Testis Cancer

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Purpose: We quantified the burden of testis cancer in the United States by identifying trends in its incidence, its treatment and the use of health care resources to estimate the economic impact of the disease.
Materials and Methods: The analytical methods used to generate these results were described previously.
Results: The overall incidence of testis cancer in the United States increased 46% between 1975 and 2001. During the same period the ratio of seminoma to nonseminoma increased and there were fewer men presenting with stage II and III tumors. Survival rates increased successively, attaining the current level of 95.9%. Treatment patterns changed and active surveillance increased as a primary treatment modality. Overall hospitalization rates for men with testis cancer decreased from 1.8/100,000 in 1994 and 1.4/100,000 in 2000. Care for white men shifted to the outpatient setting, which did not occur for black men. The estimated annual expenditure for testis cancer for privately insured individuals between ages 18 and 54 years was $6,236. National estimates of annual medical expenditures placed the total cost of treatment at $21.8 million in 2000, representing an increase of 10% over the total in 1994. Of men with testis cancer 16% missed work for treatment of the disease with an average of 8.4 total hours of work missed.
Conclusions: The cost of testis cancer is estimated at almost $21.8 million annually. It appears to be increasing with time despite a shift to active surveillance treatments and less hospitalization.

Key Words: testis, testicular neoplasms, health care costs, hospitalization, prevalence

The incidence of testis cancer is increasing. In 2005 approximately 8,000 new cases were diagnosed in the United States.[1] Because of advances in therapy, overall survival rates are high. Modifications in surgical and radiation techniques as well as improved methods of systemic chemotherapy have substantially decreased the morbidity of therapy. Nonetheless, the sequelae of multimodality therapy are not insignificant and they can have broad and far-reaching consequences with regard to general health, reproduction and economic productivity. We explored the burden of testis cancer in the United States by evaluating trends in incidence, mortality and treatment, quantifying 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 were described previously.[2,3]

RESULTS

Prevalence and Incidence

Testis cancer represents less than 1% of all male cancers.[4] According to the SEER database the age adjusted incidence rate of testis cancer from 1997 to 2001 was estimated to be 5.5/100,000 population. The overall incidence of testis cancer in the United States has been steadily increasing.[4] SEER data showed that the overall incidence of testicular germ cell tumors increased 46% between 1975 and 2001 from 3.7/100,000 to 5.4/100,000 population, which corresponds to an annual change of 1.5% across all populations under study (table 1).

Age. Testis cancer is being diagnosed at an earlier age. In men younger than 50 years in the SEER database the incidence of testis cancer increased from 4.2/100,000 to 6.7/100,000 between 1975 and 2001. During the same period the incidence in men older than 50 years decreased from 2.4/100,000 to 2.0/100,000. McKiernan et al reviewed similar SEER data on 1973 to 1995 and found that birth cohort was strongly associated with the relative risk of testis cancer and the peak age at diagnosis decreased for each successive birth cohort (fig. 1).[4]

Ethnicity. SEER data indicated that the lifetime risk of being diagnosed with testis cancer was 4 times greater for white men than for black men (table 2). The age adjusted incidence in 1997 to 2001 for white men was 6.2/100,000 population, while that for black men was 1.5/100,000. The age adjusted incidence in the Hispanic, Asian/Pacific Islander and Native American/Alaskan populations was between these rates. Between 1975 and 2001 the incidence of testis cancer in white men increased 54% from 4.1/100,000 to 6.3/100,000. In black men the overall incidence of testis cancer remained stable between 1973 and 1998 at about 0.9/100,000 to 1.04/100,000.[5]

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TABLE 1. *Age adjusted testicular cancer incidence rates by age*

Diagnosis Yr	All	Younger Than 50	50 or Older
1975	3.7	4.2	2.4
1976	3.4	4.2	1.5
1977	4.3	5.1	2.2
1978	3.6	4.2	1.8
1979	3.9	4.5	2.2
1980	4.4	5.3	1.9
1981	4.2	5.1	1.8
1982	4.4	5.2	2.3
1983	4.6	5.5	2.2
1984	4.4	5.3	1.9
1985	4.5	5.5	1.8
1986	4.8	5.8	2.2
1987	5.0	6.3	1.8
1988	4.6	5.8	1.5
1989	5.5	6.7	2.2
1990	5.1	6.3	2.1
1991	5.1	6.2	2.1
1992	5.2	6.4	1.9
1993	5.1	6.4	1.6
1994	5.5	6.7	2.1
1995	4.6	5.6	1.8
1996	5.2	6.6	1.7
1997	5.4	6.5	2.4
1998	5.6	7.1	1.6
1999	5.4	6.8	1.8
2000	5.7	7.1	2.0
2001	5.4	6.7	2.0
1997–2001	5.5	6.9	2.0

SEER 9 areas, rates per 100,000 and age adjusted to the 2000 standard population by 5-year age groups (source: SEER Program [www.seer.cancer.gov] SEER*Stat Database: Incidence–SEER 9 Regs Public Use, November 2004 Sub [1973–2002], National Cancer Institute, DCCPS, Surveillance Research Program, Cancer Statistics Branch, released April 2005, based on the November 2004 submission).

TABLE 2. *Age adjusted incidence rates for testicular cancer in 1997 to 2001 by race/ethnicity*

	1997–2001 Rate/100,000 Population	1992–2001 Annual % Change Trend
All	5.2	1.2*
White:	6.2	1.3*
Hispanic*	3.7	1.0
NonHispanic	7.0	1.8*
Black	1.5	6.4*
Asian/Pacific Islander	2.1	2.3
American Indian/Alaska native	2.3	Not available
Hispanic	3.6	1.1

Incidence data from the 12 SEER areas San Francisco, Connecticut, Detroit, Hawaii, Iowa, New Mexico, Seattle, Utah, Atlanta, San Jose-Monterey, Los Angeles and Alaska Native Registry, Hispanic and non-Hispanic not mutually exclusive from white, black, Asian/Pacific Islander and American Indian/Alaska natives, and Hispanic and nonHispanic incidence data do not include Detroit, Hawaii and Alaska Native Registry (source: SEER Program [www.seer.cancer.gov] SEER*Stat Database: Incidence–SEER 9 Regs Public Use, November 2004 Sub [1973–2002], National Cancer Institute, DCCPS, Surveillance Research Program, Cancer Statistics Branch, released April 2005, based on the November 2004 submission).

* Significantly different from zero ($p < 0.05$).

Histology. SEER data on 1973 to 1998 demonstrated that seminoma and nonseminoma have distinguishable incidence patterns in white and black racial groups (fig. 2).[5] For white men the incidence of seminoma increased, while the incidence of NSGCT decreased. In addition, the ratio of seminoma to nonseminoma in white men changed from 50/50 in 1973 to 1978, to 60/40 in 1994 to 1998. In black men seminoma also showed a continued increasing incidence coupled with an overall decrease in NSGCT. Moreover, the seminoma-to-nonseminoma ratio in black men increased from 60/40 to 70/30. Biggs and Schwartz evaluated the relationships between histology and ethnicity in their examination of 16,086 cases from the SEER database (table 3).[6] Seminomas represented an average of 56% of the cases under study from a low of 51% in Hispanic-American men to a high of 70% in Japanese-American men. Of the NSGCT subtypes mixed germ cell (mean 22%, range 14% to 29%) was the most common, followed by embryonal (mean 16%, range 9% to 17%) and then teratoma (mean 3%, range 0% to 5%), and finally choriocarcinoma and yolk sac (mean 1% each, range 0% to 3% and 0% to 2%, respectively). This order of histological frequency (mixed, embryonal, teratoma, choriocarcinoma and

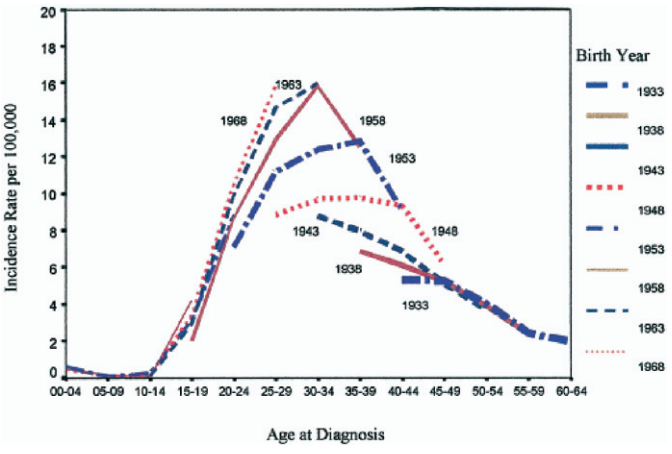

FIG. 1. Testicular cancer rates by birth cohort vs patient age at diagnosis.[4]

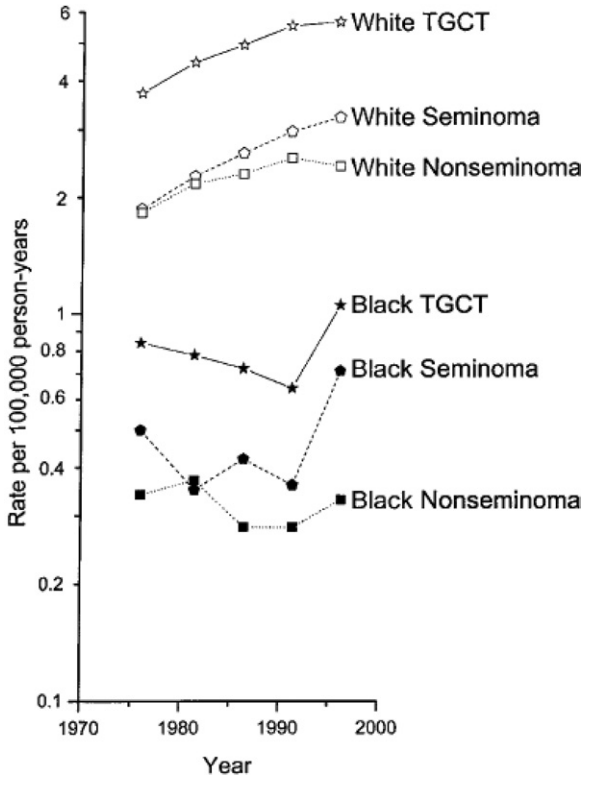

FIG. 2. Incidence of testicular germ cell tumors (*TGCT*) in SEER Program from 1973 to 1978 and 1994 to 1998 by patient race/ethnicity and tumor type.[5]

TABLE 3. *Characteristics of patients with testicular cancer by age and race/ethnicity*

	No. NonHispanic White (%)	No. Black (%)	No. Native American (%)	No. Chinese (%)	No. Japanese (%)	No. Filipino (%)	No. Hawaiian (%)	No. Hispanic White (%)	Total (%)
All	13,922	329	89	129	141	60	94	1,322	16,086
Diagnosis age:									
15–19	598 (4)	13 (4)	6 (7)	1 (1)	2 (1)	1 (2)	6 (6)	107 (8)	734 (5)
20–29	4,572 (33)	101 (31)	43 (48)	41 (32)	39 (28)	27 (45)	42 (45)	575 (44)	5,443 (34)
30–39	5,185 (37)	137 (42)	25 (29)	50 (39)	60 (43)	19 (32)	33 (35)	426 (32)	5,935 (37)
40–49	2,354 (17)	55 (17)	10 (11)	25 (19)	28 (20)	8 (13)	8 (9)	150 (11)	2,638 (16)
50–59	767 (6)	13 (4)	3 (3)	10 (8)	6 (4)	2 (3)	3 (3)	41 (3)	845 (5)
60 or Older	446 (3)	10 (3)	2 (2)	2 (2)	6 (4)	3 (5)	2 (2)	20 (2)	491 (3)
Diagnosis stage:									
Localized	9,084 (65)	202 (61)	51 (57)	98 (76)	100 (71)	43 (72)	47 (50)	841 (64)	10,466 (65)
Regional	2,896 (21)	65 (20)	13 (15)	16 (12)	25 (18)	10 (17)	22 (23)	248 (19)	3,295 (21)
Distant	1,640 (12)	53 (16)	24 (27)	12 (9)	15 (11)	6 (10)	25 (27)	213 (16)	1,988 (12)
Unstaged	302 (2)	9 (3)	1 (1)	3 (2)	1 (1)	1 (2)	0	20 (2)	337 (2)
Histology:									
Seminoma	7,779 (56)	197 (60)	47 (53)	84 (65)	99 (70)	39 (65)	49 (52)	678 (51)	8,972 (56)
NSGCT	5,995 (43)	119 (36)	40 (45)	39 (30)	42 (30)	20 (33)	44 (47)	635 (48)	6,934 (43)
Embryonical	2,318 (17)	33 (10)	12 (13)	15 (12)	12 (9)	6 (10)	16 (17)	182 (14)	2,594 (16)
Yolk sac	118 (1)	3 (1)	1 (1)	0	0	0	2 (2)	14 (1)	138 (1)
Teratoma	447 (3)	8 (2)	4 (4)	3 (2)	5 (4)	0	5 (5)	50 (4)	533 (3)
Chorioca	124 (1)	7 (2)	3 (3)	3 (2)	0	0	1 (1)	11 (1)	149 (1)
Mixed germ cell	2,988 (21)	68 (21)	20 (22)	18 (14)	25 (18)	14 (23)	20 (21)	378 (29)	3,531 (22)
Nongerm cell	146 (1)	13 (4)	2 (2)	6 (5)	0	1 (2)	1 (1)	9 (1)	180 (1)

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yolk sac) was found across all ethnic groups. Black, Native American, Hawaiian-American and Hispanic patients with testis cancer were more likely than white patients to have more aggressive NSGCT.

Stage. NCDB data from 1985 to 1991 indicated that the proportion of tumors presenting as stage I remained relatively stable at approximately 65%, whereas the percent of stage II and III tumors decreased from 12.9% to 6.1% and 8.9% to 6.7%, respectively (table 4). Stage IV tumors increased from 14% to 22% during the same period. The stage distribution of men in the SEER database from 1995 to 2000 showed 70% had localized disease, 18% had regional spread, 10% had distant spread and 1% had unstaged disease. White men were more likely to present with localized disease than were black men (71% vs 63%), who conversely were more likely to have metastatic disease (20% vs 18% and 16% vs 10% for regional and distant spread, respectively). Biggs and Schwartz evaluated the relationships between stage and ethnicity in the SEER database and found that an average of 65% of patients presented with localized disease, which is similar to findings in the NCDB data.[6] However, black, Native American, Hawaiian-American and Hispanic patients with testis cancer were more likely than white men to be diagnosed with late stage disease. Overall 21% of men presented with regional metastases and 12% presented with distant metastases.

Survival and Mortality

Survival. According to the SEER database from 1974 to the current 5-year survival rates increased successively, at-

TABLE 4. *Testicular tumor characteristics*[7]

	No. 1985–1986 (%)	No. 1990–1991 (%)	No. 1995–1996 (%)
Anatomical site:			
Undescended testis	39 (1.7)	138 (2.4)	160 (2.1)
Descended testis	56 (2.5)	278 (4.9)	2,187 (29.3)
Testis NOS	2,185 (95.8)	5,261 (92.7)	5,105 (68.5)
Totals	2,280 (100.0)	5,677 (100.0)	7,452 (100.0)
Histology:			
Seminoma NOS	1,219 (53.5)	3,029 (53.4)	4,171 (56.0)
Spermatocytic seminoma	14 (0.6)	31 (0.5)	40 (0.5)
Embryonal Ca	430 (18.9)	846 (15.4)	853 (11.4)
Malignant teratoma	373 (16.4)	1,203 (21.2)	1,659 (22.3)
Chorioca	118 (5.2)	210 (3.7)	184 (2.5)
Nongerm cell tumors	118 (5.2)	322 (5.7)	537 (7.2)
Unspecified	8 (0.4)	6 (0.1)	8 (0.1)
Totals	2,280 (100.0)	5,677 (100.0)	7,452 (100.0)
AJCC stage:*			
I	779 (64.2)	3,141 (65.0)	4,800 (73.4)
II	156 (12.9)	295 (6.1)	1,107 (16.9)
III	108 (8.9)	324 (6.7)	633 (9.7)
IV	170 (14.0)	1,069 (22.1)	Not available
Subtotal	1,213 (100.0)	4,829 (100.0)	6,540 (100.0)
Unknown	1,067 (46.8)	848 (14.9)	912 (12.2)
Totals	2,280 (100.0)	5,677 (100.0)	7,452 (100.0)

* According to the AJCC *Manual for Staging of Cancer,* 2nd (1985 to 1986), 3rd (1990 to 1991) and 4th (1995 to 1996) editions.

TABLE 5. *Five-year relative survival for testicular cancer by race/ethnicity, diagnosis year, stage and age*

	All Males			White Males			Black Males	
	All	Younger Than 50	50 or Older	All	Younger Than 50	50 or Older	All	Younger Than 50
Diagnosis yr:								
1960–1963	Not available	Not available	Not available	63.0	Not available	Not available	Not available	Not available
1970–1973	Not available	Not available	Not available	72.0	Not available	Not available	Not available	Not available
1974–1976	78.7	78.1	82.9	78.8	78.2	83.3	75.9*	—
1977–1979	87.5	88.6	77.1	87.9	89.0	78.1	66.2*	—
1980–1982	91.9	91.9	91.8	92.1	92.0	92.7	89.7*	89.2*
1983–1985	91.0	91.8	82.3	91.3	92.3	80.7	87.9*	84.3*
1986–1988	95.2	95.3	93.5	95.7	95.7 95.8	94.4	—	—
1989–1991	95.4	95.5	93.8	95.9	95.8	94.8	89.8*	93.6*
1992–1994	95.4	95.7	90.4	95.6	95.9	60.1	85.2*	84.5*
1995–2000	95.9†	96.4†	88.3	96.2†	96.7†	89.4	87.3	90.4
1995–2000 All stages:	95.9	96.4	88.3	96.2	96.7	89.4	87.3	90.4
Localized	99.4	99.4	97.0	99.4	99.4	97.6	96.5*	99.6
Regional	95.9	96.4	89.9*	96.1	96.5	90.6*	Not available	Not available
Distant	71.8	75.1	38.7*	73.1	76.6	39.5*	Not available	Not available
Unstaged	89.1	91.6	Not available	90.2	93.0	Not available	Not available	Not available
1995–2000 Diagnosis age:								
Younger than 45	96.5	Not available	Not available	96.7	Not available	Not available	Not available	Not available
45–54	94.5	Not available	Not available	95.3	Not available	Not available	Not available	Not available
55–64	87.2	Not available	Not available	87.9	Not available	Not available	Not available	Not available
65–74	74.2*	Not available	Not available	75.9*	Not available	Not available	Not available	Not available
75 or Older	—	Not available	Not available	—	Not available	Not available	Not available	Not available
Younger than 65	96.1	Not available	Not available	96.4	Not available	Not available	Not available	Not available
65 or Older	73.9*	Not available	Not available	77.6*	Not available	Not available	Not available	Not available

Rates for 1960 to 1973 based on End Results data from a series of hospital registries and 1 population based registry, and rates for 1974 to 2000 from SEER 9 areas based on data from population based registries in Connecticut, Puerto Rico, Utah, Iowa, Hawaii, Atlanta, Detroit, Seattle-Puget Sound and San Francisco-Oakland, on patient followup into 2001 with no available data on black males 50 years or older (source: SEER Program [www.seer.cancer.gov] SEER*Stat Database: Incidence–SEER 9 Regs Public Use, November 2004 Sub [1973–2002], National Cancer Institute, DCCPS, Surveilance Research Program, Cancer Statistics Branch, released April 2005, based on the November 2004 submission).

* Survival rate SE between 5% and 10%.

† Statistically significant vs 1974 to 1976 ($p < 0.05$).

taining the current level of 95.9%. Table 5 shows 5-year relative survival rates by race, year of diagnosis, stage and age from the SEER database. Black men with testis cancer experienced a 5% decrease in survival rates between 1989 and 1991, and 1992 and 1994 from 89.8% to 85.2%. However, this was a temporary downturn and in the 1995 to 2000 data set the survival of black men increased to 87.3%. Survival rates are best for patients who present with localized disease. When stratified by stage at presentation, men diagnosed between 1995 and 2000 with localized disease had a survival rate of 99.4% compared with 95.9% and 71.8% for regional and distant disease, respectively. Men diagnosed at a younger age also had better survival rates. In the 1995 to 2000 cohort men younger than 50 years had a 5-year relative survival rate of 96.4% compared with 88.3% for men older than 50 years. Finally, men diagnosed more recently had better survival rates. A man diagnosed in 1995 had a 95.9% chance of 5-year survival, while the rate for a man diagnosed in 1974 was 78.7%. Men with seminoma had better survival rates than those with NSGCT. The 5-year survival rate for seminoma was 97.9% and that for NSGCT was 96.5%.

Mortality. Testis tumors are exceedingly curable and mortality is low. SEER data on 1997 to 2001 placed the age adjusted death rate from testis cancer for American men at 0.3/100,000 (table 6). The overall death rate from testicular germ cell tumors decreased by 71% between 1975 and 2001 from 0.7/100,000 to 0.2/100,000. During this period the death rate decreased from 0.8/100,000 to 0.3/100,000 for white men and from 0.4/100,000 to 0.2/100,000 for black men. These findings indicate that white males have a higher lifetime risk of dying from testis cancer than black males (0.02% vs 0.01%).

Changes in Treatment Approaches

Seminoma. The management of seminoma remained relatively consistent in the last decade. Approximately 75% of patients in the NCDB underwent radiotherapy after radical orchiectomy.[7] However, a growing proportion of patients with clinical stage I disease were being treated initially with surgery alone, representing an increase from 15.8% in 1985 to 1986, to 21% in 1995 to 1996, presumptively followed thereafter with surveillance.[5] The use of surgery and radiation remained stable at 76% in 1985 to 1986 and 74% in 1995 to 1996 during the period studied. As expected, the use of LND in seminoma was rare at 0.6%. Chemotherapy is becoming the standard treatment for advanced seminoma

TABLE 6. *Age adjusted death rates for testicular cancer in 1997 to 2001 by race/ethnicity*

Race/Ethnicity	1997–2001 Rate/100,000 Population	1992–2001 Annual % Change Trend
All	0.3	−1.3
White:	0.3	−1.4
Hispanic	0.2	−4.0
NonHispanic	0.3	−0.8
Black	0.2	2.3
Hispanic	0.2	−3.9

Data from public use file provided by the National Center for Health Statistics, Hispanic and nonHispanic data not mutually exclusive from Whites, Blacks, Asian/Pacific Islanders, and American Indians/Alaska natives data, Hispanic and nonHispanic incidence data do not include Detroit, Hawaii and Alaska Native Registry, and no available data on Asian/Pacific Islander or North American native/Alaska native (source: SEER Program [www.seer.cancer.gov] SEER*Stat Database: Incidence–SEER 9 Regs Public Use, November 2004 Sub (1973–2002). National Cancer Institute, DCCPS, Surveillance Research Program, Cancer Statistics Branch, released April 2005, based on the November 2004 submission).

after orchiectomy. Its rate of use increased from 25.7% in 1985 to 1986, to 51.5% in 1995 to 1996.[7] Consequently the rate of use of radiotherapy for higher stage disease decreased from 43.3% in 1985 to 1986, to 27.2% in 1995 to 1996.[5] These results may reflect in part the increasing use of single dose carboplatin for stage I seminoma.

NSGCT. For patients with early stage NSGCT NCDB data revealed an increase in the use of surgery as a single modality therapy from 69.8% in 1985 to 1986, to 75% in 1995 to 1996. While the use of retroperitoneal LND increased from 12.6% in 1985 to 1986, to 17.6% in 1995 to 1996, so did orchiectomy as single therapy from 18.3% in 1985 to 1986, to 45% in 1995 to 1996, again reflecting the use of surveillance as primary treatment, followed by salvage therapy if necessary.[5] The rate of use of chemotherapy for early disease remained relatively stable at 24%. However, its rate of use for advanced NSGCT increased from 75% in 1985 to 1986, to 87% in 1995 to 1996 (table 7).[5]

Trends in Health Care Resources and Use

Inpatient care. Patients with testis cancer may require inpatient hospitalization for surgery, chemotherapy or any of the potential side effects of either treatment. Orchiectomy rarely requires hospitalization. According to HCUP the rate of national inpatient hospitalizations for testis cancer as a primary diagnosis was 1.8/100,000 (2,230 admissions) in 1994 and 1.4/100,000 (1,907) in 2000 (table 8). The age adjusted hospitalization rate decreased slightly for white men and increased slightly for Hispanic men. No HCUP data were available on black men with testis cancer.

Hospitalization rates were highest in the 25 to 34-year-old age group, followed by the 18 to 24, 35 to 44 and 45 to 54-year-old groups, reflecting the age distribution of men with testis cancer. Little geographic variation existed except in the Northeast, where hospitalization rates were almost double those of all other regions in 1994. Admission rates were highest in urban areas, most likely reflecting the treatment of many patients with testis cancer at tertiary care centers of excellence for complex surgery and chemotherapy.

Outpatient care. An individual with testis cancer may be seen in the outpatient setting during diagnosis, treatment and followup. This includes initial evaluation before and after orchiectomy, before and after any secondary surgeries, during radiation and chemotherapy, and during surveil-

TABLE 7. *Treatment modality by histological disease type and testicular cancer stage*[7]

	1985–1986		1990–1991		1995–1996	
	Early	Advanced	Early	Advanced	Early	Advanced
			Seminoma			
Surgery alone:						
Testicle excision without LND	4.7	1.4	13.9	3.3	16.8	4.4
Testicle excision with LND	3.7	1.4	1.0	1.4	0.6	0.7
Orchiectomy NOS	3.5	2.7	3.6	0.7	3.5	1.7
Surgery NOS	3.9	0.0	0.5	0.0	0.1	0.2
Surgery + radiation:						
Testicle excision without LND	25.3	18.9	57.4	15.6	61.2	20.4
Testicle excision with LND	12.0	8.1	2.2	2.5	1.7	1.2
Orchiectomy NOS	17.2	9.5	12.4	5.8	11.1	4.9
Surgery NOS	20.9	6.8	1.1	1.1	0.1	0.7
Surgery + chemotherapy:						
Testicle excision without LND	0.5	10.8	1.7	30.1	1.2	38.4
Testicle excision with LND	0.5	5.4	0.3	4.3	0.1	4.1
Orchiectomy NOS	0.8	2.7	0.8	8.7	0.6	7.3
Surgery NOS	0.5	6.8	0.1	2.9	0.0	1.7
Other treatment modalities	5.7	21.6	4.0	22.1	1.9	13.6
No treatment indicated	0.7	4.1	1.1	1.4	0.5	0.5
Totals	100	100	100	100	100	100
No. cases	593	74	2393	276	3391	411
			NSGCT			
Surgery alone:						
Testicle excision without LND	18.3	2.7	35.2	2.6	45.3	5.9
Testicle excision with LND	12.6	1.6	21.4	3.2	17.6	3.6
Orchiectomy NOS	13.3	2.1	9.2	2.1	9.5	1.6
Surgery NOS	25.6	5.3	2.4	1.3	2.4	0.8
Surgery + radiation:						
Testicle excision without LND	0.7	0.0	0.4	0.1	0.6	0.1
Testicle excision with LND	0.3	0.0	0.0	0.0	0.1	0.0
Orchiectomy NOS	0.3	0.0	0.1	0.0	0.1	0.0
Surgery NOS	0.3	0.0	0.0	0.1	0.0	0.0
Surgery + chemotherapy:						
Testicle excision without LND	5.6	28.3	13.6	38.4	15.0	45.6
Testicle excision with LND	5.6	14.4	6.5	20.6	2.8	17.9
Orchiectomy NOS	4.3	13.9	5.2	10.4	3.9	12.1
Surgery NOS	8.0	18.7	1.2	7.0	0.5	3.5
Other treatment modalities	1.7	11.8	4.0	13.4	1.8	8.5
No treatment indicated	3.3	1.1	0.9	0.8	0.5	0.4
Totals	100	100	100	100	100	100
No. cases	301	187	1207	719	1542	827

Early—1985 to 1986 AJCC stages I and II, 1990 to 1991 AJCC stages I to III, and 1995 to 1996 AJCC stages I and II N1, and advanced—1985 to 1986 AJCC stages III and IV, 1990 to 1991 AJCC stage IV, and 1995 to 1996 AJCC stages II (N2 or higher) and III according to the AJCC *Manual for Staging of Cancer,* 2nd (1985 to 1986), 3rd (1990 to 1991) and 4th (1995 to 1996) editions.

TABLE 8. *Inpatient hospital stays for testicular cancer as primary diagnosis*

	1994			1996			1998			2000		
	Count	Rate (95% CI)	Age Adjusted Rate	Count	Rate (95% CI)	Age Adjusted Rate	Count	Rate (95% CI)	Age Adjusted Rate	Count	Rate (95% CI)	Age Adjusted Rate
Totals	2,230	1.8 (1.6–2.0)	1.8	1,890	1.5 (1.3–1.7)	1.5	1,993	1.5 (0.9–2.2)	1.5	1,907	1.4 (1.2–1.6)	1.4
Age:*												
18–24	407	3.3 (2.4–4.2)		296	2.4 (1.7–3.1)		414	3.3 (1.5–5.1)		396	3.0 (2.2–3.8)	
25–34	951	4.7 (3.8–5.6)		771	3.9 (3.1–4.7)		732	3.8 (2.0–5.6)		647	3.5 (2.8–4.3)	
35–44	561	2.8 (2.3–3.4)		483	2.3 (1.8–2.8)		522	2.4 (1.4–3.4)		553	2.5 (2.0–3.1)	
45–54	158	1.1 (0.7–1.6)		†	†		†	†		151	0.8 (0.5–1.2)	
55–64	†	†		†	†		†	†		†	†	
Race/ethnicity:												
White	1,526	1.7 (1.4–1.9)	1.7	1,221	1.3 (1.1–1.5)	1.3	1,333	1.4 (0.6–2.2)	1.5	1,027	1.1 (0.9–1.3)	1.1
Hispanic	176	1.4 (0.8–1.8)	1.1	138	1.0 (0.5–1.4)	0.9	†	†	1.1	289	1.8 (1.0–2.5)	1.5
Region:												
Midwest	489	1.7 (1.2–2.1)	1.7	477	1.6 (1.2–2.0)	1.6	349	1.1 (0.7–1.6)	1.2	392	1.3 (0.9–1.6)	1.3
Northeast	686	2.8 (2.1–3.5)	2.8	345	1.4 (0.9–1.9)	1.4	†	†	3.0	334	1.4 (1.0–1.6)	1.4
South	579.0	1.4 (1.1–1.7)	1.4	610	1.4 (1.1–1.7)	1.4	455	1.0 (0.8–1.2)	1.0	575	1.2 (0.9–1.6)	1.2
West	475	1.7 (1.3–2.1)	1.7	458	1.6 (1.0–2.1)	1.5	443	1.5 (1.0–2.0)	1.4	606	2.0 (1.4–2.6)	2.0
Metropolitan statistical area:												
Rural	188	0.6 (0.4–0.8)	0.6	187	0.6 (0.4–0.9)	0.7	†	†	†	194	0.7 (0.4–0.9)	0.7
Urban	2,034	2.2 (1.9–2.5)	2.2	1,695	1.7 (1.4–2.0)	1.7	1,863	1.8 (1.0–2.7)	1.8	1,713	1.6 (1.4–1.9)	1.6

Rate per 100,000 based on 1994, 1996, 1998 and 2000 population estimates from CPS, CPS Utilities, Unicon Research Corp., for relevant demographic categories of male civilian noninstitutionalized population in the United States, age adjusted rate adjusted to the United States Census derived age distribution of the year under analysis and individuals of other races, and with missing or unavailable race and ethnicity, and missing metropolitan statistical area included in the total (counts may not sum to total due to rounding) (source: HCUP Nationwide Inpatient Sample, 1994, 1996, 1998 and 2000).

* Values for younger than 18, and 65 to 85 years or older do not meet reliability or precision standard.

† Value does not meet reliability or precision standard.

lance for recurrence. Emergency room visits are exceedingly rare and consequently there is insufficient information on which to base any conclusions.

Physician office visits. In Centers for Medicare and Medicaid Services data for 1992, 1995, 1998 and 2001 physician office visit rates increased significantly from 1992 to 1998 and then remained stable for men younger than 65 years (table 9). For men older than 65 years the age adjusted rate varied minimally from 1992 to 2001. Variability was seen across geographic regions and racial/ethnic strata. Greater reliance on outpatient care resulted not surprisingly in increased physician office visits, corresponding to the decrease in inpatient hospitalizations (table 8). Data on physician office visits by black and Hispanic men are difficult to interpret due to small sample size, and low counts preclude drawing firm conclusions regarding trends. However, for black men the rates of physician office visits decreased steadily from 1992 to 2001 (with an exception in 1998) with an overall ultimate decrease of 50%. A similar trend was seen in Hispanic men, for whom the number of physician office visits almost tripled from 1995 to 1998 and then subsequently decreased by 40%.

Hospital outpatient visits. In Centers for Medicare and Medicaid Services data on 1992, 1995, 1998 and 2001 age adjusted outpatient hospital visit rates decreased consistently from 1992 to 1998 before rebounding slightly in 2001 for an overall 48% decrease (table 10). The decrease was most notable in men younger than 65 years (an 88% decrease). Outpatient visits from 1992 to 2001 decreased by 83% in the Midwest and Northeast, by 68% in the West and by 45% in the South. A decrease would be expected for men on surveillance and outpatient chemotherapy because these treatments are commonly performed in physician offices. In fact, table 11 shows that inpatient chemotherapy is decreasing. From 1994 to 2000 the rate of inpatient chemotherapy infusions decreased by 33%.

Economic Impact

According to data from the Ingenix data set for 2002 the estimated annual expenditure for privately insured individuals between ages 18 and 54 years with claims corresponding to a diagnosis of testis cancer was $9,953 (table 12). Of this amount $8,816 were for medical costs and $1,137 were for prescription medications. The annual expenditure for males 18 to 54 years old without a claim for testis cancer was $3,717. The difference of $6,236 after controlling for differences in age distribution, median household income, health insurance type and 28 comorbid conditions may be attributable to expenditures directly or indirectly related to testis cancer.

Men 45 to 54 years old had the highest annual expenditure at $7,343, although sample sizes were small (table 12). Moreover, this age group had an increase in medication costs, which were 70% greater than the mean medication costs for all age groups. This may reflect a greater use of chemotherapy in the older patient population, and a greater reliance on surgery and/or observation in younger patients. When stratified by region, costs were fairly consistent and they generally correlated with expenditures of men without testis cancer (table 12).

National estimates of annual medical expenditures placed the total cost of treating testis cancer at $21.8 million in 2000 exclusive of medications, representing a 10% increase over the total in 1994 (table 13). Between 1994 and 2000 the percent of total costs attributable to hospital outpatient costs remained stable at 7.7% to 8.7%, the percent of ambulatory surgery costs remained stable at 14.9% to 16.8% and inpatient costs decreased slightly from 77.4% to 74.6%. This reflects the trend of care being transferred to the office and outpatient settings.

TABLE 9. *Physician office visits by Medicare beneficiaries with testicular cancer as primary diagnosis*

	1992			1995			1998			2001		
	Count	Rate (95% CI)	Age Adjusted Rate	Count	Rate (95% CI)	Age Adjusted Rate	Count	Rate (95% CI)	Age Adjusted Rate	Count	Rate (95% CI)	Age Adjusted Rate
Totals	4,360	29 (25–33)		6,080	40 (35–44)		5,940	41 (36–46)		6,240	40 (36–45)	
Total younger than 65	1,840	59 (47–71)		2,440	71 (58–83)		2,920	85 (71–99)		3,180	84 (71–97)	
Total 65 or older	2,520	21 (18–25)	23	3,640	31 (26–35)	31	3,020	27 (23–32)	27	3,060	26 (22–31)	26
Age:												
65–69	660	16 (11–22)		1,440	37 (29–46)		680	20 (13–27)		1,240	35 (26–44)	
70–74	520	16 (9.8–22)		640	19 (13–26)		1,200	39 (29–49)		720	23 (16–31)	
75–79	740	33 (22–43)		1,000	44 (32–56)		520	23 (14–32)		700	29 (19–38)	
80–84	200	15 (5.8–25)		260	19 (8.6–29)		280	20 (9.7–31)		120	8.0 (1.6–14)	
85–89	160	27 (8.2–46)		100	16 (1.9–30)		340	52 (27–77)		120	17 (3.3–30)	
90–94	240	118 (51–186)		180	85 (29–141)		0			160	69 (21–117)	
95–97	0			20	53 (0.0–156)		0			0		
98 or Older	0			0			0			0		
Race/ethnicity:												
White	3,840	31 (26–35)	30	5,300	41 (36–46)	41	5,400	44 (39–49)	44	5,620	43 (38–48)	43
Black	280	22 (10–33)	24	300	22 (11–33)	16	320	24 (12–36)	25	180	12 (4.2–20)	12
Asian	Not available	Not available	Not available	0			0			0		
Hispanic	Not available	Not available	Not available	40	20 (0.0–48)	20	160	48 (15–81)	54	120	32 (6.4–58)	32
North American native	Not available	Not available	Not available	0			0			40	120 (0.0–285)	120
Region:												
Midwest	860	23 (16–30)	25	1,700	44 (35–53)	43	1,440	39 (30–48)	40	1,340	35 (27–44)	37
Northeast	1,700	54 (42–65)	48	880	28 (19–36)	26	820	30 (20–39)	29	1,780	61 (48–74)	60
South	1,360	26 (20–32)	27	1,980	36 (29–43)	34	2,480	46 (38–54)	49	2,540	44 (36–51)	42
West	440	18 (11–26)	19	1,520	66 (51–80)	75	1,140	51 (38–64)	43	580	23 (15–32)	23

Unweighted counts multiplied by 20 to arrive at values, rate per 100,000 male Medicare beneficiaries in the same demographic stratum, age adjusted rate adjusted to the 2000 United States Census and individuals of other races, unknown race and ethnicity, and other region included in the total (counts less than 600 should be interpreted with caution) (source: Centers for Medicare and Medicaid Services, 5% Carrier and Outpatient Files, 1992, 1995, 1998 and 2001).

TABLE 10. *Hospital outpatient visits by Medicare beneficiaries with testicular cancer as primary diagnosis*

	1992			1995			1998			2001		
	Count	Rate (95% CI)	Age Adjusted Rate	Count	Rate (95% CI)	Age Adjusted Rate	Count	Rate (95% CI)	Age Adjusted Rate	Count	Rate (95% CI)	Age Adjusted Rate
Total	1,800	12 (9.6–15)		820	5.4 (3.7–7.0)		1,060	7.3 (5.4–9.3)		460	3.0 (1.8–4.2)	
Total younger than 65	1,320	42 (32–52)		520	15 (9.3–21)		900	26 (19–34)		200	5.3 (2.0–8.5)	
Total 65 or older	480	4.1 (2.4–5.7)	4.2	300	2.5 (1.3–3.8)	2.4	160	1.4 (0.4–2.5)	1.4	260	2.2 (1.0–3.5)	2.2
Age:												
65–69	100	2.5 (0.3–4.6)		180	4.7 (1.6–7.7)		80	2.4 (0.1–4.7)		120	3.4 (0.7–6.1)	
70–74	140	4.3 (1.1–7.5)		40	1.2 (0.0–2.8)		20	0.7 (0.0–1.9)		60	1.9 (0.0–4.2)	
75–79	160	7.1 (2.2–12)		60	2.6 (0.0–5.6)		60	2.6 (0.0–5.6)		80	3.3 (0.1–6.4)	
80–84	80	6.1 (0.2–12)		20	1.4 (0.0–4.2)		0			0		
85–89	0			0			0			0		
90–94	0			0			0			0		
95–97	0			0			0			0		
98 or Older	0			0			0			0		
Race/ethnicity:												
White	1,660	13 (10–16)	13	740	5.7 (3.9–7.5)	5.5	900	7.4 (5.2–9.5)	7.4	380	2.9 (1.6–4.2)	2.9
Black	20	1.6 (0.0–4.6)	1.6	20	1.4 (0.0–4.3)	1.4	20	1.5 (0.0–4.4)	1.5	60	4.1 (0.0–8.7)	4.1
Asian	Not available	Not available	Not available	0			20	15 (0.0–43)	15	0		0.0
Hispanic	Not available	Not available	Not available	20	10 (0.0–30)	10	120	36 (7.2–64)	36	20	5.3 (0.0–16)	5.3
North American native	Not available	Not available	Not available	0			0			0		
Region:												
Midwest	680	18 (12–25)	19	440	11 (6.6–16)	10	180	4.9 (1.7–8.1)	4.9	120	3.2 (0.6–5.7)	3.2
Northeast	540	17 (11–23)	16	180	5.7 (1.9–9.4)	5.7	80	2.9 (0.1–5.7)	2.9	80	2.7 (0.1–5.4)	2.7
South	200	3.8 (1.5–6.2)	3.8	80	1.5 (0.0–2.9)	1.5	620	12 (7.5–16)	12	120	2.1 (0.4–3.7)	2.1
West	380	16 (8.7–23)	15	120	5.2 (1.0–9.3)	6.0	160	7.2 (2.2–12)	7.2	120	4.8 (1.0–8.7)	4.8

Unweighted counts multiplied by 20 to arrive at values, rate per 100,000 male Medicare beneficiaries in the same demographic stratum, age adjusted rates adjusted to the 2000 United States Census and individuals of other races, unknown race and ethnicity, and other region included in the total (counts less than 600 should be interpreted with caution) (source: Centers for Medicare and Medicaid Services, 5% Carrier and Outpatient Files, 1992, 1995, 1998 and 2001).

TABLE 11. *Chemotherapy during inpatient hospital stays for testicular cancer as primary diagnosis rate*

	Count	Rate/100,000 Population (95% CI)	Rate/100,000 Visits for Condition (95% CI)
1994:			
Total	2,230	1.8 (1.6–2.0)	
Chemotherapy	384	0.3 (0.2–0.4)	16,323 (11,883–20,807)
1996:			
Total	1,890	1.5 (1.3–1.7)	
Chemotherapy	298	0.2 (0.2–0.3)	15,787 (11,376–20,159)
1998:			
Total	1,993	1.5 (0.9–2.2)	
Chemotherapy	336	0.3 (0.2–0.3)	16,859 (11,139–22,529)
2000:			
Total	1,907	1.4 (1.2–1.6)	
Chemotherapy	295	0.2 (0.2–0.3)	15,469 (10,388–20,556)

Rate per 100,000 based on 1994 to 2000 population estimates from CPS, CPS Utilities, Unicon Research Corp., for relevant demographic categories of male civilian noninstitutionalized population in the United States and rate per 100,000 male visits for testicular cancer in HCUP National Inpatient Sample, 1994 to 2000 (source: HCUP Nationwide Inpatient Sample, 1994, 1996, 1998 and 2000).

TABLE 13. *Testicular cancer expenditures by service site*

	$ Expenditures (%)
1994:	
Hospital outpt	1,521,508 (7.7)
Physician office	— (0.0)
Ambulatory surgery	2,941,777 (14.9)
Emergency room	— (0.0)
Inpt	15,300,472 (77.4)
Total	19,763,756
1996:	
Hospital outpt	1,638,654 (8.7)
Physician office	— (0.0)
Ambulatory surgery	3,168,275 (16.9)
Emergency room	— (0.0)
Inpt	13,966,091 (74.4)
Total	18,773,020
1998:	
Hospital outpt	1,740,460 (8.4)
Physician office	— (0.0)
Ambulatory surgery	3,365,113 (16.2)
Emergency room	— (0.0)
Inpt	15,642,173 (75.4)
Total	20,747,745
2000:	
Hospital outpt	1,885,498 (8.7)
Physician office	— (0.0)
Ambulatory surgery	3,645,539 (16.8)
Emergency room	— (0.0)
Inpt	16,214,464 (74.6)
Total	21,745,500

Source: National Ambulatory and Medical Care Survey, National Hospital and Ambulatory Medical Care Survey, HCUP and Medical Expenditure Panel Survey, 1994, 1996, 1998 and 2000.

Testis cancer is rare in prepubertal males. However, data from the National Association of Children's Hospitals and Related Institutions database indicated that the mean inpatient cost per child with testis cancer listed as a primary diagnosis was $21,892 in 2001, representing a 2.3-fold increase over the cost in 1999 (table 14). In summary data from 1999 to 2001 increases in costs correlated directly with increases in age. Males 11 years or older with a primary diagnosis of testis cancer had costs that were almost 3 times greater than those for patients 10 years or younger. This may be because older children admitted to inpatient facilities had a higher proportion of recurrent cancers involving more intensive care, while younger patients were admitted for the initial cancer procedure.

Marketscan Health and Productivity Management data on 1999 allowed assessment of the impact of a diagnosis of testis cancer on employment (table 15). Most men with testis cancer were in the age range when they would be enrolled in school or employed. Marketscan Health and Productivity Management data indicated that 16% of men with testis cancer missed work for treatment of the disease. An average of 0.7 hours of work was missed for inpatient hospitalization and 7.7 hours were missed for outpatient visits. Hence, the average total hours of work missed was 8.4. This suggests that most men with testis cancer were under surveillance or underwent primary treatment before 1999, of which either would result in only occasional followup visits to a physician office.

DISCUSSION

Testis cancer is relatively uncommon, representing less than 1% of all male malignancies. Still, it is currently the most common cancer in men 20 to 34 years old. Although the incidence of testis cancer in the United States contin-

TABLE 12. *Estimated annual expenditures of privately insured employees with and without testicular cancer medical claim in 2002*

	$ Annual Expenditures/Pt Ages 18–64 Without Testicular Ca (285,095 men)			$ Annual Expenditures/Pt Ages 18–64 With Testicular Ca (236 men)		
	Medical	Prescription Drugs	Totals	Medical	Prescription Drugs	Totals
All						
Age:	2,682	1,035	3,717	8,816	1,137	9,953
18–34	1,288	654	1,942	6,905	875	7,780
35–44	2,149	875	3,024	6,443	1,193	7,636
45–54	3,067	1,211	4,278	9,680	1,941	11,621
Region:						
Midwest	2,584	1,022	3,606	8,492	1,126	9,618
Northeast	2,611	1,122	3,733	8,580	1,232	9,812
South	2,747	969	3,716	9,029	1,057	10,086
West	2,920	1,058	3,978	9,596	1,174	10,770

Primary beneficiaries 18 to 64 years old with employer provided insurance who were continuously enrolled in 2002, estimated annual expenditures derived from multivariate models controlled for age, gender, work status (active/retired), median household income based on zip code, urban/rural residence and medical and drug plan characteristics (managed care, deductible and co-insurance/co-payments) and binary indicators for 28 chronic disease conditions with predicted expenditures for ages 55 to 64 years omitted due to small sample size (source: Ingenix, 2002).

TABLE 14. *Annual work loss of males treated for testicular cancer*

	No. Workers (% missing work)	Av Hrs Work Absence (range)		
		Inpt	Outpt	Totals
Totals	45 (16)	0.7 (0–2.1)	7.7 (0–19.5)	8.4 (0–20.3)
Age:				
18–29	5 (0)	0	0	0
30–39	16 (19)	2 (0–6.3)	0.8 (0–1.9)	2.8 (0–7.1)
40–49	18 (17)	0	18 (0–48.6)	17.9 (0–48.6)
50–64	6 (17)	0	1.8 (0–6.5)	1.8 (0–6.5)
Region:				
Northeast	4 (0)	0	0	0
North Central	15 (13)	0	1.3 (0–3.1)	1.3 (0–3.1)
South	18 (17)	1.8 (0–5.5)	2.9 (0–8.5)	4.7 (0–11.2)
West	5 (40)	0	55 (0–198.3)	54.7 (0–198.3)
Unknown	3 (0)	0	0	0

Individuals with an inpatient or outpatient claim for testicular cancer and for whom absence data were collected, work loss based on reported absences contiguous to the admission or discharge dates of each hospitalization, or the date of the outpatient visit, and inpatient and outpatient including absences that started or stopped the day before or after a visit (source: Marketscan Health and Productivity Management, 1999).

ues to increase, the rate of increase is slowing. The reasons for this are unknown, although there is speculation that an increase in environmental endocrine disruptions may have a role.[8] No formal testis cancer prevention programs exist, so that there is no obvious explanation for this decrease. It is possible that the decrease is the indirect result of changes in behavior that influence risk factors, most specifically programs directed at preventing trauma and at awareness of the hazards of maternal hormone exposure, although to our knowledge this has never been definitively studied. Moreover, testis cancer is being diagnosed at an earlier age. This shift may reflect improved physician education, a greater emphasis on making young and adolescent boys more aware of their health issues and the dissemination of self-examination programs. However, the lack of stage migration at diagnosis casts doubt on the success of self-examination programs.

It has long been known that there is a disparity in the incidence and prevalence of testis cancer between white and black men in the United States. It is unclear whether this represents a sampling bias or a true biological and genetic difference. When changes in the incidence of testicular germ cell tumors in white and black men are stratified by histological subtypes, seminoma and nonseminoma have distinguishable incidence patterns in white and black racial groups.[5] The divergent trends in the incidence of seminoma and NSGCT may be the result of changes in underlying risk factors and etiological causes, alterations in biology, refinements in histological evaluation or changes in diagnostic practices, including coding practices.

White males have a higher lifetime risk of dying from testis cancer than black males (0.02% vs 0.01%). From 1992 to 2001 the annual mortality rate for white men decreased by 1.3%. While the annual mortality rate for black men was lower than that for white men, it increased by 2.3% between 1992 and 2001. No clear explanation for this divergence was apparent. It seems unlikely that the biology of testis cancer in black men has changed to make it more deadly. However, it is plausible that changes in epigenetic factors, such as diet or environmental exposure, could be worsening the prognosis. It is also possible that access to medical care or the treatment provided to black men deteriorated during the decade under study. In fact, 5-year relative survival rates for black men decreased between 1992 and 1994.

Biggs and Schwartz evaluated the relationship between survival and ethnicity in their examination of 16,086 cases from the SEER database between 1973 and 1999.[6] After multivariate analysis was performed to control for stage, histology and period of diagnosis black, Native American, Filipino and Hawaiian men were found to be at 2 to 3.5-fold greater risk for dying than nonHispanic white men. The risk of dying was 40% higher for

TABLE 15. *Annual work loss of males treated for testicular cancer*

	No. Workers (% missing work)	Av Hrs Work Absence (range)		
		Inpt	Outpt	Totals
Totals	45 (16)	0.7 (0–2.1)	7.7 (0–19.5)	8.4 (0–20.3)
Age:				
18–29	5 (0)	0	0	0
30–39	16 (19)	2 (0–6.3)	0.8 (0–1.9)	2.8 (0–7.1)
40–49	18 (17)	0	18 (0–48.6)	17.9 (0–48.6)
50–64	6 (17)	0	1.8 (0–6.5)	1.8 (0–6.5)
Region:				
Northeast	4 (0)	0	0	0
North Central	15 (13)	0	1.3 (0–3.1)	1.3 (0–3.1)
South	18 (17)	1.8 (0–5.5)	2.9 (0–8.5)	4.7 (0–11.2)
West	5 (40)	0	55 (0–198.3)	54.7 (0–198.3)
Unknown	3 (0)	0	0	0

Individuals with an inpatient or outpatient claim for testicular cancer and for whom absence data were collected, work loss based on reported absences contiguous to the admission or discharge dates of each hospitalization, or the date of the outpatient visit, and inpatient and outpatient including absences that started or stopped the day before or after a visit (source: Marketscan Health and Productivity Management, 1999).

Hispanic than for nonHispanic men. The investigators postulated that the observed disparities may reflect biological differences in the tumor, patient comorbidities or differences for which race is a proxy, including social, economic and health insurance status, treatment options and uptake, health care access and use, and environment, cultural and lifestyle factors.

Survival rates are best for patients who present with localized disease. From 1985 to 1991 the proportion of tumors presenting as stage I remained relatively stable, while the percent of stage II and III tumors decreased and stage IV tumors increased. This is an unexpected finding. With increased physician and patient education and awareness as well as self-examination programs one would expect stage migration, that is an increasing percent of localized tumors (stage I) coupled with decreasing rates of disseminated disease (stages II–IV). Several factors may explain these findings. Almost half of the patients in the NCDB had an unknown stage and this rate decreased to 12.2% by 1995 to 1996. In addition, considerable changes in staging practices occurred during the 11 years of data acquisition. However, when NCDB data were further divided into early and advanced disease, there still appeared to be little change in stage distribution with time. These data confirm that more seminomas than NSGCTs are discovered earlier in the disease course. Interestingly in the SEER analysis men of Asian ancestry (China, Japan and the Philippines) had the highest incidence of localized disease, whereas Hawaiian men, who share some genetic heritage with this population, had the lowest incidence. This may reflect access to health care on the Hawaiian Islands as well as dietary and other environmental factors.

Men with seminomas have better survival rates than those with NSGCT. Although this may represent a difference in tumor biology and behavior between the 2 types of testis cancer, it may also result from the finding that men with seminoma generally present at an earlier stage.

Overall hospitalization rates for men with testis cancer decreased. This may reflect changes in treatment paradigms, including 1) improved surgical technique, 2) trends among surgeons to shorten postoperative hospital stay, 3) outpatient orchiectomy, 4) decreases in the number of chemotherapy cycles as primary treatment and the forgoing of some as adjuvant to retroperitoneal LND, 5) greater reliance on outpatient chemotherapy, 6) improved treatment and support of patients receiving chemotherapy and 7) increasing use of surveillance as a primary modality of treatment. Certain aspects of therapy are not covered in the available databases, such as the use of laparoscopy and changes in the dosing of chemotherapeutic agents. These are expected to have a profound effect in the next decade.

In white men, who are the majority of patients with testis cancer, care has clearly shifted to the outpatient setting. However, for black men the rates of hospitalization have not decreased as significantly and the rates of physician office visits also decreased steadily from 1992 to 2001 with an overall 50% ultimate decrease. A similar trend was seen in Hispanic men. This may reflect disparities in access to outpatient health care. Alternatively the high rates of hospitalization and low rates of outpatient visits by nonwhite men with testis cancer may reflect an unwillingness of physicians to use surveillance or outpatient chemotherapy for minority populations because of concerns about compliance or other factors. In addition, it is possible that nonwhite men are more comfortable receiving more aggressive, definitive and/or inpatient care, and they elect against outpatient treatment. Lastly, perhaps nonwhite men are presenting with more aggressive tumors that require greater amounts of in-hospital care and are associated with worse survival outcomes. Whatever the reason, this disparity requires further study.

White men experienced a 78% decrease in outpatient hospital visits. A decrease would be expected for men on surveillance and outpatient chemotherapy because these treatments are commonly performed in physician offices. Our data confirmed that inpatient chemotherapy is decreasing. From 1994 to 2000 the rate of inpatient chemotherapy infusions decreased by 33%.

Although inpatient hospitalization decreased, there was an increase in outpatient hospital visits by black men. Such an increase in hospital outpatient visits would also be expected if there was an increase in the number of men receiving radiotherapy. Hence, when data on outpatient hospital visits were combined with the inpatient hospital and physician office visit data presented, one could postulate that white patients with testis cancer are receiving increasing surveillance and in-office chemotherapy treatments, whereas nonwhite men are receiving less surveillance and more primary therapy, including radiation and procedures that require hospitalization, such as surgery and high dose chemotherapy.

Economic trends echoed the shifts from inpatient to outpatient care. While the total cost of treating testis cancer increased 10% between 1994 and 2000, inpatient costs decreased. Moreover, with more men being treated with surveillance and outpatient care the impact of testis cancer on the workplace seems limited.

CONCLUSIONS

The incidence of testis cancer in the United States continues to increase. However, the rate of increase is slowing. Fortunately testis tumors are exceedingly curable and their successful treatment represents a medical triumph and underscores the strength of multimodality therapy. Modifications in surgical technique and radiotherapy as well as improved methods of systemic chemotherapy have substantially decreased the morbidity of therapy. However, because of these successes, the treatment paradigms for testis cancer are changing. More patients are being treated with surveillance for early stage disease and care in general has shifted to the outpatient setting. With these changes there has been minimal standardization in treatment approaches. This as well as the relative rarity of testis cancer and subsequent limited database information makes evaluation for a project such as Urological Diseases in America difficult. There is a need to collect more comprehensive, detailed information, so that the burden of testis cancer on patients and the economy can be better evaluated.

Abbreviations and Acronyms

AJCC	=	American Joint Committee on Cancer
CPS	=	Current Population Survey
DCCPS	=	Division of Cancer Control and Population Sciences
HCUP	=	Healthcare Cost and Utilization Project
LND	=	lymphadenectomy
NCDB	=	National Cancer Data Base
NOS	=	not otherwise specified
NSGCT	=	nonseminomatous germ cell tumor
SEER	=	Surveillance, Epidemiology and End Results

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