

Urolithiasis/Endourology

UROLOGIC DISEASES IN AMERICA PROJECT: UROLITHIASIS

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ABSTRACT

Purpose: We quantified the burden of urolithiasis in the United States by identifying trends in the use of health care resources and estimating the economic impact of the disease.

Materials and Methods: The analytical methods used to generate these results have been described previously.

Results: The rate of national inpatient hospitalizations for a diagnosis of urolithiasis decreased by 15% and hospital length of stay decreased from 2.6 to 2.2 days between 1994 and 2000. Rates of hospitalization were 2.5 to 3-fold higher for Medicare beneficiaries with little change between 1992 and 1998. Almost 2 million outpatient visits for a primary diagnosis of urolithiasis were recorded in 2000. Hospital outpatient visits increased by 40% between 1994 and 2000 and physician office visits increased by 43% between 1992 and 2000. In the Medicare population hospital outpatient and office visits increased by 29% and 41%, respectively, between 1992 and 1998. The distribution of surgical procedures remained relatively stable through the 1990s. Shock wave lithotripsy was the most commonly performed procedure, followed closely by ureteroscopy. Overall the total estimated annual expenditure for individuals with claims for a diagnosis of urolithiasis was almost \$2.1 billion in 2000, representing a 50% increase since 1994.

Conclusions: The cost of urolithiasis is estimated at almost \$2 billion annually and it appears to be increasing with time despite a shift in inpatient to outpatient treatment and the emergence of minimally invasive treatment modalities, perhaps because the prevalence of stone disease is increasing.

KEY WORDS: urinary tract; hospitalization; urinary calculi; cost and cost analysis; prevalence

Approximately 13% of men and 7% of women in the United States will be diagnosed with a kidney stone at some time in their lives and these numbers appear to be increasing.¹ Although some stones may be asymptomatic and detected only incidentally on imaging obtained for other purposes, frequently kidney stones are associated with pain, obstruction and infection, and they may require emergency room or physician visits, hospitalization and surgical intervention. Furthermore, the likelihood of experiencing another stone after a single stone event has been estimated to be up to 50% at 5 years.^{2–4} Even asymptomatic caliceal stones carry a risk of becoming symptomatic or requiring intervention within 5 years of diagnosis.⁵ Consequently medical evaluation and treatment of patients with a history of stones has been recommended to decrease recurrence, although this strategy may commit individuals at high risk to lifelong dietary modification and medication. Given this outlook, a diagnosis of kidney stones may have substantial impact with regard to patient morbidity and health care dollars. We explored the

burden of urolithiasis in the United States by quantifying and identifying trends in the use of health care resources and estimating the economic impact of the disease.

MATERIALS AND METHODS

The analytical methods used to generate these results have been described previously.^{6,7}

TRENDS IN USE

Inpatient. The Healthcare Cost and Utilization Project (HCUP) data set revealed a rate of hospitalization for upper tract stones of 62/100,000 population in 2000, a 15% decrease since 1994 (data not shown). Rates were highest in the 55- to 64-year-old age group. When stratified by ethnicity, hospitalization rates for white individuals were highest in all years of study and rates for Hispanic individuals were approximately 52% to 65% those of white individuals. Hospitalization rates in the West were consistently half that observed in the Northeast, Midwest and South, and little difference in admission rates was noted between urban and rural areas. The male-to-female ratio decreased with time from 1.86 in 1994 to 1.45 in 2000 (table 1).

Data from the Centers for Medicare and Medicaid Services (CMS) from 1992, 1995 and 1998 indicate that inpatient hospitalization rates for Medicare beneficiaries with nephrolithiasis were 2.5 to 3 times higher than in the population represented by HCUP (table 2). Hospitalization rates decreased by only 5%

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TABLE 1. Inpatient hospital stays by individuals with upper tract urolithiasis listed as primary diagnosis*

	Age Adjusted 1994		Age Adjusted 1996		Age Adjusted 1998		Age Adjusted 2000	
	Count	Rate (95% CI)	Count	Rate (95% CI)	Count	Rate (95% CI)	Count	Rate (95% CI)
Total†	199,638	79 (75–83)	193,325	73 (70–77)	190,129	71 (68–74)	193,699	71 (68–74)
Race/ethnicity:								
White	131,957	71 (67–75)	124,173	65 (62–68)	120,284	63 (60–66)	119,745	62 (59–65)
Black	7,772	25 (22–27)	7,957	24 (22–26)	8,272	25 (22–28)	7,643	22 (20–24)
Asian/Pacific Islander	1,818	26 (19–32)	1,831	19 (16–22)	2,038	20 (14–26)	2,068	20 (16–23)
Hispanic	10,205	40 (34–45)	11,366	40 (33–47)	12,153	40 (33–46)	14,724	45 (40–50)
Sex:								
Male	123,765	100 (95–106)	116,243	91 (86–95)	112,690	86 (81–91)	108,937	82 (78–86)
Female	75,857	59 (56–61)	77,074	57 (54–60)	77,439	56 (54–59)	84,744	60 (58–63)
Region:								
Midwest	51,727	86 (77–94)	48,167	78 (71–85)	46,514	74 (69–80)	49,578	78 (72–84)
Northeast	49,834	97 (88–107)	45,182	88 (81–95)	44,119	86 (76–96)	40,210	78 (69–86)
South	73,657	86 (78–94)	76,193	83 (76–90)	74,548	79 (73–85)	76,661	80 (73–87)
West	24,420	44 (39–48)	23,782	41 (36–45)	24,947	41 (37–46)	27,250	44 (39–48)
Metropolitan statistical area (MSA):								
Rural	43,444	68 (62–74)	43,931	74 (68–80)	41,353	68 (63–74)	45,093	75 (70–80)
Urban	155,363	82 (77–87)	149,002	73 (69–77)	147,378	71 (67–75)	148,257	70 (66–73)

Rate per 100,000 individuals based on 1994, 1996, 1998 and 2000 population estimates from Current Population Survey (CPS). (CPS Utilities, Unicon Research Corp., Santa Monica, California) for relevant demographic categories of the American civilian noninstitutionalized population age adjusted to the 2000 United States Census and counts may not sum to totals due to rounding.

* HCUP Nationwide Inpatient Sample, 1994, 1996, 1998 and 2000.

† Persons of missing age, other races, missing or unavailable race and ethnicity, and missing MSA are included in totals.

TABLE 2. Inpatient stays by Medicare beneficiaries with upper tract urolithiasis listed as primary diagnosis*

	1992			1995			1998		
	Count	Rate (95% CI)	Age Adjusted Rate (95% CI)	Count	Rate (95% CI)	Age Adjusted Rate (95% CI)	Count	Rate (95% CI)	Age Adjusted Rate (95% CI)
Totals:†									
All ages	67,080	194 (193–196)	194 (193–196)	66,460	188 (186–189)	188 (186–189)	61,540	184 (182–185)	184 (182–185)
Younger than 65	9,000	164 (161–168)		10,140	165 (162–169)		9,400	151 (148–154)	
65 or older	58,080	200 (198–201)		56,320	192 (191–194)		52,140	191 (189–192)	
Age:									
65–74	34,300	209 (207–211)		30,360	188 (185–190)		25,640	179 (177–181)	
75–84	19,880	211 (208–214)		20,080	208 (205–211)		20,920	220 (217–223)	
85–94	3,660	128 (124–132)		5,520	180 (175–184)		5,280	171 (166–175)	
95 or older	240	72 (63–80)		360	99 (88–109)		300	75 (67–84)	
Race/ethnicity:									
White	58,400	200 (198–202)	199 (197–200)	59,420	196 (194–197)	195 (194–197)	54,560	192 (190–194)	192 (190–193)
Black	4,580	155 (150–159)	158 (154–163)	4,800	149 (145–153)	152 (148–156)	4,320	139 (135–144)	141 (137–146)
Asian	Not available	Not available	Not available	120	72 (59–84)	48 (37–59)	360	115 (103–126)	108 (97–120)
Hispanic	Not available	Not available	Not available	640	160 (148–173)	175 (162–188)	1,180	168 (158–177)	179 (169–189)
North American native	Not available	Not available	Not available	60	165 (124–207)	221 (171–270)	120	222 (183–261)	222 (183–261)
Sex:									
Male	38,440	261 (258–264)	267 (264–269)	38,200	251 (248–254)	256 (254–259)	33,320	230 (228–233)	234 (232–237)
Female	28,640	145 (143–146)	140 (139–142)	28,260	140 (138–142)	136 (134–137)	28,220	148 (146–150)	145 (143–147)
Region:									
Midwest	16,720	192 (189–194)	191 (188–194)	16,120	179 (176–182)	179 (176–182)	15,460	179 (176–182)	176 (173–179)
Northeast	16,980	220 (217–224)	219 (215–222)	17,400	227 (223–230)	225 (221–228)	13,400	200 (197–203)	196 (192–199)
South	26,020	213 (210–215)	216 (214–219)	25,180	198 (196–201)	200 (198–203)	24,600	199 (196–201)	203 (201–206)
West	6,680	131 (128–134)	125 (122–128)	7,280	140 (137–144)	137 (134–140)	7,420	150 (146–153)	149 (146–153)

Unweighted counts were multiplied by 20 to arrive at values, and rates are per 100,000 Medicare beneficiaries in same demographic stratum and age adjusted to the 2000 United States Census (counts less than 600 should be interpreted with caution).

* CMS, Medicare Provider Analysis and Review and 5% Carrier File, 1992, 1995 and 1998.

† Includes persons of other races, unknown race and ethnicity, and other region.

between 1992 and 1998 from 194/100,000 to 184/100,000, a much less pronounced decrease than reported in the HCUP database during a similar time frame. Admission rates for Medicare patients in the 65 years and older age group were consistently higher than in the younger than 65 years age group, peaking in all years of study in the 75 to 84-year-old age group. Rates were lowest in the West. In 1995 white individuals had the highest and Asian individuals had the lowest rates of hospitalization. However, in 1998 rates were highest in North American Natives, a finding that should be viewed cautiously because of low counts in this group.

According to HCUP the mean hospital length of stay (LOS) for admissions associated with a primary diagnosis of upper tract stones consistently decreased from 2.6 days in 1994 to 2.2 days in 2000, a trend reflected in all age groups (table 3). The longest LOS (4.4 days) occurred in the 85 years and older age group and the shortest (1.8 days) occurred in the young-

est adult age group (18 to 24 years). Mean LOS was highest in the black American population and hospitalizations tended to be longer in urban compared with rural areas. When LOS was stratified by payor, private insurance/health maintenance organization (HMO) and self-pay groups were associated with the shortest LOS but showed the least variation during the study years. In contrast, Medicare patients had the longest LOS but showed a consistent decrease (23%) during the study years from 3.9 days in 1994 to 3.0 days in 2000.

In the pediatric population, represented by the National Association of Children’s Hospitals and Related Institutions, the mean LOS for admissions associated with a diagnosis of upper or lower tract stones varied from 3.1 days in 1999 to 2.8 days in 2000 to 3.2 days in 2001 (table 4). LOS was consistently highest (by 1.8 to 2.9-fold) in the 0 to 2-year-old age group compared with other age groups.

TABLE 3. National trends in inpatient LOS in individuals hospitalized with upper tract urolithiasis listed as primary diagnosis*

	Mean LOS (days)			
	1994	1996	1998	2000
All	2.6	2.4	2.3	2.2
Age:				
Younger than 18	2.5	2.4	2.2	1.9
18–24	2.2	2.0	1.9	1.8
25–34	2.2	2.0	1.9	1.9
35–44	2.3	2.1	2.1	2.0
45–54	2.4	2.3	2.1	2.1
55–64	2.7	2.4	2.3	2.3
65–74	3.4	3.1	2.8	2.6
75–84	4.3	3.7	3.5	3.3
85 or Older	4.7	4.3	4.6	4.4
Race/ethnicity:				
White	2.6	2.4	2.2	2.1
Black	3.5	3.4	3.1	3.1
Asian/Pacific Islander	2.8	3.1	2.6	2.7
Hispanic	2.9	2.7	2.6	2.4
Other	3.9	2.4	2.5	2.3
Region:				
Midwest	2.4	2.2	2.1	1.9
Northeast	3.1	2.7	2.5	2.4
South	2.6	2.3	2.3	2.3
West	2.4	2.4	2.2	2.3
MSA:				
Rural	2.4	2.1	2.0	1.9
Urban	2.7	2.5	2.4	2.3
Primary payor:				
Medicare	3.9	3.3	3.1	3.0
Medicaid	3.5	3.2	2.9	2.7
Private insurance/HMO	2.2	2.0	2.0	1.9
Self-pay	2.2	2.1	2.0	2.0
No charge	†	2.3	2.6	2.7
Other	2.6	2.3	2.3	2.3

* HCUP Nationwide Inpatient Sample, 1994, 1996, 1998 and 2000.
 † Value does not meet reliability or precision standard.

Procedures performed during hospitalization for urolithiasis included diagnostic imaging studies, drainage of the collecting system to relieve pain or obstruction and surgical stone removal. Data on commercially insured individuals derived from the Center for Health Care Policy and Evaluation (CHCPE) demonstrated a 2.5-fold increase in the total number of procedures performed during inpatient hospitalization of patients with a primary diagnosis of urolithiasis (upper and lower tract stones) between 1994 and 2000, al-

TABLE 5. National hospital outpatient visits by individuals with urolithiasis*

Visit Reason	Count	Rate (95% CI)
Primary:		
1994	114,687	45 (29–62)
1996	31,666	12 (6–18)
1998	83,383	31 (14–48)
2000	171,784	63 (34–92)
Any:		
1994	130,704	52 (34–69)
1996	68,343	26 (13–40)
1998	138,576	52 (30–74)
2000	300,073	110 (69–151)

Rate per 100,000 individuals based on 1994, 1996, 1998 and 2000 population estimates from CPS for relevant demographic categories of American civilian noninstitutionalized population.
 * NHAMCS-Outpatient, 1994, 1996, 1998 and 2000.

though the procedure rate overall remained at 25/100,000 individuals (data not shown). Rates in men exceeded those in women in all study years. Procedure rates increased with age, peaking in the 55 to 64-year-old age group.

Outpatient. An individual may be seen in the outpatient setting as part of the diagnosis of urolithiasis, during urological treatment (before and/or after the procedure) or for medical evaluation and prevention. We focused on visits for which urolithiasis (upper and lower tract stones) was the primary diagnosis.

Hospital Outpatient Visits: Table 5 lists the rates for hospital outpatient visits by patients with urolithiasis as the primary reason for the visit based on National Hospital Ambulatory Medical Care Survey (NHAMCS) data for 1994 to 2000. The estimated rate in 2000 was 40% higher than that in 1994 (63/100,000 vs 45/100,000). However, the overlapping CIs preclude definitive inferences. Overall the absolute number of hospital outpatient visits during this period increased from 114,687 to 171,784.

The hospital outpatient visit rate in Medicare patients increased slightly from 1992 to 1998 for those younger than 65 years and for those 65 years and older (table 6). For example, in the older group the rate increased from 28/100,000 in 1992 to 36/100,000 in 1998. The visit rate decreased with increasing age and the rates were approximately twice as high in men as in women (fig. 1). Rates were lowest in the South in 1992 and 1995, and in the West in 1998.

TABLE 4. Trends in mean inpatient LOS in children hospitalized with urolithiasis listed as primary diagnosis*

	1999		2000		2001	
	Count	Mean Days LOS (95% CI)	Count	Mean Days LOS (95% CI)	Count	Mean Days LOS (95% CI)
All	461	3.1 (2.7–3.6)	553	2.8 (2.6–3.1)	619	3.2 (2.7–3.8)
Age (yrs):						
0–2	43	7.5 (3.8–11.2)	45	4.8 (3.2–6.4)	37	6.2 (4.2–8.2)
3–10	193	2.8 (2.4–3.2)	198	2.6 (2.3–2.9)	225	2.9 (2.4–3.4)
11–17	225	2.6 (2.3–2.9)	310	2.7 (2.3–3.1)	357	3.1 (2.2–4.1)
Race/ethnicity:						
White	338	3.1 (2.6–3.6)	385	2.7 (2.4–3.0)	447	2.8 (2.5–3.1)
Black	31	3.4 (1.9–5.0)	34	3.7 (2.5–4.8)	38	4.1 (1.8–6.3)
Asian	1	4.0	3	1.3 (0–2.8)	2	1.5 (0–7.8)
Hispanic	36	3.1 (2.4–3.8)	51	2.8 (2.0–3.5)	78	3.4 (2.6–4.1)
American Indian	0		3	2.7 (0–5.5)	1	2.0
Other	17	2.4 (1.2–3.5)	21	2.4 (1.5–3.3)	32	8.6 (0–18.6)
Missing	38	3.6 (2.5–4.6)	56	3.6 (2.4–4.7)	21	2.9 (2.1–3.6)
Sex:						
Male	261	3.0 (2.5–3.6)	280	2.8 (2.4–3.2)	312	3.0 (2.5–3.4)
Female	200	3.3 (2.6–4.0)	273	2.8 (2.4–3.2)	307	3.5 (2.4–4.5)
Region:						
Midwest	160	3.3 (2.4–4.3)	197	2.7 (2.2–3.2)	199	3.2 (1.6–4.8)
Northeast	24	2.5 (1.7–3.2)	39	2.5 (2.0–3.0)	56	2.6 (2.1–3.1)
South	203	3.0 (2.5–3.5)	246	2.8 (2.4–3.2)	287	3.0 (2.6–3.4)
West	61	3.2 (2.4–4.2)	50	3.3 (2.0–4.7)	77	4.4 (3.0–5.7)
Missing	13	3.9 (2.0–5.8)	21	3.9 (2.5–5.3)	0	

* National Association of Children's Hospitals and Related Institutions, 1999 to 2001.

TABLE 6. Outpatient hospital visits by Medicare beneficiaries with upper and/or lower tract urolithiasis listed as primary diagnosis*

	1992			1995			1998		
	Count	Rate (95% CI)	Age Adjusted Rate (95% CI)	Count	Rate (95% CI)	Age Adjusted Rate (95% CI)	Count	Rate (95% CI)	Age Adjusted Rate (95% CI)
Totals:†	10,980	32 (31-32)	32 (31-32)	13,320	38 (37-38)	38 (37-38)	13,920	42 (41-42)	42 (41-42)
All ages	2,700	49 (47-51)		3,480	57 (55-59)		4,020	65 (63-67)	
Younger than 65	8,280	28 (28-29)		9,840	34 (33-34)		9,900	36 (36-37)	
Age:									
65-74	5,100	31 (30-32)		5,960	37 (36-38)		6,660	46 (45-48)	
75-84	2,840	30 (29-31)		3,280	34 (33-35)		2,780	29 (28-30)	
85-94	300	10 (9.3-12)		560	18 (17-20)		360	12 (10-13)	
95 or Older	40	12 (8.3-16)		40	11 (7.7-14)		100	25 (20-30)	
Race/ethnicity:									
White	8,060	28 (27-28)	28 (27-28)	10,440	34 (34-35)	34 (34-35)	10,560	37 (36-38)	37 (36-38)
Black	1,920	65 (62-68)	64 (61-67)	1,900	59 (56-62)	57 (54-60)	1,820	59 (56-61)	59 (56-61)
Asian	Not available	Not available	Not available	120	72 (59-84)	72 (59-84)	220	70 (61-79)	70 (61-79)
Hispanic	Not available	Not available	Not available	320	80 (71-89)	80 (71-89)	620	88 (81-95)	85 (78-92)
North American native	Not available	Not available	Not available	Not available	Not available	Not available	80	148 (115-181)	148 (115-181)
Sex:									
Male	5,780	39 (38-40)	41 (40-42)	8,020	53 (52-54)	53 (52-55)	7,620	53 (51-54)	52 (51-53)
Female	5,200	26 (26-27)	25 (25-26)	5,300	26 (26-27)	26 (25-26)	6,300	33 (32-34)	33 (33-34)
Region:									
Midwest	3,460	40 (38-41)	39 (37-40)	3,580	40 (38-41)	40 (38-41)	3,800	44 (43-45)	44 (43-46)
Northeast	2,500	32 (31-34)	33 (32-35)	3,860	50 (49-52)	52 (50-53)	3,720	56 (54-57)	53 (52-55)
South	2,560	21 (20-22)	22 (21-22)	3,660	29 (28-30)	28 (27-29)	4,560	37 (36-38)	37 (36-39)
West	2,040	40 (38-42)	39 (38-41)	1,880	36 (35-38)	37 (36-39)	1,720	35 (33-36)	36 (34-38)

Unweighted counts were multiplied by 20 to arrive at values, and rates are per 100,000 Medicare beneficiaries in same demographic stratum and age adjusted to the 2000 United States Census (counts less than 600 should be interpreted with caution).

* CMS, 5% Carrier and Outpatient Files, 1992, 1995 and 1998.

† Includes persons of other races, unknown race and ethnicity, and other region.

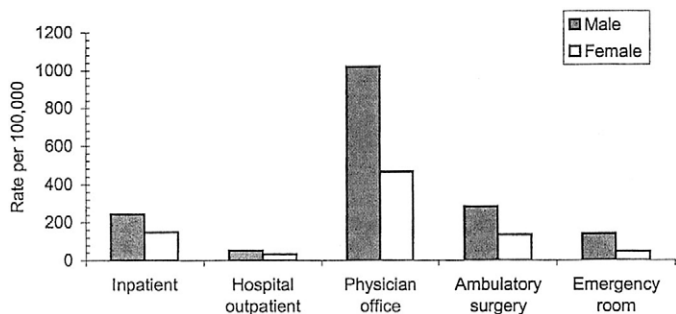


FIG. 1. National rates of visits for urolithiasis by gender and site of service in 1998 according to CMS, 1998.

Physician Office Visits: Physician office visit rates for patients with a primary diagnosis of urolithiasis were determined from National Ambulatory Medical Care Survey (NAMCS) data. The rates were stable between 1992 and 1996, and then increased in 1998 and 2000. The visit rate was 43% higher in 2000 than it was in 1992 (table 7). The total number of visits almost doubled between 1992 and 2000, increasing from 950,000 to 1,825,000.

In the Medicare data physician office visit rates increased 41% between 1992 to 1998 for those younger than 65 years and 25% for those 65 years or older (table 8). The rates peaked in the 65- to 74-year-old age group. In 1995 and 1998 the rates were higher for Hispanic than for Asian and white individuals, and rates were lowest for black Americans.

Veterans Affairs (VA) Data on Adult Outpatients: Although we use the term rate for Veterans Affairs (VA) data, the data represent the number of cases being seen for the specified condition per 100,000 unique VA outpatients. The rates for outpatient visits by VA patients with a primary diagnosis of urinary tract stones decreased between 1999 and 2001 (table 9). This decrease occurred for upper tract and lower tract stones and the rate for upper tract stones was almost 10 times that for lower tract stones. The visit rate was highest in the 55 to 64-year-old age group for upper tract stones (table 9). The rate for males was 50% higher than for females, and Hispanic individuals as a group had the highest rates. There were also regional differences with the highest rates occurring in the South. The VA is one of the few sources that provides information specifically for bladder stones. The visit rate for a primary diagnosis of bladder stones decreased slightly from 45/100,000 individuals in 1999 to 38/100,000 in 2001 (table 10). Two-thirds of the visits for lower tract stones in 2001 were for bladder stones.

Physician Office and Hospital Outpatient Visits Combined: Combined NAMCS and NHAMCS data revealed almost 2 million visits in 2000 by patients with urolithiasis as the primary reason for the visit. This translates into a rate of 731/100,000 population. There were 2.7 million visits by patients with urolithiasis listed as any of the reasons for the visit (982/100,000 population). Thus, the majority of visits for urolithiasis (74%) were for urolithiasis as the primary diagnosis (tables 5 and 7).

Ambulatory Surgery Procedures: Visits to an ambulatory surgery center by individuals with commercial insurance who had a primary diagnosis of urolithiasis (upper or lower tract stones) were tabulated for 1994, 1996, 1998 and 2000 from the CHCPE (data not shown). The total number of visits increased more than 4-fold between 1994 and 1998, and the rate of visits increased by 58% (from 117/100,000 to 185/100,000 individuals). During the years studied, the male-to-female ratio varied from 1.5 to 1.8, which was slightly lower than expected in view of the ratio of incidence rates for stone disease. The peak age for visits was between 65 and 74 years for 1994, 1996 and 1998 but it decreased to 55 to 64 years in 2000 (fig. 2). Regional differences were apparent with the

TABLE 7. National physician office visits by individuals with urolithiasis*

Visit Reason	Count	Rate (95% CI)
1992		
Primary:		
Total	949,581	379 (234–524)
Age younger than 54	669,280	337 (172–501)
Age 55 or Older	†	†
Any:		
Total	1,242,509	496 (334–658)
Age younger than 54	748,240	376 (203–550)
Age 55 or older	494,269	956 (540–1,371)
1994		
Primary:		
Total	1,002,487	397 (265–528)
Age younger than 54	630,282	311 (176–447)
Age 55 or older	372,205	738 (366–1,111)
Any:		
Total	1,275,273	504 (361–647)
Age younger than 54	797,164	394 (247–541)
Age 55 or older	478,109	948 (542–1,355)
1996		
Primary:		
Total	924,895	351 (236–466)
Age younger than 54	554,821	263 (159–367)
Age 55 or older	†	†
Any:		
Total	1,374,098	521 (370–673)
Age younger than 54	751,502	356 (223–490)
Age 55 or older	622,596	1,184 (643–1,725)
1998		
Primary:		
Total	1,289,692	481 (321–641)
Age younger than 54	661,079	309 (184–434)
Age 55 or older	†	†
Any:		
Total	1,497,817	558 (391–725)
Age younger than 54	745,868	349 (217–481)
Age 55 or older	751,949	1,385 (743–2,026)
2000		
Primary:		
Total	1,825,123	668 (464–871)
Age younger than 55	1,184,522	545 (319–771)
Age 55 or older	640,601	1,143 (677–1,610)
Any:		
Total	2,382,217	872 (641–1,102)
Age younger than 54	1,582,354	728 (467–989)
Age 55 or older	799,863	1,428 (941–1,914)

Figure does not meet standard for reliability or precision.
 Rate per 100,000 individuals based on 1992, 1994, 1996, 1998 and 2000 population estimates from CPS for relevant demographic categories of American adult civilian noninstitutionalized population (counts may not sum to totals due to rounding).
 * NAMCS 1992, 1994, 1996, 1998 and 2000.
 † Value does not meet reliability or precision standard.

highest rates consistently seen in the South. The CMS database revealed that ambulatory surgery visits by Medicare patients with a primary diagnosis of urolithiasis also increased with time from 42,320 total visits in 1992 to 66,580 in 1998 and, likewise, the visit rate increased from 123/100,000 to 199/100,000 (table 11). Available data on ambulatory surgery for urolithiasis in children are too sparse to provide reliable estimates of use.

Emergency room visits. Between 1994 and 1998 emergency room visits by individuals with a primary diagnosis of urolithiasis remained relatively stable (NHAMCS), although there was a 50% increase in 2000 (table 12). Future studies are needed to determine whether this represented a sharp increase or simply year-to-year variability. In general the rate for males was twice that for females. Emergency room visits were less common in the Medicare population (data not shown) than in the NHAMCS population. In Medicare beneficiaries, the rate increased between 1992 and 1998 for the younger than 65 and 65 years and older groups (53% and 31%, respectively) for males and females, and in all regions. Males were 3 times more likely than females to visit an

TABLE 8. Physician office visits by Medicare beneficiaries with upper and/or lower tract urolithiasis listed as primary diagnosis*

	1992			1995			1998		
	Count	Rate (95% CI)	Age Adjusted Rate (95% CI)	Count	Rate (95% CI)	Age Adjusted Rate (95% CI)	Count	Rate (95% CI)	Age Adjusted Rate (95% CI)
Totals:†									
All ages	178,320	516 (514-519)	516 (514-519)	221,220	625 (622-627)	625 (622-627)	235,920	704 (701-706)	704 (701-706)
Younger than 65	20,800	380 (375-385)		34,000	554 (549-560)		39,680	639 (632-645)	
65 or Older	157,520	542 (539-545)		187,220	640 (637-643)		196,240	718 (715-721)	
Age:									
65-74	106,340	647 (643-651)		123,640	764 (760-768)		122,760	857 (852-862)	
75-84	44,400	471 (466-475)		55,440	575 (570-580)		63,460	668 (663-673)	
85-94	6,560	229 (223-234)		7,920	258 (252-263)		9,480	307 (301-313)	
95 or Older	220	66 (57-74)		220	60 (52-68)		540	136 (124-147)	
Race/ethnicity:									
White	157,460	539 (537-542)	538 (536-541)	200,800	662 (659-664)	661 (658-664)	209,780	738 (735-742)	738 (735-741)
Black	9,660	326 (320-333)	321 (314-327)	10,440	324 (318-330)	316 (310-322)	11,840	382 (375-389)	375 (368-382)
Asian	Not available	Not available	Not available	1,020	610 (573-647)	646 (607-684)	2,560	815 (784-847)	828 (796-860)
Hispanic	Not available	Not available	Not available	3,100	776 (749-803)	821 (793-849)	5,840	830 (809-852)	845 (823-866)
North American native	Not available	Not available	Not available	120	331 (273-389)	276 (221-331)	260	481 (422-540)	481 (422-540)
Sex:									
Male	109,560	744 (740-748)	756 (752-761)	139,220	915 (910-920)	925 (920-930)	147,360	1,018 (1,013-1,023)	1,031 (1,026-1,037)
Female	68,760	347 (344-350)	338 (335-340)	82,000	406 (404-409)	399 (396-401)	88,560	465 (462-468)	454 (451-457)
Region:									
Midwest	37,560	430 (426-435)	430 (426-435)	46,920	521 (516-525)	523 (518-528)	51,180	593 (588-598)	594 (589-599)
Northeast	37,700	489 (484-494)	482 (477-487)	47,600	620 (615-626)	612 (607-618)	47,560	710 (704-717)	704 (698-710)
South	72,240	591 (587-595)	596 (592-600)	88,220	694 (689-699)	699 (694-704)	100,020	808 (803-813)	814 (809-819)
West	26,500	520 (514-526)	518 (512-524)	32,580	629 (622-635)	624 (617-631)	30,060	607 (600-614)	597 (590-603)

Unweighted counts were multiplied by 20 to arrive at values, and rates are per 100,000 Medicare beneficiaries in same demographic stratum and age adjusted to the 2000 United States Census (counts less than 600 should be interpreted with caution).

* CMS, 5% Carrier and Outpatient Files, 1992, 1995 and 1998.

† Includes persons of other races, unknown race and ethnicity, and other region.

TABLE 9. Upper and/or lower tract urolithiasis diagnosis codes listed as primary diagnosis in VA patients seeking outpatient care*

	Upper Tract Stone Count (rate)			Lower Tract Stone Count (rate)		
	1999	2000	2001	1999	2000	2001
Totals†	18,584 (611)	19,246 (587)	20,717 (561)	2,051 (67)	2,113 (64)	2,107 (54)
Age:						
18–24	66 (261)	69 (293)	77 (334)	5 (20)	3 (13)	3 (13)
25–34	790 (524)	736 (518)	774 (570)	44 (29)	35 (25)	50 (37)
35–44	1,909 (578)	1,786 (572)	1,661 (554)	121 (37)	119 (38)	86 (29)
45–54	5,224 (758)	5,492 (766)	5,636 (748)	355 (52)	357 (50)	361 (48)
55–64	4,080 (813)	4,406 (795)	5,167 (796)	392 (78)	411 (74)	438 (68)
65–74	4,222 (556)	4,326 (524)	4,596 (483)	614 (81)	625 (76)	599 (63)
75–84	2,165 (404)	2,294 (357)	2,602 (325)	474 (88)	511 (79)	520 (65)
85 or Older	128 (261)	137 (235)	204 (260)	46 (94)	52 (89)	50 (64)
Race/ethnicity:						
White	11,484 (841)	11,692 (794)	12,268 (762)	1,406 (103)	1,338 (91)	1,312 (81)
Black	1,482 (444)	1,538 (449)	1,667 (470)	205 (61)	243 (71)	254 (72)
Hispanic	1,222 (1,068)	1,295 (1,057)	1,183 (918)	108 (94)	112 (91)	127 (99)
Other	143 (739)	126 (622)	151 (692)	10 (52)	14 (69)	9 (41)
Unknown	4,253 (353)	4,595 (348)	5,448 (346)	322 (27)	406 (31)	405 (26)
Sex:						
Male	18,079 (624)	18,682 (598)	20,088 (570)	1,998 (69)	2,068 (66)	2,061 (58)
Female	505 (358)	564 (374)	629 (381)	53 (38)	45 (30)	46 (28)
Region:						
Midwest	3,717 (541)	3,790 (509)	3,799 (459)	432 (63)	505 (68)	424 (51)
Northeast	3,890 (530)	3,934 (505)	4,251 (489)	575 (78)	503 (65)	533 (61)
South	7,179 (705)	7,565 (678)	8,099 (626)	654 (64)	701 (63)	737 (57)
West	3,798 (632)	3,957 (623)	4,568 (653)	390 (65)	401 (63)	413 (59)
Insurance status:						
No insurance/self-pay	11,434 (626)	11,574 (639)	12,186 (640)	1,108 (61)	1,085 (60)	1,063 (56)
Medicare/Medicare supplemental	4,059 (583)	4,575 (500)	5,382 (455)	650 (93)	729 (80)	793 (67)
Medicaid	41 (828)	61 (772)	61 (679)	6 (121)	6 (76)	7 (78)
Private insurance/HMO/preferred provider organization	2,849 (587)	2,786 (546)	2,833 (512)	275 (57)	270 (53)	226 (41)
Other insurance	186 (736)	237 (824)	236 (708)	10 (40)	19 (66)	17 (51)
Unknown	15 (785)	13 (529)	19 (210)	2 (105)	4 (163)	1 (11)

The term count is used to be consistent with other Urologic Diseases of America tables but VA tables represent the population of VA users and, thus, they are not weighted to represent national population estimates, while rate is defined as the number of unique patients with each condition divided by the base population in the same fiscal year × 100,000 to calculate the rate per 100,000 unique outpatients and race/ethnicity data are from clinical observation only, not self-report (note large number of unknown values).

* Outpatient Clinic File, VA Austin Automation Center, fiscal years 1999 to 2001.

† Includes persons of other race, unknown race and ethnicity, and other region.

TABLE 10. Bladder stones diagnosis codes with no coexisting benign prostatic hyperplasia listed as primary diagnosis in VA patients seeking outpatient care*

	1999		2000		2001	
	Count	Rate	Count	Rate	Count	Rate
Totals	1,188	45	1,282	44	1,255	38
Age:						
40–44	26	14	37	21	20	12
45–54	186	28	179	26	174	24
55–64	242	49	258	48	262	41
65–74	387	52	426	52	412	44
75–84	315	61	347	55	352	45
85 or Older	32	70	35	62	35	46
Race/ethnicity:						
White	847	68	815	61	792	53
Black	102	36	155	53	152	50
Hispanic	55	53	64	57	82	69
Other	5	29	9	50	7	36
Unknown	179	18	239	21	222	16
Region:						
Midwest	274	45	348	52	292	39
Northeast	355	54	331	47	317	40
South	343	39	390	40	414	36
West	216	42	213	39	232	38
Insurance status:						
No insurance/self-pay	579	38	625	41	583	36
Medicare/Medicare supplemental	423	62	480	54	533	46
Medicaid	4	93	3	43	4	50
Private insurance/HMO/preferred provider organization	172	40	164	36	127	25
Other insurance	8	38	6	25	7	25
Unknown	2	127	4	193	1	13

The term count is used to be consistent with other Urologic Diseases of America tables but VA tables represent the population of VA users and, thus, they are not weighted to represent national population estimates, while rate is defined as the number of unique patients with each condition divided by the base population in the same fiscal year × 100,000 to calculate the rate per 100,000 unique outpatients and race/ethnicity data are from clinical observation only and not self-report (note large number of unknown values).

* Outpatient Clinic File, VA Austin Automation Center, fiscal years 1999 to 2001.

emergency room for urolithiasis. There were clear regional variations with rates highest in the South. In 1995 and 1998 the rates were highest in Hispanic individuals.

Surgical trends. The rates and distribution of minimally invasive surgical procedures, namely extracorporeal shock wave lithotripsy (ESWL, Dornier Medical Systems, Marietta,

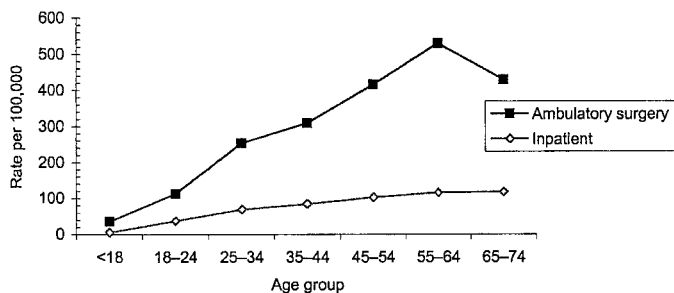


FIG. 2. National rates of inpatient and ambulatory surgery visits for urolithiasis by age group in 2000 according to Center for Health Care Policy and Evaluation (Ambulatory Surgery) and HCUP (Inpatient), 2000.

Georgia), ureteroscopy (URS) and percutaneous nephrostolithotomy (PCNL), were relatively stable in the Medicare population during 1992, 1995 and 1998 (table 13). ESWL comprised 51% to 54%, URS comprised 40% to 41% and PCNL comprised 3% to 4% of procedures. However, rates of open stone surgery decreased by 64% from 920/100,000 beneficiaries with urolithiasis in 1992 to 333/100,000 in 1998. In accordance with the decrease in rates of open surgery open operations represented only 1.6% of procedures in 1998 compared with 4.3% in 1992.

The distribution of procedures in commercially insured individuals for 1994, 1996, 1998 and 2000 derived from the CHCPE dataset (data not shown) was remarkably similar to that of Medicare patients. ESWL comprised 49% to 54% of procedures, URS comprised 40% to 42% and PCNL comprised 5% to 6%. Open stone surgery comprised 2% of procedures in 1994 and it decreased to less than 1% in 2000.

ECONOMIC IMPACT

The economic impact of urolithiasis takes into account not only the direct medical cost of treatment, including the cost of emergency room and office visits, inpatient hospitalization, ambulatory surgery and medication, but also the indirect cost associated with lost work days. In this study cost reflects expenditures by the patient and third party payors rather

TABLE 12. National emergency room visits by individuals with urolithiasis listed as primary diagnosis*

	Count	Rate (95% CI)
1994:		
Total	368,667	146 (110–181)
Male	246,375	200 (140–260)
Female	122,292	94 (55–134)
1996:		
Total	331,758	126 (93–159)
Male	189,647	148 (99–196)
Female	142,111	105 (61–149)
1998:		
Total	399,403	149 (112–186)
Male	268,193	205 (142–267)
Female	131,210	96 (55–136)
2000:		
Total	617,647	226 (175–277)
Male	406,137	305 (225–385)
Female	211,510	151 (88–214)

Rate per 100,000 based on 1994, 1996, 1998 and 2000 population estimates from CPS for relevant demographic categories of American civilian noninstitutionalized population.

* NHAMCS-Emergency Room, 1994, 1996, 1998 and 2000.

than the actual cost of services, equipment and medication. The Ingenix data set for 1999 (Ingenix, Salt Lake City, Utah) estimated the average annual expenditure for medical care and prescription drugs for privately insured individuals between 18 and 64 years old to be \$7,656 for those with and \$3,184 for those without a claim corresponding to a diagnosis of urolithiasis. The difference of \$4,472 per covered individual is the estimated effect of urolithiasis on per capita costs. Total annual medical expenditures were higher for women than for men in each group. When stratified by age, the highest expenditure for those with a urolithiasis related claim occurred in the 45 to 54-year-old age group, which corresponds to the peak incidence of stone disease.

The estimated total annual expenditure for individuals with inpatient and outpatient claims for a primary diagnosis of urolithiasis was \$2.1 billion in 2000, including \$971 million for inpatient services, \$607 million for outpatient services and \$490 million for emergency room services (table 14). From 1994 to 2000 the total annual expenditure in-

TABLE 11. Visits to ambulatory surgery centers by Medicare beneficiaries with upper and/or lower tract urolithiasis listed as primary diagnosis*

	1992		1995		1998	
	Count	Rate (95% CI)	Count	Rate (95% CI)	Count	Rate (95% CI)
Totals:†						
All ages	42,320	123 (121–124)	57,580	163 (161–164)	66,580	199 (197–200)
Younger than 65	4,480	82 (79–84)	8,040	131 (128–134)	8,480	136 (134–139)
65 or Older	37,840	130 (129–132)	49,540	169 (168–171)	58,100	213 (211–214)
Age:						
65–74	23,460	143 (141–145)	30,060	186 (184–188)	33,500	234 (231–236)
75–84	12,600	134 (131–136)	16,800	174 (172–177)	20,580	217 (214–220)
85–94	1,720	60 (57–63)	2,520	82 (79–85)	3,980	129 (125–133)
95 or Older	60	18 (13–22)	160	44 (37–51)	40	10 (7.0–13)
Race/ethnicity:						
White	37,820	130 (128–131)	51,840	171 (169–172)	59,760	210 (209–212)
Black	2,500	84 (81–88)	3,600	112 (108–115)	4,380	141 (137–146)
Asian	Not available	Not available	200	120 (103–136)	460	146 (133–160)
Hispanic	Not available	Not available	500	125 (114–136)	820	117 (109–125)
North American native	Not available	Not available	40	110 (77–143)	80	148 (115–181)
Sex:						
Male	25,900	176 (174–178)	35,880	236 (233–238)	40,860	282 (279–285)
Female	16,420	83 (82–84)	21,700	108 (106–109)	25,720	135 (133–137)
Region:						
Midwest	11,800	135 (133–138)	16,840	187 (184–190)	18,920	219 (216–222)
Northeast	7,180	93 (91–95)	10,120	132 (129–134)	13,160	197 (193–200)
South	18,320	150 (148–152)	23,040	181 (179–184)	26,680	215 (213–218)
West	4,980	98 (95–100)	7,380	142 (139–146)	7,480	151 (148–154)

Unweighted counts were multiplied by 20 to arrive at values and rate is per 100,000 Medicare beneficiaries in same demographic stratum.

* CMS, 5% Carrier and Outpatient Files, 1992, 1995 and 1998.

† Includes other races, unknown race and ethnicity, and other region.

TABLE 13. *Procedures for nephrolithiasis in Medicare beneficiaries**

	1992		1995		1998	
	Count	Rate	Count	Rate	Count	Rate
PCNL:	1,900	882	1,600	665	2,180	844
Ambulatory surgery center	0	0.0	0	0.0	0	0.0
Hospital outpt	300	139	220	91	520	201
Inpt	1,580	734	1,340	557	1,660	643
Physician office	20	9.3	40	17	0	0.0
Other	0	0.0	0	0.0	0	0.0
ESWL:	23,560	10,943	28,260	11,738	29,420	11,393
Ambulatory surgery center	1,000	464	1,160	482	1,400	542
Hospital outpt	15,300	7,106	22,100	9,179	23,680	9,170
Inpt	5,580	2,592	3,700	1,537	2,960	1,146
Physician office	860	399	840	349	1,000	387
Other	820	381	460	191	380	147
URS:	18,840	8,751	21,280	8,839	21,620	8,372
Ambulatory surgery center	120	56	640	266	740	287
Hospital outpt	5,440	2,527	9,080	3,771	12,100	4,686
Inpt	12,700	5,899	11,120	4,619	8,440	3,268
Physician office	440	204	340	141	280	108
Other	140	65	100	42	60	23
Open stone surgery:	1,980	920	1,740	723	860	333
Ambulatory surgery center	0	0.0	0	0.0	0	0.0
Hospital outpt	60	28	160	66	120	46
Inpt	1,800	836	1,480	615	720	279
Physician office	60	28	80	33	20	7.7
Other	60	28	20	8.3	0	0.0

Unweighted counts were multiplied by 20 to arrive at values and rate is per 100,000 Medicare beneficiaries with nephrolithiasis diagnosis (counts less than 600 should be interpreted with caution).

* CMS, 5% sample, 1992, 1995 and 1998.

TABLE 14. *Expenditures for urolithiasis and share of costs by service type**

	\$ Million 1994 (%)	\$ Million 1996 (%)	\$ Million 1998 (%)	\$ Million 2000 (%)
Unadjusted total†	1,373.9	1,233.9	1,518.5	2,067.4
Total share:				
Inpt care	785.9 (57.2)	811.9 (65.8)	862.5 (56.8)	971.7 (47.0)
Physician office	151.1 (11.0)	154.2 (12.5)	236.9 (15.6)	363.9 (17.6)
Hospital outpt	233.6 (17.0)	58.0 (4.7)	135.1 (8.9)	244.0 (11.8)
Emergency room	204.7 (14.9)	209.8 (17.0)	285.5 (18.8)	490.0 (23.7)

* NAMCS, NHAMCS, HCUP and MEPS, 1994, 1996, 1998 and 2000.

† Excludes spending on outpatient prescription drugs for urolithiasis treatment with average drug spending for urolithiasis related conditions estimated at \$4 million to \$14 million annually for 1996 to 1998.

TABLE 15. *Expenditures for Medicare beneficiaries 65 years and older for urolithiasis treatment**

	\$ Million 1992 (%)	\$ Million 1995 (%)	\$ Million 1998 (%)
Totals	613.4	779.4	834.4
Inpt	423.7 (69.1)	513.8 (65.9)	518.9 (62.2)
Outpt:	179.2 (29.2)	250.6 (32.2)	296.1 (35.5)
Physician office	56.7 (9.2)	81.6 (10.5)	96.1 (11.5)
Hospital outpt	5.5 (0.9)	5.1 (0.7)	4.8 (0.6)
Ambulatory surgery	117.0 (19.1)	163.9 (21.0)	195.2 (23.4)
Emergency room	10.5 (1.7)	14.9 (1.9)	19.4 (2.3)

Percents may not total 100% because of rounding.

* CMS, 1992, 1995 and 1998.

creased 50% from \$1.37 to \$2.07 billion. During that time the proportion of total expenditure attributed to outpatient services (emergency room, office visits and hospital outpatient) increased from 43% to 53%. Medicare expenditures related to urolithiasis for beneficiaries 65 years and older also increased 36% from \$613 million in 1992 to \$834 million in 1998 (table 15).

The Medical Expenditure Panel Survey (MEPS) from 1996 to 1998 estimated annual spending on outpatient prescription drugs to be \$4 to \$14 million. A total of 29% of men and 24% of women with urolithiasis filed a prescription claim related to the condition with a mean annual prescription expenditure of \$43 and \$48, respectively (data not shown).

Indirect costs of urolithiasis, including lost wages and missed work, also figure into the overall economic burden.

According to the MarketScan dataset for 1999 (MarketScan Ltd., Chichester, United Kingdom) 30% of employed individuals with an inpatient or outpatient claim for a diagnosis of nephrolithiasis reported missed days of work in association with the diagnosis. A mean total of 19 hours of missed work annually included 4.4 hours in association with inpatient claims and 14.6 hours in association with outpatient claims.

DISCUSSION

Urolithiasis is a common problem in the United States and it is increasing in frequency.¹ The true prevalence of stone disease is likely underestimated because many stones remain asymptomatic and consequently go undiagnosed.

The increased prevalence of stone disease has been paralleled by an increase in the total annual cost of urolithiasis. It now approaches \$2.1 billion. The increase in annual expenditures for urolithiasis is all the more remarkable given the shift in care of individuals with urolithiasis from the inpatient to the outpatient setting as less invasive surgical modalities have been introduced (fig. 3). Likewise, efforts to decrease the morbidity of surgical treatment, such as decreasing the size^{8,9} of or eliminating the need for a nephrostomy tube after PCNL¹⁰⁻¹² along with more effective outpatient strategies for managing acute renal colic,¹³⁻¹⁵ have contributed to a decrease in hospital LOS.

However, the cost of nephrolithiasis extends beyond surgical intervention and the management of an acute stone event. Although a relatively small proportion of stone form-

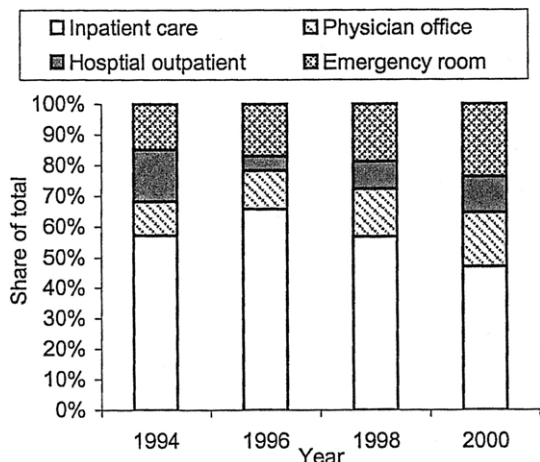


FIG. 3. Percent share of costs for urolithiasis by type of service in 1994 to 2000 according to NAMCS, NHAMCS, HCUP and MEPS, 1994, 1996, 1998 and 2000.

ers undergoes metabolic evaluation and medical management for the prevention of recurrent stones, the cost of outpatient prescription drugs for stone disease more than tripled between 1996 and 1998. While the cost-effectiveness of medical management of stone disease is debatable,^{16,17} the efficacy of drug therapy for decreasing stone recurrence is well proven.¹⁸ Moreover, when the indirect cost of stone disease is considered with regard to missed work days, lost wages and decreased productivity, the benefit of preventing stone recurrence is further underscored.

In the last 2½ decades the surgical management of stone disease has been transformed from an invasive treatment with an inpatient hospitalization and long convalescence to a minimally invasive treatment with little or no hospital time and a short recovery period. Information from several data sets suggests that ESWL is the most frequently performed surgical treatment, followed closely by URS, with little change in the distribution of procedures in the last decade. Despite the high success rates and low morbidity of PCNL this modality has consistently represented less than 10% of procedures, partly due to the reluctance of practitioners to accept a more invasive, albeit more effective, minimally invasive technique.¹⁹ However, the most consistent trend has been the steady decrease in open surgery, which now represents less than 1% of stone procedures. Interestingly these observations fail to reflect the dramatic changes in endoscopic technology that have occurred in the last decade and the relative stagnation of ESWL technology. However, a lag from the introduction of new technology to a discernible change in practice patterns may account for the lack of change in the distribution of endoscopic modalities relative to ESWL seen in these data sets. Interestingly Kerbl et al reviewed data from the Health Care Financing Administration (now known as CMS) to identify changes in the distribution of surgical procedures with time and they also found that shock wave lithotripsy and PCNL remained relatively stable at 70% to 80% and 4% to 6% of procedures, respectively, between 1992 and 2000.²⁰ However, URS increased by almost 60% during that interval from 14% to 22% of procedures, which was still a much lower proportion of procedures than indicated by the data sets that we reviewed. The reason for this discrepancy is unclear but it is likely that endoscopic treatment will represent a greater proportion of procedures in the future.

CONCLUSIONS

Urolithiasis is common in the American population and its prevalence is increasing. The available data on urolithiasis support the important influences of age, sex, region and race/eth-

nicity. The setting for the acute care and surgical treatment of patients with stones has changed with time, in that inpatient admissions and length of stay have decreased as outpatient treatment has burgeoned. The trends in distribution of surgical treatment modalities show some inconsistency among various databases, although shock wave lithotripsy remains the most commonly performed procedure for upper tract stones, followed by ureteroscopy and percutaneous nephrostolithotomy. The 1 consistent trend identified by all data sets is a dramatic decrease in the use of open surgery. The cost of urolithiasis is estimated at almost \$2 billion annually and it appears to be increasing with time despite the shift from inpatient to outpatient procedures and the shorter length of hospital stays, perhaps because the prevalence of stone disease is increasing.

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