Although the majority of these outpatient visits cannot be classified by underlying disease process, nocturnal enuresis is a listed diagnosis in up to 38% of them.

Of the commercially insured children seen for incontinence in the outpatient setting, 75% were 3- to 10-year-olds, and 15% to 20% were 11- to 17-year-olds. Only 2% to 3% of the outpatient visits were made by children under the age of 3, in whom urinary incontinence seldom has a pathologic basis.

Urinary incontinence is a relatively common reason for children to seek medical care, but it rarely requires hospitalization. When it does require inpatient care, the average length of stay is between 5 and 7 days, and the length of stay appears to be even greater in facilities providing tertiary care. Fewer than 10 of every 100,000 visits for incontinence in children are ambulatory surgical visits.

The economic burden of pediatric urinary incontinence is difficult to quantify. Data are not currently available on aggregate direct costs for inpatient, outpatient, or surgical venues. Costs for inpatient care for pediatric urinary incontinence, like those for other conditions, reflect hospital length of stay. The cost per visit for outpatient surgical procedures has increased steadily during the past decade.

DEFINITION AND DIAGNOSIS

In contrast to the adult population, in which the inability to maintain voiding control is virtually always considered pathological, a child with urinary incontinence must be evaluated within the context of his or her developmental age. The impact on social functioning evolves as the child progresses through the first several years of life and is heavily influenced by social, cultural, and environmental factors.

Development of Voiding Control

In the infant, normal micturition occurs via a spinal-cord-mediated reflex. As the bladder fills, it surpasses an intrinsic volume threshold, which results in a spontaneous bladder contraction. This vesico-vesical reflex coordinates relaxation of the bladder neck and external urethral sphincter. Voiding is complete, occurs at low pressure, and is autonomous. In the infant, the volume threshold for urination is low; the infant voids approximately 20 times per day (1).

As the infant develops and neural pathways in the spinal cord mature, the vesico-vesical reflex is suppressed. A more complex voiding reflex, mediated at the level of the pons and midbrain, assumes coordination of voiding control. During this transitional period, functional bladder capacity increases, and the frequency of urination decreases. By 2 years of age, most children void 10 to 12 times per

Table 1. Codes used in the diagnosis and management of pediatric urinary incontinence

Individuals under 18 with one of the following ICD-9 diagnosis codes, but not a coexisting 952.XX or 953.XX code:	
307.6	Enuresis
596.59	Other functional disorder of bladder
596.52	Low bladder compliance
596.51	Hypertonicity of bladder (overactive bladder specified in 2001)
596.8	Other specified disorders of bladder
596.9	Unspecified disorder of bladder
599.8	Other specified disorders of urethra and urinary tract
599.81	Urethral hypermobility
599.82	Intrinsic urethral sphincter deficiency (ISD)
599.83	Urethral instability
599.84	Other specified disorders of urethra
625.6	Stress incontinence, female
788.3	Urinary incontinence
788.31	Urge incontinence
788.3	Urinary incontinence, unspecified
788.32	Stress incontinence, male
788.33	Mixed incontinence, male, female
788.34	Incontinence without sensory awareness
788.36	Nocturnal enuresis
788.37	Continuous leakage
788.39	Other urinary incontinence

day, are aware of bladder fullness, and can announce their need to urinate (1). Between 2 and 3 years of age, children attain the ability to volitionally postpone voiding and to initiate voiding at bladder volumes less than capacity. During this period, an adult pattern of daytime urinary control emerges, characterized by a stable, quiescent bladder.

As with other developmental milestones, the time course for attaining urinary continence demonstrates individual variability. The majority of children master toileting prior to entrance into school, (i.e., by around 5 years of age). Beyond this age, incontinence becomes an increasing social concern. Brazelton and colleagues studied the development of voiding control and found that 26% of children had attained daytime continence by the age of 24 months, 52.5% by 27 months, 85% by 30 months, and 98% by 3 years of age (2). Bloom and colleagues studied 1,186 normal children and found that the age at which toilet training was achieved ranged from 9 months to 5.25 years, with a mean of 2.4 years. Toilet training occurred slightly earlier in females (3).

Defining pediatric urinary incontinence has historically been complicated by the lack of standardized definitions for pediatric voiding disorders. In 1997, the International Children's Continence Society attempted to ameliorate this problem by generating a report on standardization and definitions for lower urinary tract dysfunction in children (4). In the consensus report, urinary incontinence is defined as *the involuntary loss of urine, objectively demonstrable, and constituting a social or hygienic problem.*

Urethral incontinence occurs via a native or reconstructed urethra and is stratified as follows:

- stress incontinence, the involuntary loss of urine occurring in absence of detrusor contraction, when intravesical pressure exceeds urethral pressure;
- reflex incontinence, the loss of urine due to detrusor hyperreflexia and/or involuntary urethral
- relaxation in the absence of the sensation to void;
- overflow incontinence, any involuntary loss of urine associated with overdistension of the bladder;
- urge incontinence, involuntary loss of urine associated with a strong desire to void.

Extraurethral incontinence is defined as urine loss via a conduit other than the urethra, such as ectopic ureters (in girls) and vesicostomies. *Enuresis* denotes a physiologically coordinated void occurring at an inappropriate or socially unacceptable time or place.

The most recent version of the Diagnostic and Statistical Manual (DSM IV-TR) defines the essential features as repeated voiding of urine into bed or clothes and two occurrences per week for at least three months, causing clinically significant distress or impairment in social, academic (occupational), or other important areas of functioning. The child must have reached an age at which continence is expected (a chronological age of 5 years, or a mental age of 5 years for a developmentally delayed child), and the condition must not be due exclusively to the direct physiological effects of a substance or general medical condition (5).

Etiologic Classification of Pediatric Urinary Incontinence

Childhood urinary incontinence can be classified as organic or functional. Organic incontinence refers to an underlying disease process, which can be either neurogenic or structural in nature. Neurogenic forms of incontinence can be congenital or acquired; they include etiologies such as neurospinal dysraphism, sacral agenesis, cerebral palsy, spinal cord injury, and tethered spinal cord. Structural incontinence refers to developmental, iatrogenic, or traumatic anatomic abnormalities of the lower urinary tract that interfere with the urinary system's ability to hold, store, or evacuate urine. Structural incontinence includes diseases such as exstrophy-epispadias complex, ectopic ureter, and posterior urethral valves.

Functional incontinence is that in which no anatomic or neurologic abnormality can be found. It comprises a heterogeneous group of disorders, including the urge syndrome, dysfunctional voiding, lazy bladder, and enuresis. The prevalence of functional incontinence in the pediatric population merits special focus.

Urge incontinence occurs predominantly in girls and is commonly associated with other medical complaints, such as constipation, recurrent urinary tract infections, and vesicoureteral reflux. It is manifested clinically by urinary frequency, the sudden imperative to void, and holding maneuvers such as

squatting on the heel (the so-called Vincent's Curtsy), crossing the legs, and flexing the pelvic floor muscles. This symptom complex is the result of overactivity of the detrusor muscle, which results in sudden bladder contractions at volumes below age-expected capacity. Incontinence occurs in those children who are unable to suppress bladder contraction volitionally.

The inability to maintain detrusor quiescence is common during the transitional phase between infantile and adult patterns of urinary control. Urge incontinence represents recurrence or persistence of this transitional phase.

Dysfunctional voiding includes several patterns of voiding with a single underlying feature: overactivity of the pelvic floor muscles during micturition. It is likely that urge incontinence and dysfunctional voiding represent different time points along the natural history of a single disease process. Children with urgency symptoms learn to abort detrusor contractions by volitional contraction of the external urethral sphincter and pelvic floor muscles. The long-term consequences of pelvic floor overactivity include high-pressure voiding, urinary infections, ureteral reflux, and, ultimately, decompensation of the detrusor muscle. Urinary incontinence can occur at any point along the continuum and results from infection, inefficient holding response, or overflow incontinence.

Enuresis is characterized by synergistic bladder-urethral function and typically occurs while the child is asleep (enuresis nocturna). This disorder is extraordinarily common in young children, with a reported incidence of 15% to 20% in 5-year-olds. It is characterized by spontaneous resolution, with 15% resolving each year after the age of 5. At age 7, the prevalence is approximately 8%. Approximately 2% of 15-year-olds continue to have wet nights (6).

A rare type of enuresis, giggle incontinence (enuresis risoria), occurs only during intense laughter. It is characterized by an abrupt, uncontrollable bladder contraction. Bladder emptying is generally complete. Affected individuals often modify their social interactions to avoid situations that are likely to induce laughter. The term diurnal enuresis (enuresis diurna) is commonly used to describe daytime wetting. A better term for this disorder is diurnal incontinence.

Vaginal voiding refers to a specific form of wetting that is characterized by post-void dribbling. It is seen predominantly in slender females who are unable to adopt an appropriate posture while voiding. This leads to trapping of urine in the vagina. It can also be seen in overweight females who are unable to adequately separate their labia during urination. The treatment of vaginal voiding involves modification of voiding posture to prevent pooling of urine in the vagina.

Evaluation of a child with incontinence typically begins in an office-based setting. A thorough medical history will delineate the pattern of incontinence and may identify underlying neurologic or structural anomalies. Parents are carefully questioned about the child's voiding habits, including straining, urinary frequency, posturing, pain with urination, and infection. A meticulous obstetrical history will reveal evidence of fetal distress, anoxia, birth trauma, hydronephrosis, or oligohydramnios. Developmental delays or impaired upper- or lower-extremity motor skills warrant careful attention. The association of encopresis and wetting in the older child raises the suspicion of occult neuropathy.

The physical examination should include inspection of the abdomen, genitalia, and back, as well as a directed neurologic examination. The lower back is inspected for scoliosis and stigmata of occult spinal dysraphism, such as a sacral dimple, hair patch, hemangioma, or lipoma. The coccyx is examined for evidence of sacral agenesis. The genital exam may disclose labial adhesions or an abnormal urethral position in females, or urethral abnormalities in males.

Most patients brought for evaluation before the age of 5 require no more than a history and physical examination. Additional diagnostic studies in patients younger than 5 are generally reserved for those who have evidence of a structural or neurologic abnormality or associated urinary tract symptoms such as infection or hematuria.

Noninvasive diagnostic studies used to evaluate incontinence include urinalysis, spinal tomography, urine-flow measurement, electromyography, and renal/bladder ultrasonography. Invasive studies, such as voiding cystography, and multichannel urodynamic evaluation are reserved for selected

clinical situations. These procedures are generally performed in an outpatient setting.

Patients with functional incontinence are treated on an ambulatory basis with observational, medical, or behavioral therapy. Only rarely does a patient with functional incontinence require surgical intervention, and then only after all nonsurgical interventions have been exhausted. Inpatient treatment is largely reserved for those with neurologic or structural abnormalities who require surgical therapy.

Table 3. Trends in mean inpatient length of stay (days) for children hospitalized with urinary incontinence listed as primary diagnosis

	Length of Stay
1994	4.7
1996	5.1
1998	5.3
2000	5.6

SOURCE: Healthcare Cost and Utilization Project Nationwide Inpatient Sample, 1994, 1996, 1998, 2000.

ANALYTIC PERSPECTIVE

Pediatric urinary incontinence is commonly seen in both urologic and general pediatric practice. The contemporary literature is replete with patient-based and specialty department-based investigations of voiding disorders in children. Unfortunately, there is a paucity of population-based investigations of these conditions. Data collected from existing healthcare utilization databases do, however, provide insight into the trends in utilization of services for pediatric incontinence. An important caveat is that undercoding or miscoding may lead to undercounting of many conditions which fall under the umbrella of pediatric incontinence.

Most of the data in this chapter come from five databases. The data include observations derived from both public and proprietary sources and represent patient encounters in many healthcare settings. Both commercially insured and government-insured pediatric populations are included. In all cases, pediatric incontinence has been identified for analysis using the relevant 5-digit ICD-9 codes. Patients meeting criteria for inclusion are stratified where possible by age, gender, geographic region, and race/ethnicity. The disease codes used to define urinary incontinence in each of these databases are listed in Table 1.

The pediatric group is defined as patients 0 to 17 years of age. The youngest age group consists of patients less than 3 years of age and represents a cohort in which the majority are physiologically and developmentally incapable of voiding control. Children between the ages of 3 and 11 constitute the cohort in which incontinence encounters are most common. Adolescents and young adults aged 11 to 17 are included in a separate cohort. More detailed age stratification is impossible because of limited sample sizes in the datasets. These age strata present methodological limitations in analyzing nocturnal enuresis, about which awareness increases at about age 7 when children start school and are exposed to a broader social environment. Eighteen-year-olds are included in the adult analyses.

Results are reported within three venues of healthcare delivery—inpatient, outpatient, and ambulatory surgery—followed by an economic perspective. In general, datasets are analyzed by both primary and any listed diagnoses of incontinence. Trend analyses are available for databases with serial years of data.

Given the heterogeneity of the incontinence population and the limitations of ICD-9 coding, it is impossible to stratify subjects etiologically. Samples

Table 2. Inpatient hospital stays by children with urinary incontinence listed as primary diagnosis, count, rate[a] (95% CI)

	Count	Rate
1994	283	0.4 (0.2–0.6)
1996	208	0.3 (0.1–0.4)
1998	195	0.3 (0.1–0.4)
2000	201	0.3 (0.1–0.4)

[a]Rate per 100,000 based on 1994, 1996, 1998, 2000 population estimates from Current Population Survey (CPS), CPS Utilities, Unicon Research Corporation, for relevant demographic categories of US civilian non-institutionalized population under 18 years of age.

SOURCE: Healthcare Cost and Utilization Project Nationwide Inpatient Sample, 1994, 1996, 1998, 2000.

Table 4. Mean inpatient length of stay (days) for children hospitalized with urinary incontinence listed as primary diagnosis, 1999–2001 (95% CI)

	Count	Length of Stay	
Total	1,251	6.9	(6.5–7.3)
Age			
0–2	83	4.5	(3.1–5.9)
3–10	672	6.5	(6.1–7.0)
11–17	496	7.8	(7.0–8.5)
Race/ethnicity			
White	873	6.7	(6.3–7.2)
Black	116	7.2	(6.1–8.3)
Asian	11	7.1	(4.7–9.5)
Hispanic	150	6.7	(5.8–7.7)
American Indian	2	5.0	(0–18)
Other	42	9.4	(5.8–13)
Missing	57	7.4	(5.5–9.4)
Gender			
Male	593	6.7	(6.3–7.2)
Female	658	7.0	(6.4–7.6)
Region			
Midwest	451	7.4	(6.8–8.0)
Northeast	79	6.5	(2.7–10)
South	512	6.8	(6.4–7.2)
West	197	6.3	(5.5–7.2)
Missing	12	5.2	(2.8–7.7)

SOURCE: National Association of Children's Hospitals and Related Institutions, 1999–2001.

in which raw counts are less than 30 have been suppressed and are not presented in this chapter. The analyses reported here are limited by the absence of national data on the use of prescription medications for children with incontinence.

TRENDS IN HEALTHCARE RESOURCE UTILIZATION

Inpatient Care

Urinary incontinence is a common reason for care-seeking by the pediatric population, but it requires hospitalization far less frequently than is the case for adults. The rate of annual admissions nationwide for a primary diagnosis of incontinence is less than 1 per 100,000 children (Table 2). There is no indication that these numbers changed substantially between 1994 and 2000. However, over the same time period, the average length of hospital stay increased from 4.7 to 5.6 days. Hospital stays were slightly longer, on average, for patients admitted to urban hospitals than for the total group studied (Table 3).

The National Association of Children's Hospitals and Related Institutions (NACHRI) database provides information on several aspects of inpatient care in the nation's pediatric hospitals, including data on length of hospital stay for calendar years 1999 to 2001 (Table 4). A cohort of 1,251 patients with urinary incontinence listed as the principal diagnosis was identified. The average length of hospitalization for these patients was 6.9 days. The duration was greater for older children, averaging 7.8 days in the 11- to 17-year-old cohort, compared with 4.5 days for patients under 3 years of age. Duration of hospitalization did not vary by gender, race/ethnicity, or geographic region. Unlike the length of stay reported in the Health Cost and Utilization Project (HCUP) data, length of stay in the NACHRI data was stable over the time frame studied (Tables 3 and 5). Because NACHRI collects data primarily from tertiary-care pediatric specialty hospitals, its findings are likely weighted toward patients receiving higher intensity care than is represented in the population-based HCUP.

Outpatient Care

Most of the evaluation and management of incontinence in children is performed in physicians' offices. The National Hospital Ambulatory Medical Care Survey (NHAMCS) provides data on a nationally representative sample of visits to hospital outpatient departments. NHAMCS data for patients with urinary incontinence are shown in Table 6. During four years of data collection (1994, 1996, 1998, and 2000), 243,210 hospital outpatient visits were made by children with urinary incontinence listed as any diagnosis. This represents a rate of 343 visits per 100,000 children. There were 127,586 visits for a primary diagnosis of urinary incontinence, a rate of 180 visits per 100,000 children. According to data from Schmitt (7), about 10% of children 6 years of age wet the bed. Taken together, these data suggest that urinary incontinence is a relatively common diagnosis in the pediatric population.

Analogous data from the National Ambulatory Medical Care Survey (NAMCS) are detailed in Table

Table 5. Trends in mean inpatient length of stay (days) for children hospitalized with urinary incontinence listed as primary diagnosis (95% CI)

	1999		2000		2001	
	Count	Length of Stay	Count	Length of Stay	Count	Length of Stay
Total[a]	371	6.8 (6.2–7.3)	413	7.3 (6.4–8.1)	467	6.6 (6.1–7.2)
Age						
0–2	30	5.2 (2.0–8.3)	26	3.0 (1.6–4.4)	27	5.3 (2.8–7.7)
3–10	198	6.6 (5.9–7.4)	218	6.7 (6.1–7.2)	256	6.4 (5.6–7.2)
11–17	143	7.3 (6.5–8.1)	169	8.7 (6.7–11)	184	7.3 (6.5–8.0)
Race/ethnicity						
White	265	6.6 (6.0–7.2)	291	7.3 (6.1–8.4)	317	6.4 (5.8–6.9)
Black	33	6.8 (5.3–8.2)	37	7.9 (4.9–11)	46	7.0 (5.8–8.1)
Asian	4	5.5 (2.7–8.3)	2	6.5 (0–51)	5	8.6 (3.4–14)
Hispanic	42	6.5 (4.6–8.4)	41	7.0 (5.1–8.9)	67	6.7 (5.4–8.1)
American Indian	1	4.0 ...	0	...	1	6.0 ...
Other	9	7.2 (3.9–10)	17	8.2 (5.5–11)	16	11.8 (2.5–21)
Missing	17	10.4 (4.2–16)	25	6.4 (4.7–8.1)	15	5.9 (3.9–7.8)
Gender						
Male	204	6.8 (6.0–7.6)	188	7.1 (6.3–7.9)	201	6.3 (5.7–6.9)
Female	167	6.7 (5.9–7.5)	225	7.4 (6.0–8.8)	266	6.9 (6.0–7.7)
Region						
Midwest	138	8.0 (6.9–9.0)	147	7.2 (6.4–8.1)	166	7.0 (5.8–8.1)
Northeast	23	4.4 (2.1–6.7)	28	9.8 (0–20)	28	5.0 (3.6–6.4)
South	139	6.6 (5.9–7.4)	176	7.0 (6.2–7.8)	197	6.7 (6.1–7.4)
West	63	5.3 (4.2–6.4)	58	7.2 (5.4–9.0)	76	6.4 (5.0–7.9)
Missing	8	5.6 (1.9–9.4)	4	4.5 (0.5–8.5)	0	...

...data not available.

SOURCE: National Association of Children's Hospitals and Related Institutions, 1999–2001.

Table 6. Hospital outpatient visits by children with urinary incontinence, 1994–2000 (merged), count (95% CI), number of visits, percentage of visits, rate (95% CI)

Total	4-Year Count (95% CI)	Total No. Visits by Males/ Females < 18, 1994–2000	% of Visits	4-Year Rate[a] (95% CI)
Primary diagnosis	127,586 (77,011–178,161)	72,578,652	0.2	180 (109–252)
Any diagnosis	243,210 (173,678–312,742)	72,578,652	0.3	343 (245–442)

[a]Rate per 100,00 based on the sum of weighted counts in 1994, 1996, 1998, and 2000 over the mean estimated base population across those four years. Population estimates from Current Population Survey (CPS), CPS Utilities, Unicon Research Corporation, for relevant demographic
categories of US civilian non-institutionalized population under age 18.

SOURCE: National Hospital Ambulatory Medical Care Survey, 1994, 1996, 1998, 2000.

Table 7. Physician office visits by children with urinary incontinence, count (95% CI), number of visits, percentage of visits (%), rate[a] (95% CI)

Total	5-Year Count (95% CI)	Total No. Visits by Males/ Females <18, 1992–2000	Percent of Visits	5-Year Rate (95% CI)
Primary diagnosis	1,126,911 (683,252–1,570,570)	809,286,031	0.1%	1,612 (977–2,247)
Any diagnosis	1,781,506 (1,247,877–2,315,135)	809,286,031	0.2%	2,548 (1,785–3,312)

[a]Rate per 100,00 based on the sum of weighted counts in 1992, 1994, 1996, 1998, and 2000 over the mean estimated base population across those five years. Population estimates from Current Population Survey (CPS), CPS Utilities, Unicon Research Corporation for relevant demographic categories of US civilian non-institutionalized population under age 18.

SOURCE: National Ambulatory Medical Care Survey, 1992, 1994, 1996, 1998, 2000.

7. In contrast to NHAMCS, these data are collected by physicians in office-based settings. During 1992, 1994, 1996, 1998, and 2000, there were 1,781,506 visits for which urinary incontinence was coded as any diagnosis, a rate of 2,548 per 100,000 children. A total of 1,126,911 office visits were made by children with a primary diagnosis of incontinence, a rate of 1,612 per 100,000 children.

Trends in healthcare utilization for urinary incontinence are available from the Center for Health Care Policy and Evaluation (CHCPE). This dataset contains national data from both traditional, commercially managed health plans and managed Medicaid programs. Data were evaluated for even years between 1994 and 2000. Base populations for the rates presented are children with the same demographic characteristics. Among members of commercial health plans, physician outpatient visits for a primary diagnosis of urinary incontinence ranged from 495 per 100,000 to 533 per 100,000; there was no trend toward an increasing rate over time (Table 8). Rates for visits in which incontinence was listed as any diagnosis ranged from 658 per 100,000 in 1994 to 782 per 100,000 in 2000, with an increasing trend over the years studied (Table 8). In each year studied, visits by boys were more common than visits by girls, the ratio being approximately 1.3:1. More than 75% of the visits were made by 3- to 10-year-olds. Interestingly, more than 2% of physician encounters occurred with patients under the age of 3 (Figure 1).

The findings were similar among enrollees in managed Medicaid plans. During the same time frame, 1994 to 2000, outpatient visits for a primary diagnosis of incontinence ranged from 497 per 100,000 to 682 per 100,000 (Table 9). Visit rates for which incontinence was listed as any diagnosis ranged from 739 per 100,000 to 1,083 per 100,000 (Table 9). Boys and girls were seen in similar proportions.

A detailed assessment of disease states contributing to incontinence is beyond the scope of the databases analyzed, in terms of both sample size constraints and the inherent lack of precision in ICD-9 coding. Nevertheless, the CHCPE data allowed us to parse the relative proportion of visits for selected diagnoses of incontinence (Table 10). The most common single condition in outpatients with a diagnosis of incontinence was nocturnal enuresis. The rate of physician outpatient visits for this condition was similar between commercially insured and managed Medicaid populations, ranging from 102 per 100,000 in 1994 to 283 per 100,000 in 2000. A trend

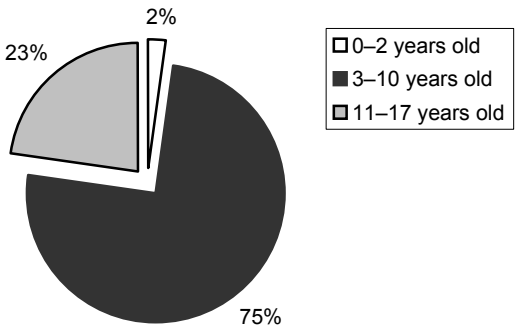

Figure 1. Age distribution of physician outpatient visits for children having commerical health insurance with urinary incontinence listed as primary diagnosis.

SOURCE: Center for Health Care Policy and Evaluation, 1994, 1996, 1998, 2000.

Table 8. Physician outpatient visits for urinary incontinence by children having commercial health insurance, count[a], rate[b]

	1994		1996		1998		2000	
	Count	Rate	Count	Rate	Count	Rate	Count	Rate
				As Primary Diagnosis				
Total	1,589	501	2,287	504	3,308	495	3,841	533
Age								
< 3	28	*	65	111	81	91	80	84
3–10	1,166	800	1,714	822	2,501	814	2,882	884
11–17	395	302	508	273	726	266	879	294
Gender								
Male	975	599	1,331	574	1,853	541	2,094	566
Female	614	397	956	432	1,455	447	1,747	498
				As Any Diagnosis				
Total	2,089	658	3,104	685	4,655	697	5,636	782
Age								
< 3	48	118	96	164	123	139	137	144
3–10	1,549	1,063	2,371	1,137	3,565	1,161	4,271	1,310
11–17	492	376	637	342	967	355	1,228	411
Gender								
Male	1,294	795	1,784	769	2,628	767	3,114	842
Female	795	514	1,320	596	2,027	623	2,522	719

*Figure does not meet standard for reliability or precision.

[a]Counts less than 30 should be interpreted with caution.

[b]Rate per 100,000 based on member months of enrollment in calendar year for children in the same demographic stratum.

SOURCE: Center for Health Care Policy and Evaluation, 1994, 1996, 1998, 2000.

toward increased utilization was seen in both groups between 1994 and 2000. The increased utilization of physician outpatient services by children with nocturnal enuresis may be due in part to increased public awareness of the disorder.

Ambulatory Surgery

Because most children with urinary incontinence receive medical or behavioral treatment, their utilization of ambulatory surgical services should be low. In general, those who undergo surgical therapy require inpatient care. CHCPE data support this generalization. Fewer than 9 per 100,000 commercially insured children presenting for ambulatory surgical treatment in 1998 and 2000 had incontinence listed as any diagnosis. As expected, rates were highest among 3- to 10-year-olds (Table 11). Small counts in this dataset preclude reliable estimation of these rates for 1994 and 1996. Stratification by race/ethnicity, gender, and geographic region is also impossible with this dataset.

ECONOMIC IMPACT

Little information is available about the economic burden of pediatric urinary incontinence in the United States. Urinary incontinence encompasses a heterogeneous family of disorders with clinical strategies dictated by the underlying condition. Costs should primarily reflect the nature of that condition. Unfortunately, available data do not allow this type of analysis.

Hospital admissions represent a small fraction of the children seeking care for urinary incontinence. This implies that care delivered in the hospital setting should represent a small proportion of overall costs. NACHRI cost data from its participating children's hospitals indicate that between calendar years 1999

Table 9. Physician outpatient visits for urinary incontinence by children having Medicaid, count[a], rate[b]

	1994		1996		1998		2000	
	Count	Rate	Count	Rate	Count	Rate	Count	Rate
				As Primary Diagnosis				
Total	210	656	293	497	246	649	318	682
Age								
< 3	9	*	14	*	3	*	9	*
3–10	178	975	239	735	203	1,049	242	1,039
11–17	23	*	40	311	40	411	67	516
Gender								
Male	96	599	138	467	127	667	160	684
Female	114	713	155	526	119	631	158	680
				As Any Diagnosis				
Total	298	931	436	739	330	871	505	1,083
Age								
< 3	13	*	19	*	5	*	16	*
3–10	252	1,380	348	1,070	277	1,431	392	1,683
11–17	33	568	69	537	48	493	97	747
Gender								
Male	145	904	228	772	181	951	267	1,141
Female	153	957	208	706	149	791	238	1,024

*Figure does not meet standard for reliability or precision.
[a]Counts less than 30 should be interpreted with caution.
[b]Rate per 100,000 based on member months of enrollment in calendar year for children in the same demographic stratum.
SOURCE: Center for Health Care Policy and Evaluation, 1994, 1996, 1998, 2000.

Table 10. Number of plan members per year with a physician outpatient visit for pediatric urinary incontinence, by underlying condition, count[a], rate[b]

	1994		1996		1998		2000	
	Count	Rate	Count	Rate	Count	Rate	Count	Rate
				Commercially Insured Population				
Spina bifida-associated	2	0.6	7	1.5	11	1.6	14	1.9
Spinal cord injury-associated	1	0.3	0	0	4	0.6	5	0.7
Neurogenic incontinence NOS	10	3.2	32	7.1	66	9.9	91	13
Nocturnal enuresis	322	102	642	142	1,249	187	1,660	231
Other incontinence	1,224	386	1,687	372	2,380	356	2,642	367
				Medicaid Population				
Spina bifida-associated	0	0	1	1.7	1	2.6	0	0
Spinal cord injury-associated	0	0	0	0	0	0	0	0
Neurogenic incontinence NOS	2	1.1	3	5.1	1	2.6	3	6.4
Nocturnal enuresis	38	119	59	100	61	161	132	283
Other incontinence	182	568	276	468	191	504	233	500

[a]Counts less than 30 should be interpreted with caution.
[b]Rate per 100,000 children in the same demographic stratum.
NOTE: Categories are not mutually exclusive. Underlying condition was assigned to the incontinence visit if a diagnosis code for that condition occurred on a claim for that patient that year.
SOURCE: Center for Health Care Policy and Evaluation, 1994, 1996, 1998, 200.

Table 11. Visits to ambulatory surgery centers for urinary incontinence listed as any diagnosis by children having commercial health insurance, count[a], rate[b]

	1994		1996		1998		2000	
	Count	Rate	Count	Rate	Count	Rate	Count	Rate
Total	20	*	23	*	57	8.5	63	8.8
Age								
< 3	0	0	3	*	3	*	1	*
3–10	15	*	13	*	38	12	44	14
11–17	5	*	7	*	16	*	18	*
Gender								
Male	12	*	9	*	24	*	33	8.9
Female	8	*	14	*	33	10	30	8.6

*Figure does not meet standard for reliability or precision.
[a]Counts less than 30 should be interpreted with caution.
[b]Rate per 100,000 based on member months of enrollment in calendar year for children in the same demographic stratum.
SOURCE: Center for Health Care Policy and Evaluation, 1994, 1996, 1998, 2000.

Table 12. Mean inpatient cost per child[a] admitted with urinary incontinence listed as primary diagnosis, 1999–2001 (95% CI)

	Count	Mean Cost	
Total	1,251	$15,219	(14,158–16,279)
Age			
0–2	83	$8,366	(6,342–10,390)
3–10	672	$14,223	(13,071–15,376)
11–17	496	$17,715	(15,591–19,838)
Race/ethnicity[b]			
White	873	$15,190	(13,911–16,469)
Black	116	$14,157	(11,095–17,220)
Asian	11	$14,291	(9,243–19,340)
Hispanic	150	$14,838	(12,879–16,797)
American Indian	2	$106,191	(0–107,008)
Gender			
Male	593	$14,788	(13,811–15,766)
Female	658	$15,607	(13,791–17,422)
Region[b]			
Midwest	451	$15,472	(13,797–17,147)
Northeast	79	$17,285	(6,081–28,489)
South	512	$15,594	(14,548–16,640)
West	197	$13,763	(11,850–15,675)

[a]Calculated using adjusted ratio of costs to charges, including variable and fixed cost among participating children's hospitals.
[b]Values do not sum to total due to inclusion of children whose region or race/ethnicity is listed as other or missing.
SOURCE: National Association of Children's Hospitals and Related Institutions, 1999–2001.

and 2001, the average cost of hospitalization for urinary incontinence was $15,219; it increased from $8,366 in those under age 3 to $14,223 in 3- to 10-year-olds, and to $17,715 in 11- to 17-year-olds (Table 12). This trend appears to reflect a longer average length of hospital stay for the older two groups (Table 4). However, the data are not risk-adjusted and therefore must be interpreted with caution. No variability by gender or race/ethnicity was noted in the costs of hospitalization.

The aggregate costs of delivering outpatient care for incontinence are not available, but CHCPE data provide trends in physician payment over the years from 1994 to 2000. During this period, the total mean payment for physician office visits by commercially insured children with a primary diagnosis of incontinence rose from $45 in 1994 to $60 in 2000, of which $10 to $13 was patient co-payments. Payments did not differ by age group (Table 13). Outpatient physician payments were much lower for children covered by managed Medicaid plans, ranging from $24 in 1994 to $38 in 2000 (Table 14). The differences in payments between commercially insured children and those in managed Medicaid plans were due only in part to the absence of patient co-payments in the latter group.

Although there are no direct measures of the medical coasts associated with pediatric UI, the total probably does not exceed $15 to $20 million. Table 7 shows that there are roughly 225,000 physician

Table 13. Payments by children having commercial health insurance for physician outpatient visits with urinary incontinence listed as primary diagnosis

	Count[a]	Mean Total Payment	Total Amount Paid by Plan	Total Amount Paid by Patient	Count[a]	Mean Total Payment	Total Amount Paid by Plan	Total Amount Paid by Patient
	1994				1996			
Total	1,547	$45	$35	$10	2,245	$50	$40	$10
Age								
<3	27	$38	$28	$9.7	61	$47	$36	$11
3–10	1,137	$46	$36	$10	1,684	$51	$40	$10
11–17	383	$44	$34	$9.5	500	$47	$37	$10
Gender								
Male	953	$43	$34	$9.2	1,313	$49	$38	$10
Female	594	$49	$37	$12	932	$52	$41	$10
	1998				2000			
Total	3,263	$57	$45	$12	3,794	$60	$47	$13
Age								
<3	79	$55	$42	$13	78	$54	$42	$12
3–10	2,466	$57	$45	$12	2,851	$60	$47	$13
11–17	718	$56	$45	$11	865	$57	$45	$12
Gender								
Male	1,835	$54	$43	$11	2,070	$56	$44	$12
Female	1,428	$60	$47	$13	1,724	$63	$50	$13

[a]Counts less than 30 should be interpreted with caution.

SOURCE: Center for Health Care Policy and Evaluation, 1994, 1996, 1998, 2000.

Table 14. Payments by children having Medicaid for physician outpatient visits with urinary incontinence listed as primary diagnosis

	Count[a]	Mean Total Payment	Total Amount Paid by Plan	Total Amount Paid by Patient	Count[a]	Mean Total Payment	Total Amount Paid by Plan	Total Amount Paid by Patient
	1994				1996			
Total	207	$24	$24	$0	290	$36	$36	$0
Age								
<3	9	$28	$28	$0	13	$30	$30	$0
3–10	175	$24	$24	$0	238	$37	$37	$0
11–17	23	$28	$28	$0	39	$31	$31	$0
Gender								
Male	96	$24	$24	$0	136	$33	$33	$0
Female	111	$25	$25	$0	154	$38	$38	$0
	1998				2000			
Total	238	$40	$40	$0	271	$38	$38	$0
Age								
<3	3	$45	$45	$0	6	$34	$34	$0
3–10	197	$40	$40	$0	209	$37	$37	$0
11–17	38	$41	$41	$0	56	$39	$39	$0
Gender								
Male	124	$39	$39	$0	140	$36	$36	$0
Female	114	$41	$41	$0	131	$39	$39	$0

[a]Counts less than 30 should be interpreted with caution.

SOURCE: Center for Health Care Policy and Evalutaion, 1994, 1996, 1998, 2000.

visits for pediatric UI per year. At $50 per visit, this would total $11 million. Similarly, the 200 annual hospitalizations shown in Table 2, at $15,000 per hospitalization would add only another $3 million.

RECOMMENDATIONS

Pediatric urinary incontinence encompasses a vast array of disease states—acute, chronic, congenital, and acquired. As in other patient groups, incontinence in children implies either a symptom or a sign, rather than a specific disease entity. While patterns of care-seeking behavior are often driven by symptoms, resource utilization, management strategies, and costs are generally dictated by the underlying condition. ICD-9 coding currently relegates urinary incontinence to a 4-digit code. Most of the 5-digit ICD-9 codes for incontinence are symptom-based, and while they are illustrative, they do not provide an etiologic context. Future population-based studies should attempt to characterize care-seeking for incontinence by underlying diagnosis.

Unfortunately, it is difficult to obtain reliable epidemiologic data for urinary incontinence in children. Stratification by smaller age cohorts might provide more insight into care-seeking patterns and the natural history of incontinence complaints. A specific finding that warrants further investigation is the demonstrated healthcare utilization by patients under age 3. In most clinical contexts, wetting in this age cohort does not require investigation. It is unclear whether this finding is spurious, reflects the imprecision of ICD-9 coding, or represents changing attitudes toward toilet training in young children. Future analyses could characterize incontinence admissions by specific underlying diagnosis, associated diagnoses, nature of procedures, or distribution of charges. It is likely that patients requiring hospitalization represent a distinct subset of the incontinence population.

Although the majority of pediatric urinary incontinence care is provided in the outpatient setting, several features of such treatment warrant further investigation. The data sources analyzed for this chapter do not allow characterization of pediatric incontinence care by the subspecialty of the treating physician. Likewise, the proportion of costs associated with pharmaceutical usage, behavioral therapy, and diagnostic studies remains obscure. In addition, the available datasets do not allow for meaningful evaluation of long-term trends or regional variation.

The economic burden of urinary incontinence invites further investigation. Direct costs of incontinence could be characterized and stratified in greater detail. The available datasets do not allow evaluation of aggregate costs by treatment venue. An evaluation of indirect costs, including work absenteeism among caretakers and school absences among those treated, is also not available.

Urinary incontinence is a common reason for healthcare visits by children. Despite the prevalence of these complaints in the pediatric age group, relatively little epidemiologic and health services research has been directed at the large information gaps. To estimate the burden of pediatric incontinence care with an accurate picture of contemporary care patterns, this chapter has synthesized data from a broad array of sources, but the sparsity of the data has made the task difficult.

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