CHAPTER 2

Benign Prostatic Hyperplasia

John T. Wei, MD, MS
Associate Professor of Urology
Michigan Urology Center
Universtity of Michigan
Ann Arbor, Michigan

Elizabeth Calhoun, PhD
Associate Professor of Health Policy and Administration
Senior Research Scientist
University of Illinois at Chicago
Chicago, Illinois

Steven J. Jacobsen, MD, PhD
Director of Research
Research and Evaluation
Southern California Permanente Medical Group
Pasadena, California

Contents

Benign Prostatic Hyperplasia

John T. Wei, MD, MS
Elizabeth A. Calhoun, PhD
Steven J. Jacobsen, MD, PhD

INTRODUCTION

Benign prostatic hyperplasia (BPH), the most common benign neoplasm in American men, is a chronic condition that increases in both incidence and prevalence with age. It is associated with progressive lower urinary tract symptoms and affects nearly three out of four men during the seventh decade of life. Using definitions in the Agency for Health Care Policy and Research (AHCPR) Diagnostic and Treatment Guidelines for BPH (1), it is estimated that approximately 6.5 million of the 27 million Caucasian men 50 to 79 years of age in the United States in 2000 were expected to meet the criteria for discussing treatment options for BPH (2). In 2000, approximately 4.5 million visits were made to physicians' offices to for a primary diagnosis of BPH, and nearly 8 million visits were made with either a primary or secondary diagnosis of BPH. In the same year, approximately 87,400 prostatectomies for BPH were performed on inpatients in nonfederal hospitals in the United States. While the number of outpatient visits for BPH climbed consistently during the 1990s, there was a dramatic decline in the utilization of transurethral prostatectomy, inpatient hospitalization, and length of hospital stay for this condition. These trends reflect the changing face of medical management for BPH, i.e., increasing utilization of pharmacological agents and minimally invasive therapies. In 2000, the direct cost of BPH treatment was estimated to be $1.1 billion, exclusive of outpatient pharmaceuticals. Given the impact that BPH can have on quality of life and the cost of medical care for millions of American men, investigations into risk factors, diagnostic and therapeutic resource utilization, and outcomes related to BPH are warranted.

DEFINITION AND DIAGNOSIS

Benign prostatic hyperplasia is characterized pathologically by a cellular proliferation of the epithelial and stromal elements within the prostate gland. These changes, which begin histologically in the third decade of life and clinically in the fifth decade of life, are mediated primarily by tissue levels of dihydrotestosterone within the prostate and result in the gland's continued growth throughout life. When prostatic enlargement occurs, increased resistance in the proximal urethra may limit urinary flow during micturition, often resulting in pathophysiologic changes in the bladder wall. Consequently, lower urinary tract symptoms (LUTS) due to prostatic obstruction are inseparable from symptoms due to bladder detrusor dysfunction. Moreover, bladder dysfunction for reasons other than prostatic obstruction, such as aging or diabetic neuropathy, may occur independently; such cases are often misclassified as BPH.

Clinically, BPH is distinguished by progressive development of LUTS. These symptoms are variable and range from nocturia, incomplete emptying, urinary hesitancy, weak stream, frequency, and urgency to the development of acute urinary retention. Such symptoms can have a significant negative impact on quality of life, leading many men to seek treatment (3).

Table 1. Codes used in the diagnosis and management of benign prostatic hyperplasia

Males 40 years or older with:

ICD-9 diagnosis codes

599.6 Urinary obstruction, unspecified
600.0 Hypertrophy (benign) of prostate
600.9 Unspecified hyperplasia of prostate

ICD-9 procedure codes

60.2 Transurethral prostatectomy
60.21 Transurethral (ultrasound) guided laser induced prostatectomy (TULIP)
60.29 Other transurethral prostatectomy
60.3 Suprapubic prostatectomy
60.4 Retropubic prostatectomy
60.94 Control of (postoperative) hemorrhage of prostate
60.95 Transurethral balloon dilation of prostatic urethra
60.96 Transurethral destruction of prostate tissue by microwave thermotherapy
60.97 Other transurethral destruction of prostatic tissue by other thermotherapy

CPT procedure codes

52450 Transurethral incision of prostate
52510 Transurethral balloon dilation of the prostatic urethra
52601 Transurethral electrosurgical resection of prostate, including control of postoperative bleeding, complete (vasectomy, meatomy, cystourethroscopy, urethral calibration, and/or dilation, and internal urethrotomy are included)
52606 Transurethral fulguration for postoperative bleeding occurring after the usual follow-up time
52612 Transurethral resection of prostate; first stage of two-stage resection (partial resection)
52614 Transurethral resection of prostate; second stage of two-stage resection (resection completed)
52620 Transurethral resection of residual obstructive tissue after 90 days postoperative
52630 Transurethral resection of regrowth of obstructive tissue longer than one year postoperative
52640 Transurethral resection of postoperative bladder neck contracture
52647 Noncontact laser coagulation of prostate, including control of postoperative bleeding, complete (vasectomy, meatotomy, cystourethroscopy, urethral calibration and/or dilation, and internal urethrotomy are included)
52648 Contact laser vaporization with or without transurethral resection of prostate, including control of postoperative bleeding, complete (vasectomy, meatotomy, cystourethroscopy, urethral calibration and/or dilation, and internal urethrotomy are included)
53850 Transurethral destruction of prostate tissue by microwave thermotherapy
53852 Transurethral destruction of prostate tissue by radiofrequency thermotherapy
55801 Prostatectomy, perineal, subtotal (including control of postoperative bleeding, vasectomy, meatotomy, urethral calibration and/or dilation, and internal urethrotomy)
55821 Prostatectomy (including control of postoperative bleeding, vasectomy, meatotomy, urethral calibration and/or dilation, and internal urethrotomy); suprapubic, subtotal, one or two stages
55831 Prostatectomy (including control of postoperative bleeding, vasectomy, meatotomy, urethral calibration and/or dilation, and internal urethrotomy); retropubic, subtotal

Males 40 years or older with one of the following ICD-9 codes, but not carrying diagnosis code 185 (malignant neoplasm of prostate) as another diagnosis

594.1 Other calculus in bladder
788.20 Retention of urine, unspecified
788.21 Incomplete bladder emptying
788.29 Other specified retention of urine
788.41 Urinary frequency
788.42 Polyuria
788.43 Nocturia
788.61 Splitting of urinary stream
788.62 Slowing of urinary system

Continued on next page

Table 1 (continued). Codes used in the diagnosis and management of benign prostatic hyperplasia

Any of the following ICD-9 codes and any of the procedure or BPH medication codes	
600.1	Nodular prostate
600.2	Benign localized hyperplasia (eg adenoma of prostate, adenofibramatous hypertrophy of prostate) of prostate

While no standard definition of BPH exists, clinically significant BPH is heralded by the onset of LUTS; therefore, LUTS are usually presumed to be due to BPH in the absence of another obvious cause. The International Classification of Diseases (ICD-9-CM) coding system is frequently used to identify cases in studies of BPH prevalence; other approaches include using codes for specific pharmacological or surgical interventions as surrogates for BPH cases.

In this chapter, the burden of illness attributable to BPH and its associated medical care is characterized from a variety of data sources, including administrative datasets using ICD-9 and Current Procedural Terminology (CPT) codes, large national health surveys, and community-based studies. Table 1 lists the codes used in the diagnosis and management of BPH. Although most BPH cases are coded as 600.0, this diagnostic code usually reflects a clinical diagnosis ranging from abnormal digital rectal examination to invasive therapy for symptoms. Although these administrative data provide for concrete estimates of resource utilization, they probably underestimate the number of men affected by BPH. In the National Health and Nutrition Examination Survey (NHANES-III), four items were used to identify symptomatic men:

- number of times a night the man gets up to urinate;
- feeling that the bladder is not empty;
- trouble starting urination; and
- in men older than 60 years, decreased urinary stream.

While NHANES-III data are nationally representative, they fail to capture the full range of BPH-related voiding symptoms. Methodological differences in data collection among the datasets used result in great variability in estimates of BPH prevalence, incidence, and resource utilization. National surveys such as NHANES-III are essential for ascertaining population-based estimates, but they are limited in the quantity of information available from each subject.

In 1994, the Agency for Health Care Policy and Research (AHCPR), since renamed the Agency for Healthcare Research and Quality (AHRQ), released a set of diagnostic and treatment guidelines for BPH tailored to symptom severity (1). The potential impact of BPH can be estimated by applying these guidelines to the proportion of symptomatic males in populations-based studies (Figure 1). As underscored by the AHCPR BPH Guidelines panel, BPH actually comprises four interrelated conditions (2):

- histologic BPH;
- symptomatic BPH;
- bladder outlet obstruction, as evidenced by symptomatic BPH;
- detrusor decompensation.

The AHCPR BPH Guidelines also outline the basic evaluation and stratification of patients for treatment decision making, whereby men are stratified on the presence of mild, moderate, or severe LUTS. The guidelines recommend using the American Urological Association Symptom Index (AUASI), a validated patient-reported measure of LUTS that captures both obstructive and irritative symptoms (4). The AUASI was developed by the American Urological Association (AUA) in collaboration with the Patient Outcomes Research Team for Prostate Disease (4). The self-administered instrument includes seven questions rated on 0-to-5 Likert scales; scores can range from 0 to 35 points. Nearly 60% of urologists reported documenting the AUASI for men with LUTS (5), and the vast majority report following the AHCPR guidelines by using an AUASI score higher than 7 as an indication of moderate-to-severe symptoms. Several large community-based cohort studies, including the Olmsted County Study of Urinary Symptoms and Health Status Among Men and the Flint Men's Health Study, have adopted the AUASI as their measure of disease severity in men with LUTS. Nevertheless,

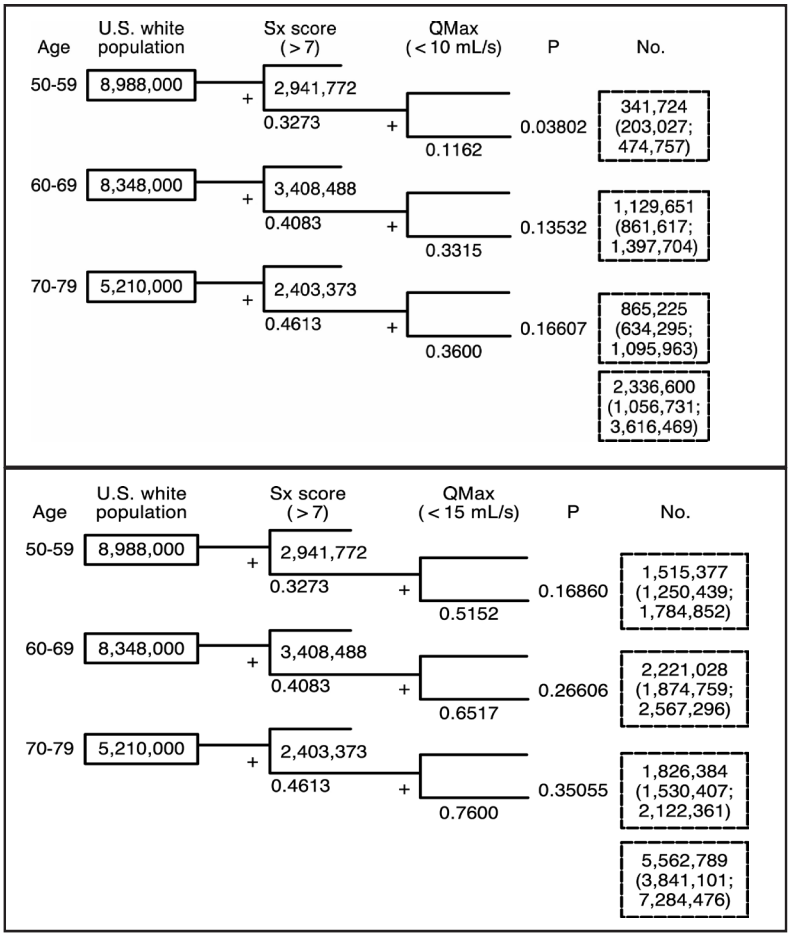

Figure 1. Potential impact of new benign prostatic hyperplasia guidelines on the 1990 US white male population aged 50 to 79 years. Top, Guideline criteria of American Urological Association Symptom Index (AUASI) greater than 7 and peak urinary flow rate (Qmax) less than 15 mL/s. Bottom, Guideline criteria of AUASI greater than 7 and Qmax less than 10 mL/s. P indicates the proportion of men within each age group meeting both criteria; No., number of men meeting both criteria (95% confidence interval). All proportions (decimal figures) are derived from the Olmsted County (Minnesota) Study of Urinary Symptoms and Health Status Among Men.

a limitation of these datasets is that histological confirmation of BPH is universally absent. Despite the widespread acceptance of the AUASI, the absence of an accepted standard definition for BPH suggests that comparisons across datasets should be approached with caution.

PREVALENCE AND INCIDENCE

Recent data from NHANES-III suggest that BPH and LUTS are common in men 30 years of age and older and increase with age; nocturia was the most prevalent of the obstructive symptoms measured (6) (Table 2). Among men aged 60 to 69, nearly three out of four men complained of nocturia; the proportion was nearly 83% among men 70 years and older, illustrating the increasing burden of LUTS that occurs with aging. However, NHANES-III captured only nocturia, urinary hesitancy, incomplete emptying, weak stream, and surgery. Other population-based studies, such as the Massachusetts Male Aging Study (MMAS), may provide more accurate assessments

Table 2. Prevalence of specific lower urinary tract symptoms and noncancer prostate surgery in US men over 30 years of age, NHANES III[a]

Age at Interview (yr)	Actual (weighted) Sample Size	Nocturia (times per night) 0	1	2	3+	Incomplete Emptying	Hesitancy	Weak Stream[b]	Noncancer Prostate Surgery[c]
30–39	1,601 (20,737,223)	64.8 ± 1.8	27.3 ± 1.6	5.3 ± 0.9	2.6 ± 0.6	6.1 ± 0.9	2.4 ± 0.6	...	...
40–49	1,307 (16,103,901)	54.4 ± 2.1	36.2 ± 2.3	6.1 ± 1.0	3.3 ± 0.7	8.0 ± 1.1	4.4 ± 0.8	...	...
50–59	935 (10,486,737)	40.7 ± 2.1	39.1 ± 2.3	13.2 ± 1.4	7.0 ± 1.0	10.2 ± 1.6	4.8 ± 1.0	...	...
60–69	1,250 (8,888,814)	28.0 ± 2.0	41.7 ± 2.1	20.3 ± 2.0	10.0 ± 1.1	17.4 ± 1.7	10.7 ± 1.2	44.8 ± 2.6	8.0 ± 1.2
70+	1,631 (7,310,268)	16.9 ± 1.7	36.4 ± 1.7	26.1 ± 1.7	20.6 ± 1.8	22.7 ± 1.5	14.1 ± 1.3	55.8 ± 1.8	22.4 ± 1.1
P-value[c]		< 0.0001	0.57	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.0003	< 0.0001
Among men who never had prostate surgery									
60–69	1,163 (8,181,653)	28.1 ± 2.2	42.4 ± 2.2	20.0 ± 1.9	9.5 ± 1.0	16.2 ± 1.5	10.0 ± 1.4	44.8 ± 2.8	...
70+	1,245 (5,671,346)	17.3 ± 2.0	37.0 ± 2.2	25.5 ± 2.0	20.2 ± 2.0	22.0 ± 1.5	14.0 ± 1.6	56.8 ± 1.9	...
P-value[c]		< 0.0001	0.04	0.02	< 0.0001	0.003	0.03	0.0002	...

...data not available.

Key: NHANES III, Third National Health and Nutrition Examination Survey.

Data presented as the percentage ± standard error, unless otherwise noted.

[a]Estimates are based on civilian non-institutionalized participants who were not observed in bed or in a wheelchair/stretcher or with leg paralysis/paresis and who gave a response to at least one lower urinary tract symptom or surgery question. Proxy respondents were excluded.

[b]Question not asked of men 30 to 59 years old.

[c]Where symptom prevalences are presented for more than two age groups, reported one-sided P values are for a test of increasing prevalence with age. Where symptoms are presented for only two age groups, reported one-sided P values are for a test of higher prevalence in the older men compared with the younger men and were calculated from a two-sample normal test with unequal variances.

SOURCE: Reprinted from Urology, 59, Platz EA, Smit E, Curhan GC, Nyberg LM, Giovannucci E, Prevalence of and racial/ethnic variation in lower urinary tract symptoms and noncancer prostate surgery in US men, 877–883, Copyright 2002, with permission from Elsevier.

Table 3. Prevalence of clinical benign prostatic hyperplasia at follow-up, by age category (Massachusetts Male Aging Study)

	Total	Age at Baseline (yrs) 40–49	50–59	60–70	P-value for Trend Across Age[a]
Total	1019	394	353	272	...
Clinical diagnosis of BPH[b]	185	33 8.4%	71 20.1%	81 29.8%	0.001
Underwent TURP for BPH	42	3 0.8%	16 4.5%	23 8.5%	0.001
Clinical diagnosis or TURP for BPH[c]	198	33 8.4%	74 21.0%	91 33.5%	0.001
On medication for enlarged or swollen prostate	48	4 1.0%	23 6.5%	21 7.7%	0.001
On medication or history of TURP for BPH[d]	86	7 1.8%	36 10.2%	43 15.8%	0.001

...data not available.

[a]Mantel-Haenszel extension test.

[b]Either frequent or difficult urination and told by a health professional that they had an enlarged or swollen prostate.

[c]Clinical diagnosis or history of TURP, "clinical BPH."

[d]On medication or history of TURP for BPH, "severe clinical BPH."

SOURCE: Reprinted from Journal of Clinical Epidemiology, 54, Meigs JB, Mohr B, Barry MJ, Collins MM, McKinlay JB, Risk factors for clinical benign prostatic hyperplasia in a community-based population of healthy aging men, 935–944, Copyright 2001, with permission from Elsevier Science.

Table 4. Frequency of benign prostatic hyperplasia[a] listed as a diagnosis in male VA patients seeking outpatient care, rate[b]

	1999		2000		2001	
	Primary Diagnosis	Any Diagnosis	Primary Diagnosis	Any Diagnosis	Primary Diagnosis	Any Diagnosis
Total	6,098	10,654	5,705	11,650	4,811	11,406
Age						
40–44	955	1,339	965	1,426	808	1,280
45–54	2,420	3,707	2,318	3,938	1,966	3,703
55–64	5,748	9,419	5,247	9,652	4,275	8,821
65–74	8,427	15,075	7,650	16,102	6,210	15,231
75–84	9,293	17,068	8,328	18,300	6,799	17,556
85+	9,109	16,223	8,563	17,663	7,136	17,199
Race/ethnicity						
White	7,663	13,055	6,993	13,688	5,889	12,809
Black	6,677	10,061	6,143	10,101	5,126	9,140
Hispanic	7,683	10,978	7,779	11,940	6,131	11,123
Other	5,900	9,459	5,128	9,201	4,302	8,681
Unknown	3,846	7,846	3,858	9,629	3,481	10,466
Region						
Midwest	6,348	11,220	5,766	12,225	4,890	11,996
Northeast	6,406	11,078	6,046	12,154	5,158	12,114
South	6,047	10,497	5,720	11,604	4,695	11,078
West	5,499	9,724	5,171	10,390	4,484	10,379
Insurance status						
No insurance/self-pay	4,837	8,034	4,525	8,451	3,747	8,008
Medicare/Medicare supplemental	9,040	16,754	7,938	17,533	6,557	16,682
Medicaid	4,830	7,942	5,034	8,466	4,359	7,936
Private insurance/HMO/PPO	5,977	10,420	5,354	11,046	4,319	10,544
Other insurance	4,844	8,286	4,451	8,217	3,778	7,808
Unknown	5,834	8,370	4,534	6,946	1,675	4,691

HMO, health maintenance organization; PPO, preferred provider organization.

[a]Represents diagnosis codes for BPH alone (no bladder stones).

[b]Rate is defined as the number of unique patients with each condition divided by the base population in the same fiscal year x 100,000 to calculate the rate per 100,000 unique outpatients.

NOTE: Race/ethnicity data from clinical observation only, not self-report; note large number of unknown values.

Source: Outpatient Clinic File (OPC), VA Austin Automation Center, 1999–2001.

of prevalence because they also include irritative symptoms such as urinary frequency and urgency (7). In the MMAS cohort, BPH was identified by clinical diagnosis or history of surgery for BPH. The prevalence ranged from 8.4% in men 40 to 49 years of age to 33.5% in men aged 60 to 70 (Table 3).

These trends are further supported by 2001 data from the Veterans Health Administration (VA), in which the prevalence of BPH listed as the primary diagnosis during outpatient visits ranged from 808 per 100,000 in men aged 40 to 44 to 7,136 per 100,000 in men older than 85 (Table 4). The rate for all men 45 and older more than doubled when BPH was listed as any diagnosis. Between 1999 and 2001, the number of male veterans with outpatient visits for BPH as a primary diagnosis decreased, while the number of visits with BPH listed as any diagnosis increased. That these rates are lower than those reported in the MMAS suggests that older male veterans may also access care for their BPH outside the VA system. Nonetheless, the VA data support the association with age that has been observed in other populations.

The Olmsted County Study (OCS) and the Flint Men's Health Study have been used to produce a variety of estimates regarding the prevalence, incidence, and natural history of BPH. The initial OCS cohort was randomly selected from a sample stratified on age and residence (City of Rochester vs balance of Olmsted County); the sampling frame was constructed from the Rochester Epidemiology Project. This sampling frame identified approximately 95% of the residents (according to the 1990 census) and included only Caucasian males. The Flint cohort was closely modeled after the OCS and included a probability sample of African American men selected from households or group dwelling units located in Flint, Michigan, and from selected census tracts in neighboring Genessee County. Prior history of prostate cancer or prior operations on the prostate gland were exclusion criteria for both the Flint Men's Health Study and the OCS. Eligible men were stratified into ten-year age groups: 40 to 49, 50 to 59, 60 to 69, and 70 to 79. Comprehensive interviews were performed to obtain information on potential personal and environmental risk factors for prostate cancer; the AUASI; family history of cancer; health behaviors such as smoking, drinking, and physical activity; occupational or other exposures to selected

Table 5. Urinary symptom frequency (percentage of men with urinary symptoms occurring more than rarely)

	Age Group (yrs)			
	40–49	50–59	60–69	70+
Total number of patients	800	612	436	271
% with symptoms showing strong age relation				
Nocturia	16	29	42	55
Weak stream	25	34	39	49
Stopping or starting	18	25	29	32
Feeling cannot wait	28	32	42	46
Feeling bladder not empty	16	17	23	23
% with symptoms not showing age relation				
Frequent urination (within 2 hrs)	34	34	36	35
Pain or burning	5	6	4	7
Strain or push	12	15	13	15
Repeat within 10 mins	12	11	18	11
Dribbling	37	43	44	36
Difficulty starting	14	18	20	19
Wet clothing	23	25	24	22
Obstructive score[a]				
% with score greater than 7	16	24	27	30
Corrected[b]	15	21	24	29
Median score	3	4	4	4
Corrected[c]	2	3	4	4
AUA score:				
% with score greater than 7	26	33	41	46
Corrected[d]	24	31	36	44
Median score	4	5	6	7

[a]Obstructive score is the sum of weak stream, stopping and starting, dribbling, hesitancy, and incomplete emptying.

[b]Corrected proportion is the age-stratified, weighted mean of dichtomous (0 and 1) variables with weights n/N (responders) and (N-n)/N (initial nonresponders), where N corresponds to the total number of randomly selected eligible and invited men, and n is the number of participants in the main study cohort, within the age decade.

[c]Corrected median scores were calculated by replicating nonresponder questionnaire data to simulate all nonresponders and calculating the median of the combined data for respondents and initial nonresponders. This approach assumes that initial nonresponders for whom data were obtained are representative of all refusals.

[d]AUA composite symptom frequency score not available from the nonresponder study. Corrected proportions were obtained by decreasing the study cohort proportions by the percentage reduction observed for AUA bother score, assuming a similar relationship would apply to the frequency score. Calculation of corrected AUA score median is not practical.

SOURCE: Reprinted from Chute CG, Panser LA, Girman CJ, Oesterling JE, Guess HA, Jacobsen SJ, Lieber MM, The prevalence of prostatism: a population-based survey of urinary symptoms, Journal of Urology, 150, 85–89, Copyright 1993, with permission from Lippincott Williams & Wilkins.

Table 6. Clinical correlates of benign prostatic hyperplasia (Flint Men's Health Study)

		Age Group (yrs)				P-value	
	Overall	40–49	50–59	60–69	70–79	ANOVA	Trend
Mean prostate vol ± SE (cc)	26.6 ± 0.5	23.3 ± 0.7	26.7 ± 0.8	32.9 ± 1.6	32.8 ± 2.0	0.0001	0.0001
Mean peak flow ± SE (cc/sec)	22.3 ± 0.9	25.6 ± 1.7	20.5 ± 1.2	18.2 ± 1.3	15.4 ± 1.5	0.0002	0.0001
Mean symptom score ± SE	7.3 ± 0.4	6.4 ± 0.6	7.5 ± 0.6	9.0 ± 0.7	7.7 ± 1.1	0.08	0.03
Mean bothersomeness score ± SE	4.0 ± 0.3	2.9 ± 0.5	4.4 ± 0.6	5.4 ± 0.6	5.4 ± 1.0	0.01	0.0001
% symptom score greater than 7	39.6	31.7	43.2	51.7	38.6	0.04	0.07
% bothersomeness score greater than 3	35.0	25.0	36.0	52.9	50.0	0.0004	0.0001

SOURCE: Reprinted from Wei JT, Schottenfeld D, Cooper K, Taylor JM, Faerber GJ, Velarde MA, Bree R, Montie JE, Cooney KA, The natural history of lower urinary tract symptoms in black American men: relationships with aging, prostate size, flow rate and bothersomeness, Journal of Urology, 165, 1,521–1,525, Copyright 2001, with permission from Lippincott Williams & Wilkins.

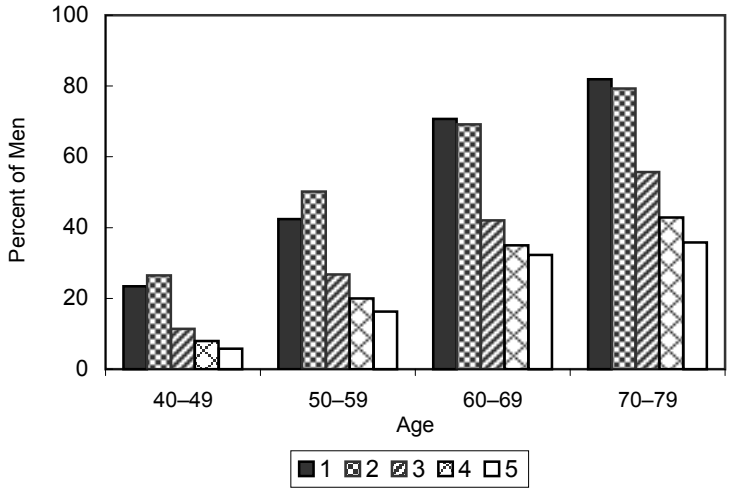

Figure 2. Age-specific prevalence of benign prostatic hyperplasia.
Note: Bar 1, prevalence of pathologically defined benign prostatic hyperplasia from a compilation of five autopsy studies (*n* = 1,075); bars 2 and 3, clinical prevalence in the Baltimore Longitudinal Study of Aging (*n* = 1,075); bar 2 is based on history and physical examination and bar 3 is based on the presence of an enlarged prostate on manual rectal examination; bar 4, prevalence is based on an enlarged prostate on manual rectal examination from a compilation of life insurance examinations (*n* = 6,975); bar 5, community prevalence in Rochester, Minnesota, based on case definition using symptoms, prostate size, and urinary flow rates (*n* = 457).

SOURCE: Adapted from Guess HA, Benign Prostatic hyperplasia: antecedents and natural history, Epidemiologic Reviews, 1992, 14, 131–153, with permission of Oxford University Press.

Table 7. Incidence of acute urinary retention, by baseline age and lower urinary tract symptom severity

	None-to-Mild Symptoms (AUASI ≤ 7)		Moderate-to-Severe Symptoms (AUASI > 7)	
Age	Incidence/1,000 Person-Years	(95% CI)	Incidence/1,000 Person-Years	(95% CI)
40–49	2.6	(0.8–6.0)	3.0	(0.4–10.8)
50–59	1.7	(0.3–4.8)	7.4	(2.7–16.1)
60–69	5.4	(2.0–11.6)	12.9	(6.2–23.8)
70–79	9.3	(3.4–20.3)	34.7	(20.2–55.5)

Total person-years 8344.4, median years of follow-up (25th, 75th percentile) 4.2 (3.6, 4.7).

SOURCE: Reprinted from Jacobsen SJ, Jacobson DJ, Girman CJ, Roberts RO, Rhodes T, Guess HA, Lieber MM, Natural history of prostatism: risk factors for acute urinary retention, Journal of Urology, 158, 481–487, Copyright 1997, with permission from Lippincott Williams & Wilkins.

chemicals; general health condition; history of chronic illnesses; sexual activity; health services utilization; and demographic characteristics. Subjects were invited to complete a clinical examination that included serum prostate specific antigen (PSA), as well as transrectal ultrasonography and uroflowmetry. These studies captured a broader range of LUTS than was possible in NHANES-III (6). In the OCS, moderate-to-severe LUTS, defined as AUASI greater than 7, ranged from 26% in men 40 to 49 years of age to 46% in men 70 and older (Table 5) (8, 9).

Using the OCS definition to identify cases, the Flint Men's Health Study found moderate to severe LUTS in 39.6% of African American men, also with a strong age association (Table 6) (10). In autopsy series, the prevalence of histological BPH is even more common (Figure 2) (11). Clinical samples based on men presenting for care allow for more detailed data but may be biased by type and severity of symptoms.

Collectively, all these studies illustrate the great prevalence of LUTS and document the burden of it that occurs with increasing age. As noted above, moderate-to-severe LUTS, defined as AUASI greater than 7, ranged from 26% in the fifth decade of life to 46% in the eighth decade. NHANES-III found no racial/ethnic variation in the prevalence of obstructive symptoms; however, overall LUTS (including irritative symptoms) appear to occur with greater severity in African American men.

NATURAL HISTORY

The natural history of BPH/LUTS is more accurately estimated in community-based cohorts than in self-selected patients seeking medical attention. The former are more likely to represent the full spectrum of illness and less likely to be biased by socioeconomic factors such as access to healthcare. Longitudinal data from the OCS suggest an annual prostate growth rate of 1.6% diagnosed by transrectal ultrasonography (12) and an average annual increase of 0.2 AUASI point (13). Over a median follow-up period of 42 months in the OCS, the proportion of men reporting moderate-to-severe LUTS increased from 33% to 49% (13).

Urinary retention, considered to represent the final symptomatic stage of progressive BPH, occurred in the OCS at an overall incidence of 6.8 episodes per 1,000 person-years of follow-up; subset analyses revealed 34.7 episodes per 1,000 person-years of follow-up in men in their seventies who had moderate-to-severe symptoms (Table 7) (14). These rates are comparable to data subsequently reported in the Health Professionals Followup Study, in which men 45 to 83 years of age were followed from 1992 to 1997. A total of 82 men developed acute urinary retention during 15,851 person-years of follow-up (15). Both studies showed that age, more severe symptoms, and larger prostate size were associated with an increase in the risk of urinary retention.

Table 8. Association between baseline measures of lower urinary tract dysfunction and risk of any treatment during follow-up

	Unadjusted[a]		Unadjusted (clinic cohort)[b]		Adjusted[c]		Adjusted[d]	
Baseline Characteristic	**Relative Risk**	**95% CI**	**Relative Risk**	**95% CI**	**Relative Risk**	**95% CI**	**Relative Risk**	**95% CI**
Age								
40–49[e]	1.0	...	1.0	...	1.0	...	1.0	...
50–59	4.4	2.5–7.7	5.1	1.5–17.9	3.3	0.9–12.0	4.2	1.2–14.8
60–69	7.7	4.4–13.3	10.8	3.2–37.0	3.7	1.0–14.0	4.0	1.1–14.8
70–79	8.7	4.8–15.6	10.1	2.8–36.9	3.2	0.8–12.7	3.1	0.8–12.3
Symptom severity (score)								
None-to-mild (7 or less)[e]	1.0	...	1.0		1.0	...	1.0	...
Moderate-to-severe (greater than 7)	5.0	3.6–7.0	8.4	4.0–17.5	5.3	2.5–11.1	5.6	2.6–11.9
Peak urinary flow rate (ml/sec)								
Greater than 12[e]	1.0	...	1.0	...	1.0	...	1.0	...
12 or Less	3.7	2.7–5.0	5.2	2.9–9.6	2.7	1.4–5.3	2.8	1.4–5.5
Prostate volume (ml)								
30 or Less[e]	...	...	1.0	...	1.0		...	...
Greater than 30	...	...	4.2	2.2–8.2	2.3	1.1–4.7	...	...
Serum PSA (ng/ml)								
1.4 or less[e]	...	...	1.0	...	...	...	1.0	...
Greater than 1.4	...	...	4.0	2.2–7.3	...	...	2.1	1.1–4.2

...data not available.

Association qualified as relative risk with associated 95% CI.

[a]Bivariate (crude) models based on entire cohort.

[b]Bivariate (crude) models based on subset randomly selected with clinical examination.

[c]Multivariate models adjusting for all factors simultaneously, including prostate volume, based on subset with clinical examination.

[d]Multivariate models adjusting for all factors simultaneously, including serum PSA, based on subset with clinical examination.

[e]Reference category.

SOURCE: Reprinted from Jacobsen SJ, Jacobsen DJ, Girman CJ, Roberts RO, Rhodes T, Guess HA, Lieber MM, Treatment for benign prostatic hyperplasia among community dwelling men: The Olmstead County study of urinary symptoms and health status, Journal of Urology, 162, 1,301–1,306, Copyright 1999, with permission from Lippincott Williams & Wilkins.

Table 9. Use of imaging tests in evaluation of benign prostatic hyperplasia and/or lower urinary tract symptoms in the male Medicare population, count[a], rate[b]

	1992		1995		1998	
	Count	Rate	Count	Rate	Count	Rate
Total	217,760	14,977	133,580	8,107	76,380	5,101
Intravenous pyelogram	56,280	3,871	25,400	1,542	14,760	986
Ambulatory surgery center	6,600	454	3,460	210	1,560	104
Inpatient	8,120	558	2,760	168	2,080	139
Hospital outpatient	920	63	520	32	260	17
Physician office	40,640	2,795	18,660	1,132	10,860	725
Transrectal ultrasound	150,960	10,382	99,560	6,042	52,360	3,497
Ambulatory surgery center	5,760	396	4,940	300	4,060	271
Inpatient	3,880	267	1,660	101	1,440	96
Hospital outpatient	900	62	620	38	440	29
Physician office	140,420	9,657	92,340	5,604	46,420	3,100
CT scan abdomen/pelvis with contrast	5,700	392	5,200	316	5,220	349
Ambulatory surgery center	320	22	160	9.7	140	9.3
Inpatient	2,660	183	2,460	149	3,040	203
Hospital outpatient	80	5.5	100	6.1	60	4.0
Physician office	2,640	182	2,480	151	1,980	132
CT scan abdomen/pelvis without contrast	2,420	166	1,680	102	2,460	164
Ambulatory surgery center	140	9.6	60	3.6	100	6.7
Inpatient	1,160	80	920	56	1,440	96
Hospital outpatient	20	1.4	0	0	20	1.3
Physician office	1,100	76	700	42	900	60
CT scan abdomen/pelvis with and without contrast	1,900	131	1,520	92	1,460	97
Ambulatory surgery center	180	12	140	8.5	80	5.3
Inpatient	560	39	660	40	620	41
Hospital outpatient	20	1.4	60	3.6	0	0
Physician office	1,140	78	660	40	760	51
CT scan abdomen, contrast use unspecified						
Inpatient	500	35	220	13	120	8.0

[a]Unweighted counts multiplied by 20 to arrive at values in the table.

[b]Rate per 100,000 men with benign prostatic hyperplasia.

NOTE: Counts less than 600 should be interpreted with caution.

SOURCE: Centers for Medicare and Medicaid Services, 5% Carrier and Outpatient Files, 1992, 1995, 1998.

Table 10. Diagnostic studies for lower urinary tract symptoms in elderly male Medicare beneficiaries (5% sample, 1991 to 1995)

	1991	1992	1993	1994	1995
Uroflowmetry					
Complex	6,717	7,575	8,528	8,687	8,607
Simple	1,059	936	802	608	535
Cystometrogram					
Complex	2,146	2,081	1,905	1,978	1,917
Simple	622	535	463	450	414
Pressure flow study					
Bladder	274	324	354	492	514
Intra-abdominal	183	226	238	329	343

SOURCE: Reprinted from Baine WB, Yu W, Summe JP, Weis KA, Epidemiologic trends in the evaluation and treatment of lower urinary tract symptoms in elderly male Medicare patients from 1991 to 1995, Journal of Urology, 160, 816–820, Copyright 1998, with permission from Lippincott Williams & Wilkins.

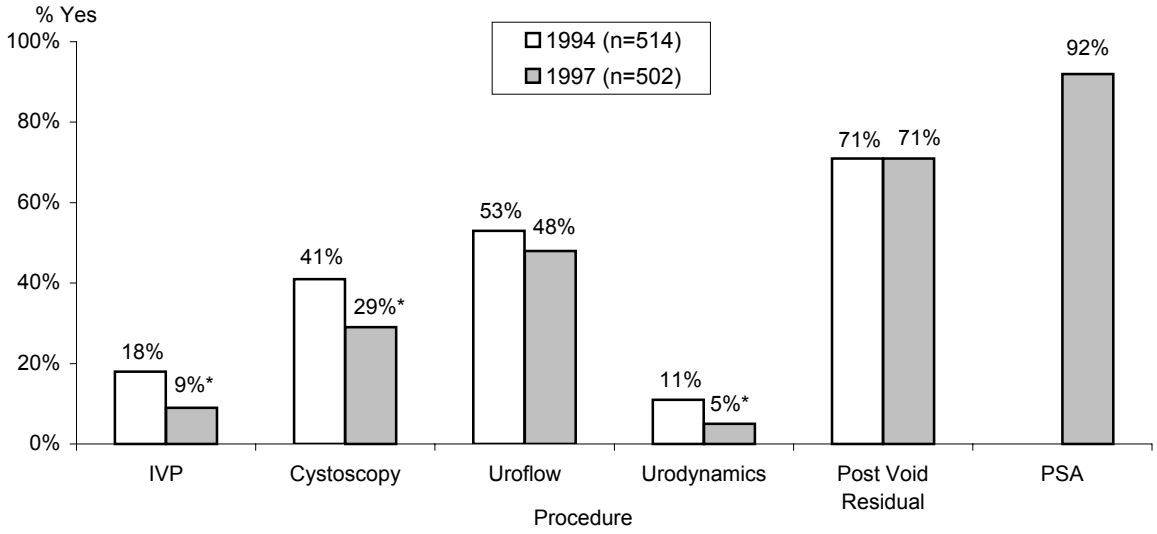

Figure 3. Tests routinely ordered in diagnostic evaluation of patients with BPH.

***Significantly less than in 1994 ($p < 0.05$).**

SOURCE: Adapted from Journal of Urology, 160, Gee WF, Holtgrewe HL, Blute ML, Miles BJ, Naslund MJ, Nellans RE, O'Leary MP, Thomas R, Painter MR, Meyer JJ, Rohner TJ, Cooper TP, Blizzard R, Fenninger RB, Emmons L, 1997 American Urological Assocation Gallup Survey: changes in diagnosis and management of prostate cancer and benign prostatic hyperplasia, and other practice trends from 1994 to 1997, 1,804–1,807, copyright 1998, with permission from Lippincott Williams & Wilkins.

RISK FACTORS

OCS data revealed that age, prostate volume, and peak urinary flow rate were each significantly associated with AUASI scores but accounted for only 13% of symptom variability. The odds of moderate to severe symptoms increased with age after the fifth decade of life, from 1.9, to 2.9, to 3.4 for men in the sixth, seventh and eighth decades, respectively. Even after adjusting for age, the odds of moderate-to-severe symptoms were 3.5 times greater for men with prostates larger than 50 cc (as determined by transrectal ultrasonography) than for men with smaller prostates. In addition, a peak urinary flow of less than 10 ml/sec was associated with a 2.4-fold risk of moderate-to-severe symptoms (14).

OCS data also showed age to be associated with an increased risk of acute urinary retention. After adjusting for baseline symptom severity and peak urinary flow rate, the relative risk of urinary retention increased after the fifth decade of life, from 0.9, to 2.1, to 4.8 for men in the sixth, seventh, and eighth decades, respectively. Men with baseline AUASI greater than 7 and peak flow rates of 12 ml/sec or less were 2.3 and 2.1 times more likely to develop urinary retention, respectively (14). After multivariate adjustment, increasing age, presence of moderate-to-severe LUTS, decreased peak flow rate, and prostate size (or PSA) were associated with an increased likelihood of receiving treatment for BPH (Table 8).

CLINICAL EVALUATION

Traditionally, intravenous pyelogram (IVP) and transrectal ultrasound have been the most commonly employed imaging examinations for BPH, even though the AHCPR BPH guidelines do not recommend their routine use (16). As expected, following the dissemination of the BPH guidelines in 1994, the use of IVP and TRUS in the Medicare population decreased consistently (Table 9). By 1998, the utilization rates for IVP and TRUS were only 986 per 100,000 and 3,497 per 100,000, representing 75% and 66% decreases from 1992, respectively. CT scans were uncommon in the evaluation of men with BPH.

Other commonly used methods for assessing lower urinary tract function include uroflowmetry, cystometrogram, and pressure flow studies. Medicare claims data indicate that between 1991 and 1995, use of complex uroflowmetry and pressure flow studies increased, while the use of cystometrograms decreased modestly (Table 10). Independent validation of these observations appeared in the 1997 American Urological Association (AUA) Gallup Poll survey of practicing urologists in the United States (5). This survey noted a decrease in the utilization of IVP, uroflowmetry, and urodynamic studies but also noted very high utilization rates for measurement of post-void bladder residual and serum PSA in men with BPH—71% and 92%, respectively (Figure 3).

TRENDS IN HEALTHCARE RESOURCE UTILIZATION

Inpatient and Outpatient Care

Historically, transurethral resection of the prostate (TURP) was the second most commonly performed operation in the United States (cataract surgery was the most common). However, since the introduction of effective alternative approaches in the 1990s, urologists have increasingly recommended pharmacological therapy and minimally invasive procedures (5). Coincident with the increased popularity of these approaches was an increase in the rate of outpatient visits for BPH: from 10,116 per 100,000 in 1994 to 14,473 per 100,000 in 2000 (Table 11). BPH-related visits to emergency rooms declined from 330 per 100,000 in 1994 to 218 per 100,000 in 2000 (Table 12), although the overlapping confidence intervals around these rates should lead to caution in interpretation.

Pharmaceutical Management

Alpha blockers and 5-alpha reductase inhibitors have become first-line therapy for men with symptomatic BPH. The AUA Gallup Poll surveys from 1994 to 1997 found that 88% of urologists recommended alpha blockers for men with moderate urinary symptoms and evidence of prostate enlargement of less than 40 cc. The use of alpha blockers for men with prostates larger than 40 cc was still highly prevalent at 69% (5).

Table 11. Physician office visits and hospital outpatient visits for benign prostatic hyperplasia and/or lower urinary tract symptoms, count, rate[a] (95% CI)

	1994		1996		1998		2000	
	Count	Rate	Count	Rate	Count	Rate	Count	Rate
Primary reason	2,899,300	6,371 (5,495–7,248)	3,658,367	7,484 (6,294–8,675)	3,990,359	7,754 (6,281–9,226)	4,418,425	8,201 (6,765–9,637)
Any reason	4,603,426	10,116 (8,826–11,406)	6,112,287	12,505 (10,856–14,153)	6,443,185	12,520 (10,531–14,508)	7,797,781	14,473 (12,406–16,540)

[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 male civilian non-institutionalized population, 40 years and older.

SOURCES: National Hospital Ambulatory Medical Care Survey—Outpatient File, 1994, 1996, 1998, 2000; National Ambulatory Medical Care Survey, 1994, 1996, 1998, 2000.

Table 12. Emergency room visits by adult males with benign prostatic hyperplasia and/or lower urinary tract symptoms listed as primary diagnosis, count, rate[a] (95% CI)

	Count	Rate
1994	150,377	330 (201–460)
1996	117,716	241 (130–352)
1998	155,923	303 (194–412)
2000	117,413	218 (117–319)

[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 male civilian non-institutionalized population, 40 years and older.

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

The Medical Therapy of Prostatic Symptoms (MTOPS) Study, a multicenter, randomized controlled trial sponsored by the National Institute of Diabetes and Digestive and Kidney Diseases, evaluated whether treatment with doxazosin (an alpha blocker) and finasteride (a 5-alpha reductase inhibitor) in combination was more effective than either drug alone in preventing the clinical progression of BPH. Clinical progression was defined as either a worsening in the AUASI score of 4 points or more, acute urinary retention, incontinence, renal insufficiency, or recurrent urinary tract infection. Results from MTOPS suggest that combination therapy was twice as effective as monotherapy in reducing the risk of progression (66% risk reduction for combination, 39% for doxazosin, and 34% for finasteride) (17).

Additional details on the medications prescribed to treat men with LUTS are available from the National Ambulatory Medical Care Survey (NAMCS) (Table 13). In 1994 and 1996, terazosin was the primary pharmacological agent used for BPH, being prescribed in 14% to 15% of BPH visits. However, with the introduction of more specific selective agents, terazosin was replaced by doxazosin and tamsulosin, which in 2000 constituted 23% of the prescriptions written at BPH-related outpatient visits. The prescription of finasteride in 6.5% and 7.3% of BPH visits in 1994 and 2000, respectively, suggests that it is used in a specific subset of men with BPH.

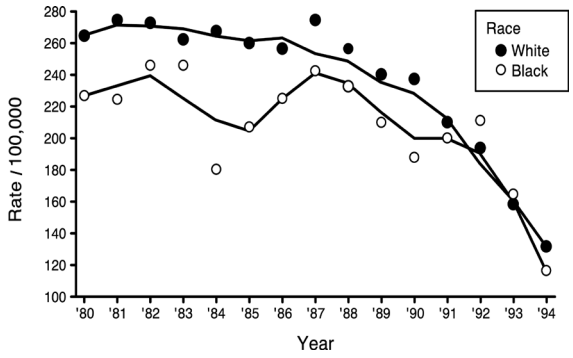

Figure 4. Annual age-adjusted discharge rate for prostatectomy, 1980 to 1994, by race. Data from: National Hospital Discharge Survey.

SOURCE: Reprinted with permission from Urology, 53, Xia Z, Roberts RO, Schottenfeld D, Lieber MM, Jacobsen SJ, Trends in prostatectomy for benign prostatic hyperplasia among black and white men in the United States: 1980 to 1994, 1,154–1,159, 1999, with permission from Elsevier Science.

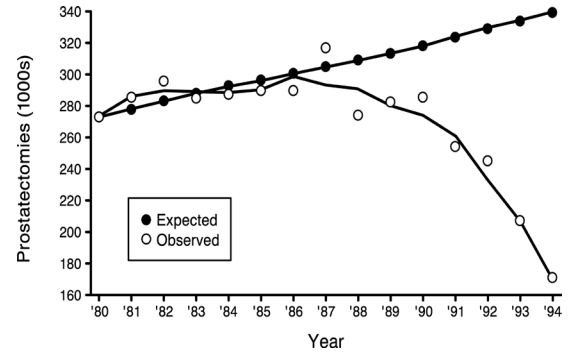

Figure 5. Observed and expected number of discharges for prostatectomy, 1980 to 1994; expected number based on 1980 discharge rates. Data from: National Hospital Discharge Survey.

SOURCE: Reprinted with permission from Urology, 53, Xia Z, Roberts RO, Schottenfeld D, Lieber MM, Jacobsen SJ, Trends in prostatectomy for benign prostatic hyperplasia among black and white men in the United States: 1980 to 1994, 1,154–1,159, 1999, with permission from Elsevier Science.

Table 13. Count of prescriptions written at physicians' offices during visits for benign prostatic hyperplasia and/or lower urinary tract symptoms

	1992		1994		1996		1998		2000	
Medicine	# of Rx	% of Visits for BPH at Which This Rx Was Given	# of Rx	% of Visits for BPH at Which This Rx Was Given	# of Rx	% of Visits for BPH at Which This Rx Was Given	# of Rx	% of Visits for BPH at Which This Rx Was Given	# of Rx	% of Visits for BPH at Which This Rx Was Given
Terazosin/Hytrin™	*	*	688,717	15	830,314	14	*	*	*	*
Doxazosin/Cardura™	*	*	*	*	*	*	*	*	819,043	11
Tamsulosin/Flomax™	*	*	*	*	*	*	*	*	870,889	12
Oxybutynin/Ditropan™	*	*	*	*	*	*	*	*	*	*
Detrol™	*	*	*	*	*	*	*	*	*	*
Detrol SA™	*	*	*	*	*	*	*	*	*	*
Finasteride/Proscar™	*	*	289,070	6.5	*	*	*	*	552,483	7.3
Ditropan XL™	*	*	*	*	*	*	*	*	*	*

Rx, prescription.
*Figure does not meet standard for reliability or precision.
SOURCE: National Ambulatory Medical Care Survey, 1992, 1994, 1996, 1998, 2000.

Table 14. Use of inpatient surgical procedures to treat symptoms of benign prostatic hyperplasia

Surgical Procedure	1994	1996	1998	2000
Open prostatectomy	5,648	4,617	4,341	4,354
TURP	136,377	103,644	88,907	87,407
Balloon dilatation	279	161	148	161
Laser prostatectomy	0	10,616	3,019	2,045
TUNA	0	0	0	35
TUMT	0	0	0	14

TURP, transurethral resection of the prostate; TUNA, transurethral needle ablation; TUMT, transurethral microwave therapy.
SOURCE: Healthcare Cost and Utilization Project Nationwide Inpatient Sample, 1994, 1996, 1998, 2000.

Table 15. Inpatient stays by male Medicare beneficiaries with benign prostatic hyperplasia and/or lower urinary tract symptoms listed as primary diagnosis, count[a], rate[b] (95% CI)

	1992		1995		1998	
	Count	Rate	Count	Rate	Count	Rate
Total[c]	154,320	1,048 (1,043–1,053)	82,060	539 (535–543)	59,760	413 (409–416)
Total < 65	5,420	175 (171–180)	3,240	94 (91–97)	2,600	76 (73–79)
Total 65+	148,900	1,280 (1,273–1,286)	78,820	669 (665–674)	57,160	518 (513–522)
Age						
65–74	78,240	1,081 (1,073–1,089)	37,600	523 (518–528)	25,380	395 (390–400)
75–84	57,800	1,637 (1,623–1,650)	33,580	918 (908–928)	25,340	692 (684–701)
85–94	12,560	1,589 (1,562–1,617)	7,420	875 (855–894)	6,320	730 (712–748)
95+	300	386 (343–430)	220	268 (233–304)	120	137 (113–161)
Race/ethnicity						
White	135,820	1,095 (1,089–1,101)	72,260	556 (552–560)	52,600	430 (426–434)
Black	10,380	815 (799–830)	6,820	493 (481–504)	4,180	313 (304–323)
Asian	…	…	180	247 (211–283)	560	408 (375–442)
Hispanic	…	…	1,080	544 (512–576)	1,240	369 (349–390)
N. American Native	…	…	60	298 (224–373)	120	429 (354–504)
Region						
Midwest	39,400	1,062 (1,052–1,073)	21,440	556 (549–564)	16,920	458 (451–464)
Northeast	35,780	1,128 (1,117–1,140)	17,540	551 (543–560)	10,960	394 (387–402)
South	55,840	1,066 (1,057–1,075)	28,020	511 (505–517)	21,600	402 (397–408)
West	20,740	923 (911–936)	13,080	564 (554–574)	9,180	410 (402–419)

… data not available.
[a]Unweighted counts were multiplied by 20 to arrive at values in the table.
[b]Rate per 100,000 Medicare beneficiaries in the same demographic stratum.
[c]Persons of other races, unknown race and ethnicity, and other region are included in the totals.
NOTE: Counts less than 600 should be interpreted with caution.
SOURCE: Centers for Medicare and Medicaid Services, MedPAR and 5% Carrier Files, 1992, 1995, 1998.

Table 16. Visits to ambulatory surgery centers by male Medicare beneficiaries for benign prostatic hyperplasia and/or lower urinary tract symptoms listed as primary diagnosis, count[a], rate[b] (95% CI)

	1992		1995		1998	
	Count	Rate	Count	Rate	Count	Rate
Total[c]	72,260	491 (487–494)	62,520	411 (408–14)	53,900	372 (369–375)
Total < 65	3,340	108 (104–112)	3,720	108 (105–111)	3,480	101 (98–105)
Total 65+	68,920	592 (588–597)	58,800	499 (495–503)	50,420	457 (453–461)
Age						
65–74	41,080	568 (562–573)	33,380	464 (460–469)	26,660	415 (410–420)
75–84	23,940	678 (669–686)	21,680	593 (585–601)	19,540	534 (526–541)
85–94	3,780	478 (463–493)	3,580	422 (408–436)	4,120	476 (461–490)
95+	120	155 (128–182)	160	195 (165–226)	100	114 (92–137)
Race/ethnicity						
White	62,580	505 (501–509)	54,820	422 (418–425)	47,220	386 (383–390)
Black	5,700	447 (436–459)	5,620	406 (395–416)	4,220	316 (307–326)
Asian	…	…	280	384 (339–429)	400	292 (263–320)
Hispanic	…	…	480	242 (220–263)	1,020	304 (285–323)
N. American Native	…	…	…	…	…	…
Region						
Midwest	24,840	670 (661–678)	19,480	505 (498–512)	17,420	471 (464–478)
Northeast	18,640	588 (579–596)	12,900	406 (399–413)	11,480	413 (406–421)
South	24,660	471 (465–477)	24,960	455 (449–461)	20,040	373 (368–379)
West	4,100	182 (177–188)	5,040	217 (211–223)	4,880	218 (212–224)

… data not available.

[a]Unweighted counts were multiplied by 20 to arrive at values in the table.

[b]Rate per 100,000 Medicare beneficiaries in the same demographic stratum.

[c]Persons of other races, unknown race and ethnicity, and other region are included in the totals.

NOTE: Counts less than 600 should be interpreted with caution.

SOURCE: Centers for Medicare and Medicaid Services, 5% Carrier and Outpatient Files, 1992, 1995, 1998.

Surgical Management

The advent of pharmacotherapy was associated with a dramatic decline in hospitalizations for TURP throughout the 1990s (Figures 4 and 5 and Table 14) (18), most notably between 1992 and 1995 (Table 15). This decline is consistent with published literature that demonstrates that the use of TURP peaked during the 1980s but declined between 1991 and 1997 by 50% among Caucasian men and 40% among African American men suffering from BPH (19). Table 16 presents Medicare data illustrating that surgery for BPH declined across almost all age, racial/ethnic, and geographic strata of patients. Overall, surgical visits by Medicare beneficiaries declined from 491 per 100,000 in 1992 to 372 per 100,000 in 2000. There was a slight increase in the rate of BPH surgeries in the West between 1992 and 1995, but the rate remained stable in 1998. Among those who were hospitalized for BPH surgery, lengths of stay (LOS) were shorter, consistent with trends following widespread adoption of prospective payment and managed care systems (Table 17). By 2000, the mean LOS was less than 3 days in all but the most elderly patients.

In the 1990s, several minimally invasive surgical therapies (MIST) were introduced. These include laser ablation, transurethral needle ablation (TUNA), transurethral microwave therapy (TUMT), high-energy focused ultrasound (HIFU), and hot-water thermotherapy. The 1997 AUA Gallup Poll of practicing urologists indicated that while 95% had performed TURP in the prior year, only 26% had performed a laser prostatectomy. Only 3% had performed TUNA or TUMT (5). Use of minimally invasive therapies is highly dependent on the availability and cost of

Table 17. Trends in mean inpatient length of stay (days) for adult males hospitalized with benign prostatic hyperplasia and/or lower urinary tract symptoms listed as primary diagnosis

	Length of Stay			
	1994	1996	1998	2000
Total	3.8	3.1	3.1	2.8
Age				
40–44	3.3	2.2	2.8	3.3
45–54	3.1	2.6	2.6	2.1
55–64	3.2	2.6	2.8	2.4
65–74	3.5	2.9	2.9	2.7
75–84	4.2	3.4	3.3	3.0
85+	5.3	4.4	4.3	4.0
Race/ethnicity				
White	3.7	3.1	3.1	2.8
Black	4.5	3.5	3.6	3.6
Asian/Pacific Islander	2.9	2.9	3.1	3.1
Hispanic	3.9	3.4	3.7	2.9
Other	4.5	2.9	3.2	3.1
Region				
Midwest	3.8	3.3	3.2	2.9
Northeast	4.8	3.7	3.7	3.2
South	3.6	3.0	2.9	2.8
West	2.7	2.4	2.7	2.4
MSA				
Rural	3.7	3.1	3.0	2.8
Urban	3.8	3.1	3.1	2.8

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

special instrumentation. As a result, not all MIST procedures have survived. According to data from the Healthcare Cost and Utilization Project (HCUP), of the MIST procedures performed in the inpatient setting, only TUNA and TUMT increased by the end of the decade (Table 14). Data from Medicare indicate that the majority of TUNA and TUMT procedures were performed in the ambulatory surgery center setting or physician office, as opposed to the inpatient setting, as expected given their minimally invasive nature (Table 18). BPH procedures in ambulatory surgery centers on commercially insured men 65 to 74 years of age increased substantially toward the end of the decade, from 264 per 100,000 in 1998 to 352 per 100,000 in 2000 (Table 19).

Age-adjusted data from NHANES-III revealed no difference in the odds of BPH surgery by racial/ethnic group, education, geographic region, or urban/rural area; however, never-married men were 70% less likely to have undergone BPH surgery (6).

Nursing Home Care

The aging of the US population has increased the number of men with BPH. Curiously, this phenomenon is not reflected in data from the National Nursing Home Survey, which indicates the presence of BPH in only 5,760 to 6,034 per 100,000 male nursing home residents (Table 20). The lower than expected number of cases identified may reflect administrative undercoding of BPH as a comorbid condition.

ECONOMIC IMPACT

The economic burden of BPH can be stratified into three areas: (1) direct medical costs associated with treatment; (2) indirect costs associated with absenteeism, work limitations, and premature mortality; and (3) intangible costs associated with pain, suffering, and grief.

Direct Costs

We estimate the direct cost of medical services provided at hospital inpatient and outpatient settings, emergency departments, and physicians' offices to treat BPH in the United States in 2000 to have been approximately $1.1 billion (Table 21). This estimate does not include the costs of outpatient prescriptions and nonprescription medications or alternative medicine visits reported by a small percentage of men with BPH. After adjusting for inflation (data not shown), total medical spending for BPH has declined over time, particularly among the Medicare population (Tables 21 and 22). This reduction in spending is largely attributable to a dramatic decline in inpatient expenditures. Total hospitalization spending for BPH fell by more than half among Medicare beneficiaries age 65 and over, from $743 million in 1992 to $315 million in 1998 (in nominal $).

Spending on outpatient prescription drugs for the treatment of BPH in 1996–1998 was $194 million annually, according to estimates from the Medical Expenditure Panel Survey (MEPS). The majority of the prescriptions and pharmacy spending were

Table 18. Surgical procedures used to treat symptoms of benign prostatic hyperplasia among male adult Medicare beneficiaries, count[a], rate[b]

	1992		1995		1998	
	Count	Rate	Count	Rate	Count	Rate
Total	174,260	11,986	122,860	7,456	95,340	6,366
Open prostatectomy	6,420	442	3,760	228	2,880	192
Ambulatory surgery center	0	0	0	0	0	0
Inpatient	6,380	439	3,740	227	2,860	191
Hospital outpatient	0	0	0	0	0	0
Physician office	40	2.8	20	1.2	20	1.3
Balloon dilation	1,080	74	200	12	320	21
Ambulatory surgery center	440	30	40	2.4	180	12
Inpatient	600	41	140	8.5	140	9.3
Hospital outpatient	20	1.4	0	0	0	0
Physician office	20	1.4	20	1.2	0	0
TUNA	0	0	0	0	420	28
Ambulatory surgery center	0	0	0	0	360	24
Inpatient	0	0	0	0	0	0
Hospital outpatient	0	0	0	0	0	0
Physician office	0	0	0	0	60	4.0
TURP	165,880	11,409	105,560	6,406	79,800	5,329
Ambulatory surgery center	1,720	118	8,620	523	7,660	512
Inpatient	162,560	11,180	96,000	5,826	71,360	4,765
Hospital outpatient	0	0	140	8.5	140	9.3
Physician office	1,600	110	800	49	640	43
Laser prostatectomy	0	0	12,600	765	7,720	516
Ambulatory surgery center	0	0	7,560	459	4,720	315
Inpatient	0	0	4,860	295	2,820	188
Hospital outpatient	0	0	160	10	100	6.7
Physician office	0	0	20	1.2	80	5.3
TUIP	880	61	740	45	860	57
Ambulatory surgery center	260	18	220	13	380	25
Inpatient	620	43	460	28	480	32
Hospital outpatient	0	0	20	1.2	0	0
Physician office	0	0	40	2	0	0
TUMT	0	0	0	0	3,340	223
Ambulatory surgery center	0	0	0	0	2,760	184
Inpatient	0	0	0	0	40	2.7
Hospital outpatient	0	0	0	0	20	1.3
Physician office	0	0	0	0	520	35

TUNA, transurethral needle ablation; TURP, transurethral resection of the prostate; TUIP, transurethral incision of the prostate; TUMT, transurethral microwave therapy.

[a]Unweighted counts multiplied by 20 to arrive at values in the table.

[b]Rate per 100,000 male adult Medicare beneficiaries with a diagnosis of benign prostatic hyperplasia and/or lower urinary tract symptoms rate is per 100,000 Medicare beneficiaries with a diagnosis of BPH/LUTS.

SOURCE: Centers for Medicare and Medicaid Services, 5% Carrier and Outpatient Files, 1992, 1995, 1998.

Table 19. Visits to ambulatory surgery centers for benign prostatic hyperplasia and/or lower urinary tract symptoms procedures listed as primary procedure by males having commercial health insurance, count[a], rate[b]

	1998		2000	
	Count	Rate	Count	Rate
Total	254	58	434	83
Age				
40–44	12	*	13	*
45–54	48	24	81	35
55–64	130	128	233	190
65–74	46	264	78	352
75–84	15	*	26	*
85+	3	*	3	*

*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 males in the same demographic stratum.
SOURCE: Center for Health Care Policy and Evaluation, 1998, 2000.

Table 20. Male nursing home residents with an admitting or current diagnosis of benign prostatic hyperplasia and/or lower urinary tract symptoms, count, rate[a] (95% CI)

	1995		1997		1999	
	Count	Rate	Count	Rate	Count	Rate
Total[b]	23,576	5,760 (4,762–6,759)	28,492	6,626 (5,526–7,727)	26,929	6,034 (4,986–7,082)
Age						
40–84	13,966	5,056 (3,912–6,199)	16,877	5,649 (4,420–6,878)	13,747	4,551 (3,439–5,663)
85+	9,611	7,222 (5,273–9,172)	11,615	8,852 (6,581–11,122)	13,182	9,141 (6,897–11,384)
Race						
White	19,142	5,756 (4,645–6,867)	25,535	7,364 (6,080–8,649)	24,195	6,759 (5,521–7,998)
Other	4,268	5,707 (3,402–8,012)	2,930	3,659 (1,686–5,632)	2,734	3,174 (1,473–4,875)

[a]Rate per 100,000 nursing home residents in the same demographic stratum.
[b]Persons of unspecified race are included in the totals.
SOURCE: National Nursing Home Survey, 1995, 1997, 1999.

for Hytrin™, followed by Cardura™ and Proscar™ (Table 23).

To examine the incremental medical costs associated with a diagnosis of BPH, we used data from 280,000 primary beneficiaries aged 18 to 64 with employer-provided insurance coverage in 1999. We estimated medical expenditures for persons with and without a primary diagnosis of BPH in 1999, controlling for differences in insurance coverage (medical and drug benefits), patient demographics, and health status (medical comorbidities). These data estimate the incremental direct annual medical costs for BPH to be $2,577 (Table 24). The average annual cost for men without a BPH claim was $3,138, while the claim for those with BPH was $5,715.

Indirect Costs

Work lost by men with BPH was measured by MarketScan in 1999 and is shown in Tables 25 and 26. One-tenth of the men with BPH missed work, losing an average of 7.3 hours annually. Each visit for outpatient care was associated with an average work loss of 4.7 hours. Because this dataset does not provide the proportion of working men who have BPH, it is impossible to gauge the aggregate extent of indirect costs as missed work from MarketScan

Table 21. Expenditures for benign prostatic hyperplasia and share of costs, by site of service (% of total)

	Year			
Service Type	**1994**	**1996**	**1998**	**2000**
Total[a]	$1,067,100,000	$1,045,800,00	$1,036,200,000	$1,099,500,000
Inpatient	$740,600,000 (69.4%)	$633,800,000 (60.6%)	$566,800, 000 (54.7%)	$579,400,000 (52.7%)
Physician Office	$278,500,000 (26.1%)	$365,000,000 (34.9%)	$409,300,00 (39.5%)	$472,800,000 (43.0%)
Hospital Outpatient	$23,500,000 (2.2%)	$26,100,000 (2.5%)	$29,000,000 (2.8%)	$22,000,000 (2.0%)
Emergency Room	$24,500,000 (2.3%)	$20,900,000 (2.0%)	$31,000,000 (3.0%)	$25,300,000 (2.3%)

[a]Total unadjusted expenditures exclude spending on outpatient prescription drugs for the treatment of BPH. Average drug spending for BPH-related conditions is estimated at $194 million annually for the period 1996 to 1998.

NOTE: Percentages may not add to 100% because of rounding.

SOURCES: National Ambulatory and Medical Care Survey; National Hospital and Ambulatory Medical Care Survey; Healthcare Cost and Utilization Project; Medical Expenditure Panel Survey, 1994, 1996, 1998, 2000.

Table 22. Expenditures for Medicare beneficiaries age 65 and over for treatment of benign prostatic hyperplasia, by site of service (% of total)

	Year		
Service Type	**1992**	**1995**	**1998**
Total	$1,132,000,000	$861,300,000	$776,000,000
Inpatient	$743.100,000 (54.7%)	$408,400,000 (47.4%)	$315,000,000 (40.6%)
Outpatient			
Physician Office	$291,200,000 (54.7%)	$322,500,000 (37.4%)	$327,500,000 (42.2%)
Hospital Outpatient	$8,700,000 (54.7%)	$11,900,000 (1.4%)	$13,400,000 (1.7%)
Ambulatory Surgery	$73,400,000 (54.7%)	$100,000,000 (11.6%)	$100,300,000 (12.9%)
Emergency Room	$15,500,000 (54.7%)	$18,500,000 (2.1%)	$19,800,000 (2.6%)

NOTE: Percentages may not add to 100% because of rounding.

SOURCE: Centers for Medicare and Medicaid Services, 1992, 1995, 1998.

analyses. Inclusion of indirect costs greatly increases estimates of the overall economic burden of BPH.

CONCLUSIONS

The substantial amount of data documenting the prevalence of BPH and its therapies attests to the tremendous impact of this condition on the health and quality of life of American men. One of the most basic and yet most difficult tasks facing the medical community will be to standardize the definition of clinical BPH, recognizing that the diagnosis is rarely histologically confirmed. Standardization of the clinical definition would allow for consistency among studies and would facilitate research on the prevention, diagnosis, and treatment of this condition.

Increasingly, BPH therapy trends indicate a move away from the gold-standard operative options toward less-invasive pharmacologic or MIST options. The use of medication for BPH has had the most obvious impact, with the proliferation of newer agents that specifically act on the prostate and bladder. Analogous to TURP, the use of most MIST procedures for BPH has declined, with the exception of TUNA and TUMT, which increased during the final years of the 1990s. Ongoing reevaluation of these trends will be necessary as newer therapies are made available and to determine the proportion of men initially started on pharmacologic agents who eventually go on to have more invasive therapy.

Although this chapter summarizes a number of important trends, others, including evolving

Table 23. Average annual spending and use of selected outpatient prescription drugs for treatment of benign prostatic hyperplasia, 1996–1998[a]

Drug Name	Number of Rx Claims	Mean Price	Total Expenditures
Hytrin™	1,923,054	$67.39	$129,594,632
Cardura™	605,744	$49.26	$29,838,949
Proscar™	518,038	$66.77	$34,589,375
Total			$194,022,956

Rx, prescription.

[a]Estimates include prescription drug claims with a corresponding diagnosis of BPH and exclude drugs for which number of claims could not be reliably estimated due to data limitations. Including expenditures for excluded prescription drugs for which the number of claims could not be reliably estimated would increase total drug spending by approximately 2%, to $198.6 million.

SOURCE: Medical Expenditure Panel Survey, 1996–1998.

Table 24. Estimated annual expenditures of privately insured male employees with and without a medical claim for benign prostatic hyperplasia in 1999[a]

	Annual Expenditures (per person)			
	Persons without BPH (N=270,431)	Persons with BPH (N=8,483)		
	Total	Total	Medical	Rx Drugs
Total	$3,138	$5,715	$4,544	$1,170
Age				
45–54	$3,227	$5,550	$4,440	$1,109
55–64	$3,293	$5,765	$4,573	$1,170
Region				
Midwest	$3,018	$6,339	$5,221	$1,117
Northeast	$3,035	$5,080	$3,977	$1,102
South	$3,327	$6,405	$5,153	$1,252
West	$3,169	$7,023	$5,624	$1,399

[a]The sample consists of primary beneficiaries ages 18 to 64 having employer-provided insurance who were continuously enrolled in 1999. Estimated annual expenditures were derived from multivariate models that control for age, gender, work status (active/retired), median household income (based on zip code), urban/rural residence, medical and drug plan characteristics (managed care, deductible, co-insurance/co-payments), and 26 disease conditions.

SOURCE: Ingenix, 1999.

Table 25. Average annual work loss of persons treated for benign prostatic hyperplasia (BPH) and/or lower urinary tract symptoms (LUTS) (95% CI)

			Average Work Absence (hrs)		
	Number of Workers[a]	% Missing Work	Inpatient[b]	Outpatient[b]	Total
BPH/LUTS	2,013	10%	0.2 (0.1–0.3)	7.1 (4.6–9.6)	7.3 (4.8–9.8)

[a]Individuals with an inpatient or outpatient claim for BPH/LUTS and for whom absence data were collected. Work loss is based on reported absences contiguous to the admission and discharge dates of each hospitalization or the date of the outpatient visit.

[b]Inpatient and outpatient include absences that start or stop the day before or after a visit.

SOURCE: MarketScan, 1999.

Table 26. Average work loss associated with a hospitalization or an ambulatory care visit for benign prostatic hyperplasia (BPH) and/or lower urinary tract symptoms (LUTS) (95% CI)

	Inpatient Care		Outpatient Care	
	Number of Hospitalizations[a]	Average Work Absence (hrs)	Number of Outpatient Visits	Average Work Absence (hrs)
BPH/LUTS	*	*	3,036	4.7 (3.3–6.1)

*Figure does not meet standard for reliability or precision.

[a]Unit of observation is an episode of treatment. Work loss is based on reported absences contiguous to the admission and discharge dates of each hospitalization or the date of the outpatient visit.

SOURCE: MarketScan, 1999.

technologies and the use of complementary and alternative therapies for BPH, remain poorly characterized. These options have garnered a great deal of public interest, but their efficacy, particularly in relation to established therapies, remains largely undetermined. Moreover, these trends will undoubtedly have a major impact on healthcare costs. Similarly, measures of the indirect costs of BPH care are poorly quantified, and the cost-effectiveness of pharmacologic and surgical interventions for BPH remains uncertain. Efforts to examine the cost implications of new therapies should be undertaken as a prerequisite for widespread adoption.

Future efforts must also address the underlying etiology of BPH. Clinical epidemiological studies that focus on the effects of sociodemographic factors such as race/ethnicity and access to healthcare on BPH prevalence and the relationship between LUTS and other conditions such as diabetes and sexual dysfunction have the potential to improve care. Given the dramatic trends of the past 10 years and the persistent variation in the management of BPH, quality of care delivered for BPH should be evaluated. The delivery of high-quality care should be the goal of all clinicians, and that goal goes hand in hand with the dissemination of evidence-based guidelines (2).

REFERENCES

1. McConnell JD, Barry MJ, Bruskewitz RC. Benign Prostatic Hyperplasia: Diagnosis and Treatment. Clinical Practice Guideline. Agency for Health Care Policy and Research. Clinical Practice Guidelines Quick Reference Guide for Clinicians 1994;8:1-17.
2. Jacobsen SJ, Girman CJ, Guess HA, Oesterling JE, Lieber MM. New diagnostic and treatment guidelines for benign prostatic hyperplasia. Potential impact in the United States. Arch Intern Med 1995;155:477-81.
3. Jacobsen SJ, Guess HA, Panser L, Girman CJ, Chute CG, Oesterling JE, Lieber MM. A population-based study of healthcare-seeking behavior for treatment of urinary symptoms. The Olmsted County Study of Urinary Symptoms and Health Status Among Men. Arch Fam Med 1993;2:729-35.
4. Barry MJ, Fowler FJ, Jr., O'Leary MP, Bruskewitz RC, Holtgrewe HL, Mebust WK, Cockett AT. The American Urological Association symptom index for benign prostatic hyperplasia. The Measurement Committee of the American Urological Association. J Urol 1992;148:1549-57; discussion 1564.
5. Gee WF, Holtgrewe HL, Blute ML, Miles BJ, Naslund MJ, Nellans RE, O'Leary MP, Thomas R, Painter MR, Meyer JJ, Rohner TJ, Cooper TP, Blizzard R, Fenninger RB, Emmons L. 1997 American Urological Association Gallup survey: Changes in diagnosis and management of prostate cancer and benign prostatic hyperplasia, and other practice trends from 1994 to 1997. J Urol 1998;160:1804-7.
6. Platz EA, Smit E, Curhan GC, Nyberg LM, Giovannucci E. Prevalence of and racial/ethnic variation in lower urinary tract symptoms and noncancer prostate surgery in U.S. men. Urology 2002;59:877-83.
7. Meigs JB, Mohr B, Barry MJ, Collins MM, McKinlay JB. Risk factors for clinical benign prostatic hyperplasia in a community-based population of healthy aging men. J Clin Epidemiol 2001;54:935-44.
8. Chute CG, Panser LA, Girman CJ, Oesterling JE, Guess HA, Jacobsen SJ, Lieber MM. The prevalence of prostatism: a population-based survey of urinary symptoms. J Urol 1993;150:85-9.
9. Girman CJ, Jacobsen SJ, Guess HA, Oesterling JE, Chute CG, Panser LA, Lieber MM. Natural history of prostatism: relationship among symptoms, prostate volume and peak urinary flow rate. J Urol 1995;153:1510-5.
10. Wei JT, Schottenfeld D, Cooper K, Taylor JM, Faerber GJ, Velarde MA, Bree R, Montie JE, Cooney KA. The natural history of lower urinary tract symptoms in black American men: relationships with aging, prostate size, flow rate and bothersomeness. J Urol 2001;165:1521-5.
11. Guess HA. Benign prostatic hyperplasia: antecedents and natural history. Epidemiol Rev 1992;14:131-53.
12. Rhodes T, Girman CJ, Jacobsen SJ, Roberts RO, Guess HA, Lieber MM. Longitudinal prostate growth rates during 5 years in randomly selected community men 40 to 79 years old. J Urol 1999;161:1174-9.
13. Jacobsen SJ, Jacobson DJ, Girman CJ, Roberts RO, Rhodes T, Guess HA, Lieber MM. Treatment for benign prostatic hyperplasia among community dwelling men: the Olmsted County study of urinary symptoms and health status. J Urol 1999;162:1301-6.
14. Jacobsen SJ, Jacobson DJ, Girman CJ, Roberts RO, Rhodes T, Guess HA, Lieber MM. Natural history of prostatism: risk factors for acute urinary retention. J Urol 1997;158:481-7.
15. Meigs JB, Barry MJ, Giovannucci E, Rimm EB, Stampfer MJ, Kawachi I. Incidence rates and risk factors for acute urinary retention: the health professionals followup study. J Urol 1999;162:376-82.
16. Andersen JT, Jacobsen O, Standgaard L. The diagnostic value of intravenous pyelography in infravesical obstruction in males. Scand J Urol Nephrol 1977;11:225-30.
17. McConnell JD, Roehrborn CG, Bautista OM, Andriole GL Jr, Dixon CM, Kusek JW, Lepor H, McVary KT, Nyberg LM, Jr, Clarke HS, Crawford ED, Diokno A, Foley JP, Foster HE, Jacobs SC, Kaplan SA, Kreder KJ, Lieber MM, Lucia MS, Miller GJ, Menon M, Milam DF, Ramsdell JW, Schenkman NS, Slawin KM, Smith JA; Medical Therapy of Prostatic Symptoms (MTOPS) Research Group. The long-term effect of doxazosin, finasteride, and combination therapy on the clinical progression of benign prostatic hyperplasia. N Engl J Med 2003;349:2449-51.
18. Xia Z, Roberts RO, Schottenfeld D, Lieber MM, Jacobsen SJ. Trends in prostatectomy for benign prostatic hyperplasia among black and white men in the United States: 1980 to 1994. Urology 1999;53:1154-9.
19. Wasson JH, Bubolz TA, Lu-Yao GL, Walker-Corkery E, Hammond CS, Barry MJ. Transurethral resection of the prostate among Medicare beneficiaries: 1984 to 1997. For the Patient Outcomes Research Team for Prostatic Diseases. J Urol 2000;164:1212-5.