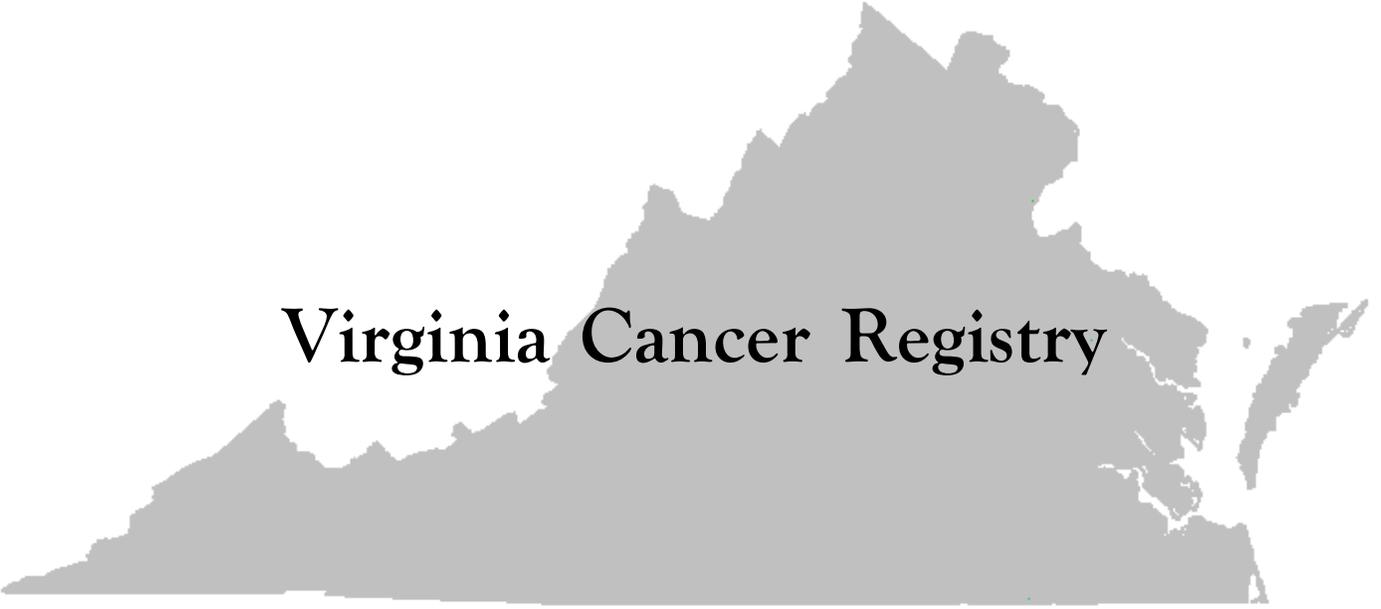


Prostate Cancer in Virginia 1970-1997



Virginia Cancer Registry

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Prostate Cancer in Virginia 1970-1997

**Virginia Department of Health
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June 2000

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Acknowledgments

The Virginia Cancer Registry wishes to thank the staff of the hospital cancer registries, pathology laboratories and medical care facilities throughout Virginia who provided the cancer incidence data for this report. The production of this report would not have been possible without their efforts to ensure the quality and completeness of the incidence data.

This report was made possible by a grant from the Centers for Disease Control and Prevention's National Program of Cancer Registries.

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Foreword

Prostate cancer is the most common cancer in men and the second most common cause of cancer deaths among men in the United States. Black men are disproportionately stricken with this cancer, which may contribute to premature death. This summary by the Virginia Cancer Registry contains the Commonwealth of Virginia's experience with this serious public health problem from 1970 to 1997. This time interval coincidentally marked the beginning of extensive use of prostate specific antigen (PSA) nationally in screening men for prostate cancer.

The following comprehensive report includes counts and incidence rates among the health regions as well as in the black and white populations in the Commonwealth. In addition to confirming the national trend of increased incidence among black men, the report contains recommendations for future research into the socioeconomic, cultural, biological and environmental basis of these disparities.

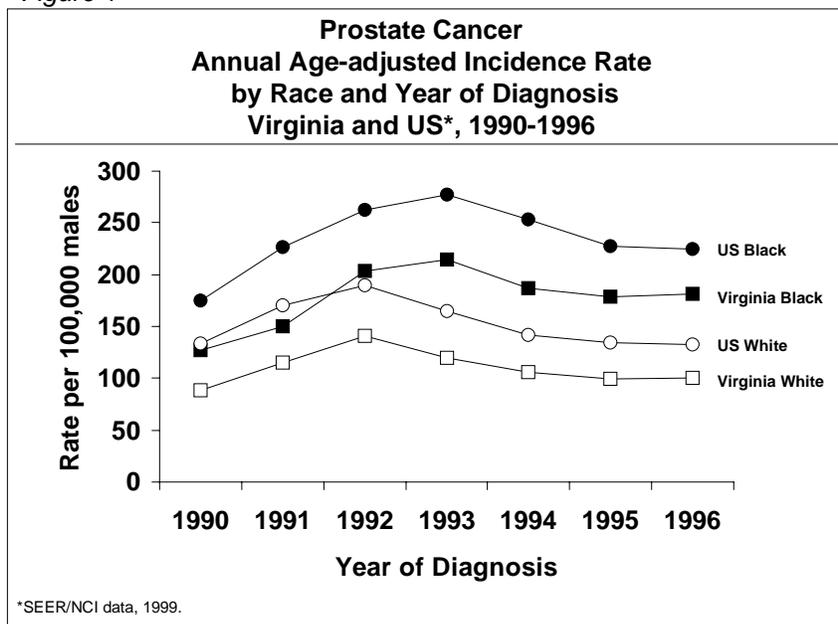
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Introduction

Prostate cancer, primarily a disease of older men, is the fourth most commonly diagnosed malignancy in men worldwide.¹ The incidence and mortality rates for this serious public health problem vary according to populations and are possibly dependent on biological, cultural and environmental influences or other factors. In the United States, prostate cancer is the most frequently diagnosed cancer in men (excluding basal and squamous cell skin cancers), accounting for 28% of all cancer cases.² Prostate cancer is the second leading cause of cancer death in U.S. men (after lung cancer), representing about 13% of male cancer deaths.² Although mortality rates for prostate cancer declined during the period 1991–1995 (at a rate of -1.6% per year), it is estimated that 180,400 new cases will be diagnosed in the U.S. and that 31,900 American men will die from this disease in the year 2000.²

In recent years the reported incidence of prostate cancer has shown a notable pattern. Following a lengthy but gradual increase since the early 1970s, incidence rates for prostate cancer in the United States rose dramatically from 1989 to 1992. Since that time, however, rates have begun to decline. Many cancer researchers agree that the rapid implementation of prostate-specific antigen (PSA) testing beginning in 1989 led to the diagnosis of a large number of preclinical prostate cancers in men not yet symptomatic.³ While this describes the recent spike as an artifact of increased screening efforts, the overall increasing trend in prostate incidence continues to place a heavy burden on the American population.

Figure 1



A disparity between black and white American men in the incidence and mortality rates of prostate cancer has been documented for more than 20 years. The current incidence rate in black men was significantly higher than that for white men, while the mortality rate from prostate cancer was more than twice as high as for white men.⁴ In fact, recent mortality rates due to prostate cancer for U.S. black men have been among the highest prostate cancer mortality rates in the world.¹

Figure 1 shows that recent Virginia incidence trends mirror these national patterns in racial disparity. Because of this racial difference, this report specifically examines issues related to the impact of race upon prostate cancer occurrence.

In addition to racial disparities, this report of the Virginia Cancer Registry (VCR) examines the overall occurrence of prostate cancer in Virginia residents between 1970 and 1997 and relates trends in detection and treatment to nationwide patterns. The discussion of these data includes diagnosis, treatment and prevention. These analyses will serve three main purposes: (1) to document prostate cancer incidence in the Commonwealth of Virginia; (2) to facilitate the assessment by hospitals and communities of their own cancer prevention and treatment efforts; and (3) to highlight areas for improved prevention and control efforts. The report concludes with recommendations for future research by Unyime O. Nseyo, M.D., Professor and Chairman of the Division of Urology in the Department of Surgery at Virginia Commonwealth University's Medical College of Virginia.

Methods

The Virginia Cancer Registry has collected demographic and clinical data on cancer patients diagnosed or treated in Virginia since 1970. The VCR became a population-based registry in 1990 when reporting of newly-diagnosed cancer cases was made mandatory for hospitals, clinics and laboratories.⁵ In order to improve the completeness of case reporting to the VCR, in 1998 the Virginia legislature amended the cancer registry law to require reporting by physician offices in certain instances. Also, data on cancer in Virginia residents diagnosed or treated in the neighboring states of West Virginia, Kentucky, North Carolina, Maryland and in the District of Columbia are collected from the central registries of those jurisdictions.

Virginia residents selected for study were diagnosed with a tumor of ICD-O-26 typography code C61.9, excluding histology codes 9590-9989. While all eligible cases diagnosed between 1970 and 1997 are included in general tables, only population-based data reported for cases diagnosed between 1990 and 1996 are used for comparison purposes. Only invasive cancers are included in the calculation of rates. These statistics provide a more complete assessment of cancer incidence in Virginia, and thus are more appropriate for national comparison.

The most recent data from the National Cancer Institute's SEER database⁷ and the American College of Surgeons' National Cancer Data Base (NCDB)⁸ are included for comparison purposes where appropriate. Data from the SEER program are used to represent national incidence figures. Data from SEER cover the years 1990 to 1996, while data from NCDB were available only for 1995. Data were analyzed using Rocky Mountain Cancer Data System programs⁹, and SEERPrep¹⁰ and SEERStat¹¹ cancer data analysis software. Comparisons between incidence rates for white and black males were performed. These tests for statistically significant differences were calculated on rate ratios at a 95% confidence level.¹² Appendix A contains technical notes and information on population estimates, calculation of rates, estimates of completeness, and definitions of terms used.

Results

From 1990 to 1997, a total of 28,244 Virginia males were diagnosed with prostate cancer, for an average of 3,530 new cases each year. These cases accounted for an average of 14% of all new cancer cases during these years, with a peak number of cases (4,372 cases) occurring in 1992. Incidence then decreased and remained fairly constant after 1994 (See Appendix C, Table C-1). The average annual age-adjusted incidence rate for prostate cancer for 1990-1996 was lower than the SEER rate for the same time period (125.4 to 154.7 cases per 100,000 males, respectively).

Demographics

Table 1 demonstrates that statewide, the disparity in incidence rates between blacks and whites was greater in Virginia than in the nation as a whole. The rate of prostate cancer was 62% higher in the black population than in the white population between 1990 and 1996. National data show that the rate for blacks was 52% higher than that for whites during this same time period.

Table 1

Distribution of Prostate Cancer Average Annual Age-adjusted Incidence Rate by Race Virginia and SEER, 1990-1996						
	White		Black		All Races	
	Count	Rate	Count	Rate	Count	Rate
Virginia	18,033	109.5	5,454	177.6 ^a	24,900	125.4
SEER	103,744	150.2	13,212	228.0 ^a	125,924	154.7

Note. Virginia 'All Races' includes 165 men of other races and 1,248 of unknown race. SEER 'All Races' includes 5,598 men of other races and 3,370 of unknown race.

^a Rate for blacks differs significantly from rate for whites at $p < .05$ level.

Figure 2

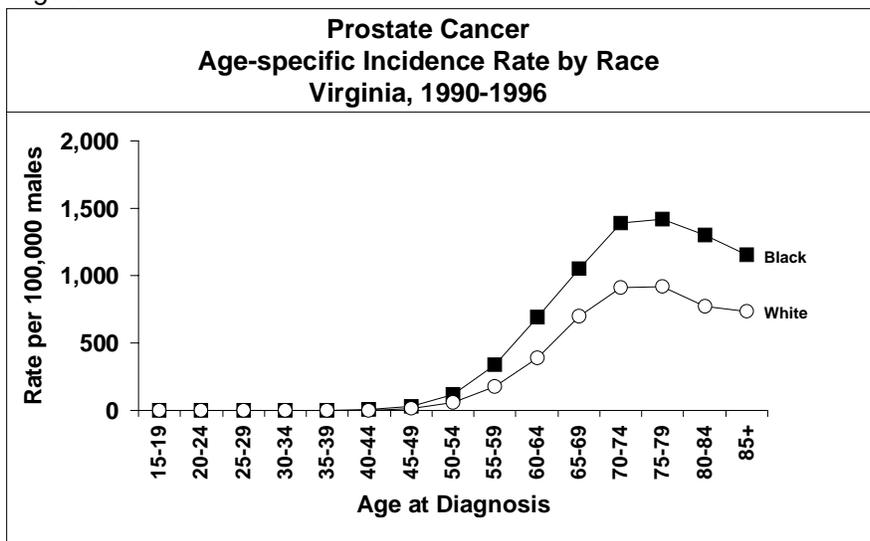


Figure 2 presents the incidence rates by age group and race. This graph is consistent with the previous trends, in that rates were higher for blacks than for whites across the age groups from 1990-1996.

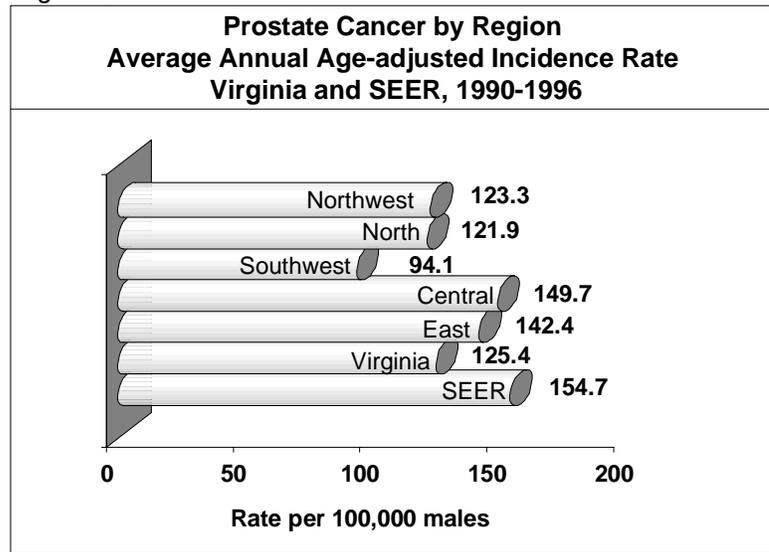
A distribution of race by age for prostate cancer cases can be found in Appendix C, Table C-2. This table reveals that black and white cases are similarly distributed across

the age groups. About 38% of both black and white cases fall between the ages of 60 to 69 years old, 39% of white cases and 37% of black cases are 70 to 79 years old. In a pattern that follows the national trend, from 1970-1997, 99% of cancer of the prostate in Virginia was diagnosed in males 50 years of age and older (See Appendix C, Table C-3).

Geographic Distribution

The localities in Virginia are combined into five health regions (See Appendix B). Figure 3 indicates that rates for the Central and East region were higher than the state rate, but no region in Virginia had a higher rate than the SEER rate. The Southwest region rate was much lower than the overall Virginia rate, due to the underreporting of cases in the area. Detailed regional annual rate comparisons and health district comparisons are provided in Appendix C, Tables C-4 and C-5.

Figure 3



Histology

In Virginia, the distribution of prostate cancer cell types indicated that 96% of reported prostate cancers were histologically classified as adenocarcinoma not otherwise specified (NOS), 0.2% were classified as acinar cell carcinoma NOS, and 3% were classified as carcinoma NOS (See Appendix C, Table C-6). These results were similar to the NCDB comparison data.

Staging

Two distinct types of staging information are reported to the VCR for prostate cases: SEER Summary Stage (in situ, local, regional, and distant) and AJCC Stage Grouping (Stages 0-IV). Appendix A contains an explanation of these staging guidelines. Because the stage categories have not changed since 1977, SEER staging is generally more appropriate to use when assessing stage trends over time. However, the more detailed AJCC stage data are utilized in patient care and treatment decisions and are used more frequently in Virginia hospital and clinical studies. For this reason, detailed analyses of 1990-1997 Virginia data are limited to cases staged using AJCC Stage Groupings. Table 2 indicates that among the prostate cancer cases diagnosed between 1990 and 1997, SEER stage data were missing in 16.0% of the cases and AJCC stage data were missing in 31.9% of cases.

Overall, 72.4% of Virginia prostate cancer cases were detected in an early stage (Stages 0, I, or II). This is slightly lower than the results reported by the NCDB (76.7%) for early stage cases. Conversely, Virginia shows a slightly higher percentage (27.5%) of prostate cancer diagnosed in Stages III and IV than reported by the NCDB (23.3%). Virginia data indicate that Stage II diagnoses increased from 1990 (27.7%) to 1997 (55.7%). There is also evidence that decreasing percentages of men are being diagnosed at the most advanced stages, from 22.9% in 1990 to 8.2% in 1997 (See Appendix C, Table C-7).

Table 2

Distribution of Prostate Cancer Number and Percentage of Cases by Stage at Diagnosis AJCC and SEER Staging Conventions									
AJCC Stage	Virginia 1990-1997		NCDB 1995		SEER Summary Stage	Virginia 1990-1997		SEER 1990-1996	
	Count	%	Count	%		Count	%	Count	%
Stage 0	634	3.3	1,337	2.1	In situ	76	0.3	168	0.2
Stage I	4,350	22.6	16,142	24.8	Local	17,699	74.6	78,972	72.4
Stage II	8,944	46.5	32,391	49.8	Regional	3,791	16.0	20,527	18.8
Stage III	2,759	14.3	8,484	13.0	Distant	2,157	9.1	9,402	8.6
Stage IV	2,544	13.2	6,701	10.3					
Total	19,231	100.0	65,055	100.0	Total	23,723	100.0	109,069	100.0
<p><u>Note.</u> Virginia data exclude 9,013 cases (31.9% of all prostate cancer) that are unstaged or missing stage data. In reported NCDB data, 6,825 cases (9.5% of all prostate cancer) are unstaged or missing stage data.</p>					<p><u>Note.</u> Virginia data exclude 4,521 cases (16.0% of all prostate cancer) that are unstaged or missing stage data. In reported SEER data, 17,023 cases (13.5% of all prostate cancer) are unstaged or missing stage data.</p>				

Looking at demographic variables, Table 3 reveals that the stage of a recently diagnosed tumor varied by race: 33.7% of black males were diagnosed in Stages III and IV compared to 25.8% of white males. The distribution for earlier stages, I and II, shows an opposite difference between the races, with 70.7% of white males and 63.6% of black males diagnosed with a tumor in Stages I and II.

Among men in each age group from 40–89 years of age, the most common stage at diagnosis was Stage II, although the percentages for Stage II decreased steadily with each advancing age group. However, nearly four out of every ten men 90 years of age and older were not diagnosed until Stage IV (See Appendix C, Table C-7). Around the state, the North region had the greatest percentage of cases diagnosed in the early stages, while men in the Southwest and Northwest regions were more often diagnosed with late stage prostate cancer.

Table 3

Distribution of Prostate Cancer, Virginia, 1990-1997 Number and Percentage of Cases by AJCC Stage at Diagnosis and Race						
AJCC Stage	White		Black		All Races	
	Count	%	Count	%	Count	%
Stage 0	512	3.5	117	2.7	634	3.3
Stage I	3,364	22.9	916	21.6	4,350	22.6
Stage II	7,029	47.8	1,792	42.0	8,944	46.5
Stage III	2,194	14.9	532	12.5	2,759	14.4
Stage IV	1,608	10.9	905	21.2	2,544	13.2
Total	14,707	100.0	4,262	100.0	19,231	100.0
<p><u>Note.</u> 'All races' includes 9,013 cases (31.9% of all prostate cancer) that were unstaged or missing stage data. There were 1,950 cases in black males (31.4%) and 5,813 cases in white males (28.4%) that were unstaged or missing stage data.</p>						

Grade

Table 4 illustrates the differences in grade of prostate cancer between whites and blacks. The grade of a tumor is determined by how abnormal the cancer cells appear when examined under a microscope, the probable growth rate of the tumor, and its tendency to spread.¹³ Among Virginia men, a higher percentage of patients were diagnosed with Grade II prostate cancer (46.1%) than any other grade. Grade IV (the most severe grade recorded) had the lowest percentage, with only 0.7%.

Table 4

Distribution of Prostate Cancer Number and Percentage of Cases by Grade and Race, Virginia, 1990-1996						
Grade	White		Black		All Races	
	Count	%	Count	%	Count	%
Grade I	3,682	20.4	973	17.8	4,968	19.9
Grade II	8,480	47.0	2,320	42.5	11,473	46.1
Grade III	3,171	17.6	1,240	22.7	4,643	18.6
Grade IV	112	0.6	42	0.8	166	0.7
Unknown	2,588	14.4	879	16.1	3,650	14.7
Total	18,033	100.0	5,454	100.0	24,900	100.0

Note. 'All races' includes 165 men of other races and 1,248 of unknown race.

Looking at the differences by race, the percentage of white males diagnosed with Grades I and II cancers (67.4%) was higher than that of black males (60.3%). However, a greater percentage of black males were diagnosed with more aggressive Grade III and Grade IV tumors than whites (23.5% vs. 18.2%, respectively).

The Virginia Cancer Registry does not receive complete reports for clinically important Gleason scores, which are based on the degree of differentiation of cancer cells found in prostate gland tissue at the time of biopsy. Gleason scores range from 2 to 10, with low scores (2-4) indicating the most favorable prognosis. Men can have a good outcome with moderate scores (5-7), which are the most common scores found at diagnosis. High Gleason scores (8-10) indicate a poor prognosis and are generally thought to carry the greatest risk of metastasis.¹³

Treatment

Table 5 indicates that the most common treatment modalities in Virginia were surgery only (34.1%) and radiation only (19.7%). Almost 54% of all prostate cancers were treated exclusively with one of these two forms of therapy. The frequency of both of these modalities in Virginia was very similar to results of NCDB. This pattern holds true for almost every stage of diagnosis. The most common treatment for Stages 0, I, II, III and Total Staged prostate cancers was surgery only, followed by radiation only (see Appendix C, Table C-8). The most advanced tumors were chiefly treated with hormone therapy.

Table 5

Distribution of Prostate Cancer Number and Percentage of Cases by First Course of Treatment Virginia, 1990-1997, and NCDB, 1995				
Treatment	Virginia 1990-1997		NCDB 1995	
	Count	%	Count	%
Surgery only	9,632	34.1	29,471	41.0
Surgery and Radiation	898	3.2	2,875	4.0
Surgery and Hormone	1,398	4.9	4,313	6.0
Radiation only	5,556	19.7	15,814	22.0
Radiation and Hormone	1,246	4.4	3,594	5.0
Hormone only	2,067	7.3	5,750	8.0
Other Treatment	475	1.7	1,438	2.0
No Reported Treatment	6,972	24.7	8,625	12.0
Total	28,244	100.0	71,880	100.0

Note. Data include in situ carcinomas. 'Other Treatment' includes chemotherapy, immunotherapy and other specified or unspecified cancer therapies.

It should be noted, however, that Virginia data showed twice the NCDB percentage of cases with no reported treatment (24.7% to 12%). This group might include a subset of patients who chose watchful waiting or observation, which is an acceptable form of treatment for prostate cancer. Nevertheless, the incomplete reporting of actual treatment procedures must be acknowledged when reviewing these data.

Treatment practices were mostly consistent for black and for white men, with a few exceptions. From Table 6, it can be seen that the percentage of white patients receiving surgery only (37.4%) was slightly higher than the percentage of black patients (28.5%) undergoing the same treatment. This tendency is similar for radiation only treatment, with 21.5% of white patients receiving this treatment versus 17.3% of black patients. However, the percentage of blacks with hormone only treatment (10.9%) is higher than the percentage of whites (6.6%). Additionally, the percentage of blacks with no reported treatment (26.3%) is greater than the percentage for whites (20.3%).

Table 6

Distribution of Prostate Cancer, Virginia, 1990-1997 Number and Percentage of Cases by First Course of Treatment and Race				
Treatment	White		Black	
	Count	%	Count	%
Surgery only	7,683	37.4	1,772	28.5
Surgery and Radiation	707	3.5	183	3.0
Surgery and Hormone	932	4.5	451	7.3
Radiation only	4,408	21.5	1,075	17.3
Radiation and Hormone	946	4.6	282	4.5
Hormone only	1,362	6.6	675	10.9
Other Treatment	328	1.6	139	2.2
No Reported Treatment	4,154	20.3	1,635	26.3
Total	20,520	100.0	6,212	100.0

Note. Data include in situ carcinomas. Data do not include 1,512 cases for other races. 'Other Treatment' includes chemotherapy, immunotherapy and other specified or unspecified cancer therapies.

Table 7 illustrates the frequencies of specific treatments for each age group. For patients through age 89, as age increases the percentage of patients receiving surgery only decreases. Conversely, the percentage of patients with no reported treatment increased from 18% in patients under 50 years old to 42% in the 80 to 89 year old patients. This increasing trend is also seen in the hormone

Table 7

Distribution of Prostate Cancer, Virginia, 1990-1997 Number and Percentage of Cases by First Course of Treatment and Age Group												
Treatment	Under 50		50 to 59		60 to 69		70 to 79		80 to 89		90 and older	
	Count	%	Count	%								
Surgery only	224	60.5	1,828	56.6	4,560	43.5	2,371	21.7	576	19.5	73	25.8
Surgery and Radiation	15	4.1	123	3.8	372	3.5	352	3.2	35	1.2	1	0.3
Surgery and Hormone	9	2.4	134	4.1	415	4.0	531	4.9	277	9.4	32	11.3
Radiation only	24	6.5	335	10.4	2,015	19.2	2,961	27.1	218	7.4	3	1.1
Radiation and Hormone	12	3.2	122	3.8	468	4.5	578	5.3	61	2.1	5	1.8
Hormone only	8	2.2	114	3.5	509	4.8	905	8.3	494	16.7	37	13.1
Other Treatment	11	3.0	61	1.9	180	1.7	173	1.6	49	1.7	1	0.3
No Reported Treatment	67	18.1	513	15.9	1,967	18.8	3,044	27.9	1,250	42.2	131	46.3
Total	370	100.0	3,230	100.0	10,486	100.0	10,915	100.0	2,960	100.0	283	100.0

Note. Data include in situ carcinomas. 'Other Treatment' includes chemotherapy, immunotherapy and other specified or unspecified cancer therapies.

only treatment group, with about 2% of the patients in the under 50 year old group having hormone treatment versus over 16% of the 80 to 89 year old patients. The breakdown for the other treatment groups appears to be more stable across the age groups.

Regionally, radiation only treatment was noticeably higher for the North and East regions, while hormone only was higher for the Northwest and Southwest regions. Since 1990, the percentage of patients receiving each treatment remained relatively constant for each year. The most substantial variation was found in the percentage of patients receiving radiation and hormone therapy, where the percentage increased over 11% from 1990 to 1997. These results are found in Appendix C, Table C-9.

Discussion and Summary

Overall incidence of prostate cancer in Virginia was lower than the national average. State rates follow the national trend over the years of 1990 to 1996 with the rates reaching their highest in 1992 and experiencing a decline since. Virginia follows the national pattern for the breakdown by age groups with males 70 and older diagnosed most frequently with the disease. Statewide, the average rate for black males during these seven years was 62% higher than that for white males, which is higher than national figures. However, Virginia rates across races were lower than the comparable national rates, most likely due to underreporting of Virginia cases.

Even though most prostate cancers in Virginia are detected in the early stages of development, the state did have a higher percentage of cases diagnosed in the late stages as compared to the NCDB and SEER results. From 1990 to 1997, the percentage of Virginian men diagnosed with tumors in the most advanced stage decreased. This trend suggests that increased awareness and education about prostate cancer have had a positive effect. Unfortunately, a greater percentage of black males were diagnosed with Stage IV prostate cancer than were white males. Late stage detection tended to increase for older patients as well; males over 80 years were diagnosed more frequently with late stage prostate cancer than younger males. Based on these results, programs aimed at education and early detection must be implemented and improved, especially for at-risk populations.

A greater percentage of males in Virginia were diagnosed with Grade II prostate cancer (46.1%) than any other grade. When broken down by race, black males were more likely to be diagnosed with Grade III or Grade IV cancers than white males (23.5% vs. 18.2%, respectively). This finding indicates that blacks may suffer from a more aggressive form of this cancer.

The treatments administered to Virginia males with prostate cancer conform to the standard treatment guidelines and the national comparison data. The most common forms of treatment in Virginia were surgery only and radiation only. Incomplete reporting of prostate cancer treatment may have affected these results. When looking at the high percentage of cases with no reported treatment, it is not clear what proportion consisted of patients on observation. It is important to note that a common and acceptable treatment for prostate cancer is watchful waiting or observation, especially for men 70 years or older. This 'treatment' option would fall in the no reported treatment category.

Recommendations for Prevention

Efforts to control specific cancers generally focus on primary prevention (risk reduction) and secondary prevention (early detection). Unfortunately, in the case of prostate cancer, preventable risk factors, particularly fat intake and diet, inactivity and smoking, remain controversial. Clinically proven strategies, which effectively prevent this disease, have not been determined. However, a promising vaccine to help strengthen the body's immune system against prostate cancer is in the developmental stages at the Johns Hopkins University Oncology Center.¹⁴ The drug finasteride is being studied as a preventive measure, as well.¹⁵ The etiology of prostate cancer is still unknown.¹⁵ Hypotheses about prostate cancer continue to be formulated and researched through biological and clinical studies.

There is evidence that cultural factors, including diet, play an important role in prostate cancer. Men in China and Japan have a very low prostate cancer mortality rate.¹⁵ However, rates for second- and third-generation Chinese Americans and Japanese Americans are the same as those for white Americans. Various dietary factors are being investigated, especially the roles of fat, fiber, and vitamin and mineral supplements in the etiology of prostate cancer. Lycopene, a carotenoid antioxidant found in tomatoes, has emerged as a possible factor in reducing prostate cancer risk.¹⁵ Studies have suggested that selenium and vitamin E may also decrease prostate cancer incidence.¹⁵ Diet has been evaluated in an attempt to account for the higher incidence and mortality rates found in black men. The diet of blacks tends to be higher in saturated fat than the diet of whites.¹⁶ Men of both races should limit the amount of saturated fat in their diets, as this appears to reduce their risk of prostate cancer.¹⁶ Dietary data are not included in the VCR database. Therefore, statistics for Virginia pertinent to diet and race cannot be included in this report.

Due to the lack of availability of primary prevention strategies, the focus is on secondary prevention, or diagnosing the cancer as early as possible. Early detection with the PSA test has revolutionized the diagnosis of prostate cancer, along with staging and follow-up of treated patients.¹⁷ PSA and the digital rectal examination (DRE) are currently the two most commonly used methods for detecting prostate cancer.¹⁸ Transrectal ultrasonography is a third testing procedure which can be used in combination with the other two.¹⁷ Screening for prostate cancer with PSA or a combination of the three tests has been proposed, but the value of widespread screening remains highly controversial.¹⁶⁻¹⁸ As yet, there is insufficient scientific evidence to determine if widespread screening reduces deaths or if early treatment of disease is more effective than delayed treatment in prolonging life.¹⁸ The medical profession is also divided on the issue of treating men 80 years of age and older. The U.S. Preventive Services Task Force (USPSTF), supported by the Centers for Disease Control and Prevention (CDC), recommends against routine screening, opting for giving objective information about detection, and risks and benefits of treatment.¹⁸ The American Cancer Society (ACS) recommends providing PSA annually to men at age 50 or over who have at least a 10 year life expectancy and who choose to have this testing.² Further, the ACS recommends that screening begin earlier for those in higher-risk groups, such as black men or men with two or more first-degree affected relatives (father or brother).² PSA values are not currently reported to the VCR, and thus cannot be included in this report.

Socioeconomic influences can be impediments to diagnosis and treatment of prostate cancer. Various studies have shown that, especially among the less affluent, costs, lack of knowledge about risk factors such as race and family history, concerns about discomfort or embarrassment or fear of an abnormal test result may cause reluctance to present for examination.¹⁶ Some of these socioeconomic factors may disproportionately affect the black population. It has been shown that involving trusted black community organizations such as the church, providing black physicians and staff (some female), and including women who are the daughters and wives of the target group in the educational component contribute to the success of an early detection program in high-risk black American men.¹⁹ It is the responsibility of clinicians and the medical profession to encourage education and screening programs which are culturally sensitive for use in minority communities.

Recommendations for Future Research

Prostate cancer remains a challenge for researchers, the answers to many questions being desperately needed. Among them are: What are the causes? Why is there such disparity between blacks and whites in the incidence of prostate cancer? What treatment is most appropriate for what stage? Why do some prostate cancers grow aggressively while others do not, and how can physicians distinguish between them? What can be done to prevent prostate cancer? Virginia's unique population distribution of urban, coastal and rural regions, including Appalachia, provides an attractive crucible to study the impact of biological, cultural, environmental and occupational factors on the incidence, choice of treatment and mortality of prostate cancer.

There are many examples of ongoing research on prostate cancer in the United States. The NCI SEER database contains the most complete data on prostate cancer in the world and has documented the changing patterns made in diagnosis in this country.¹⁵ As of 1998, NCI-supported prostate cancer research included the following areas: various informational databases; basic science research; and studies of epidemiological patterns, genetic causes, early detection, chemoprevention, patterns of care and cost, and impact of treatment on health-related quality of life.¹⁵ These studies could be used as models for similar research in Virginia.

Improved surveillance of prostate cancer in Virginia could enhance future research using this database. Such improvements could include the reporting of additional data items to the VCR. Reporting Gleason scores of tumors at diagnosis would assist in the interpretation of treatment information. Also, reporting the patient's PSA test values would help in planning appropriate screening strategies. Complete and accurate recording of occupation would help in identifying risk factors for prostate cancer. The Virginia Cancer Registry is an extremely valuable resource for research and information. It is our hope that clinical and epidemiological investigators as well as decision-makers continue to utilize the VCR to help answer the many questions regarding prostate cancer.

Appendix A: Technical Notes and Definitions

Case Ascertainment

These data reflect a conservative account of cancer in Virginia. Residents sometimes travel out-of-state for diagnosis and treatment. While the Registry now maintains data exchange agreements with central registries in five of the six neighboring states (including the District of Columbia) to minimize the loss of reporting, not all states were collecting cancer reports during the early 1990s. Also, not all Virginia hospitals, outpatient facilities, and private pathology laboratories were reporting cases to the Registry during the 1990-1997 period. Further, some patients may have been missed by the routine case finding methods used in reporting facilities. These factors combine to lead to biases in the cases that are reported. Underreporting of cancer occurs to varying degrees in different areas of the state; for example, counts may be more accurate in urbanized areas simply because the case ascertainment is more complete. Similarly, case reporting may be more complete for certain racial groups, cancer sites, or diagnosis stages. Note that age-adjusted rates for the Southwest region especially are consistently low. This will be remedied when the Virginia Cancer Registry begins exchanging cases with the central registry of the neighboring state in that region.

Incidence Rates and Population Figures

A cancer incidence rate reflects the number of new cases diagnosed per 100,000 individuals in a given area over a defined time period. Cancer rates tend to vary substantially by age, with higher rates of most cancers noted in older populations. This report provides both age-specific and age-adjusted average annual incidence rates. Age-specific rates denote the incidence of cancer among persons within specific age categories (typically 0-4 years, 5-9 years, 10-14 years, etc., up to 85+ years). Age-adjusted rates are calculated by mapping age-specific rates onto a standard population to remove the effect of different age structures and to arrive at a single summary measure for comparison. All age-adjusted incidence rates in this report were calculated by the direct method, using the age distribution of the 1970 United States population as the standard. Annual race-, sex-, and age-specific county population estimates from the U.S. Census Bureau (1999 release) were summed to produce state and health district population-at-risk figures. Except where noted, all incidence rates are expressed per 100,000 males per year and exclude in situ carcinomas.

Race Grouping

The Virginia Cancer Registry collects specific information on race and ethnicity. Such detail is not readily available from all reporting sources, and many groups are undercounted or misclassified. Therefore, cancer incidence statistics may be incomplete for certain racial and ethnic groups, and may not accurately reflect the true cancer burden in these populations. Due to these limitations, race-specific rates in this report are calculated for Whites, Blacks, and all other races combined. According to the modified 1990 U.S. Census data of September 1999, 76.0% of Virginia's population was white, 20.1% black, and 3.9% was of another race, including Asian/Pacific Islander and Native American/Alaskan Native. Note that persons of Hispanic ethnicity may be included in any race category.

Staging

The progression of cancer is classified by categories or stages. Identifying the stage of cancer at diagnosis is essential in evaluating prognosis and choosing treatment. Two staging systems are commonly used to do this. The system advocated by the American College of Surgeons is the American Joint Committee on Cancer (AJCC) Tumor, Node and Metastasis (TNM) classification and stage grouping. This system incorporates “the identification of new prognostic factors which may influence choice of treatment.”²⁰ To reflect advances in the understanding of cancer, the AJCC system has undergone several revisions since its inception in 1978. The most recent revision for staging prostate cancer occurred in 1997 with the publication of the fifth edition of the AJCC Staging Manual. Alternatively, the system developed by the National Cancer Institute’s Surveillance, Epidemiology, and End Results (SEER) program has not undergone any revisions since its inception in 1977.²¹ This system focuses more on the extent of disease and is more general in its categorization of stage. The two staging systems are outlined in the following tables.

AJCC Stage Grouping Classification

Stage 0	Prostate cancer in situ, not an invasive lesion
Stage I	Clinically inapparent tumor (tumor cells found in less than 5% of resected tissue) with well differentiated grade (Gleason score no more than 4)
Stage II	EITHER clinically inapparent tumor (tumor cells found in less than 5% of resected tissue) with moderately differentiated grade (Gleason score between 5-6) OR tumor confined to the prostate with any grade or Gleason score
Stage III	Tumor extends through the prostate capsule with any grade or Gleason score
Stage IV	EITHER tumor invades adjacent anatomical sites other than seminal vesicles OR any tumor with metastasis in lymph node(s) OR any tumor with metastasis to distant anatomical site(s)

SEER Summary Staging Classification

In situ	Prostate cancer in situ, not an invasive lesion
Local	Tumor does not extend beyond prostatic capsule and/or prostatic urethra
Regional	Extension of tumor through prostatic capsule, and/ or to adjacent anatomical sites, and/or involvement of nearby lymph nodes
Distant	Metastasis to distant anatomical sites and/or distant lymph nodes

Appendix B: Health Regions

Virginia is made up of 95 counties and 40 independent cities, which are grouped into 35 Health Districts, or five Health Regions. The composition of the Health Regions and Health Districts is listed in the table below.

Health Region	Health District	Locality
NORTHWEST	Central Shenandoah	Counties of Augusta, Bath, Highland, Rockbridge, Rockingham; Cities of Buena Vista, Harrisonburg, Lexington, Staunton, Waynesboro
	Lord Fairfax	Counties of Clarke, Frederick, Page, Shenandoah, Warren; City of Winchester
	Rappahannock	Counties of Caroline, King George, Spotsylvania, Stafford; City of Fredericksburg
	Rappahannock/ Rapidan	Counties of Culpepper, Fauquier, Madison, Orange, Rappahannock
	Thomas Jefferson	Counties of Albemarle, Fluvanna, Louisa, Nelson; City of Charlottesville
NORTH	Alexandria	City of Alexandria
	Arlington	County of Arlington
	Fairfax	County of Fairfax; Cities of Fairfax, Falls Church
	Loudoun	County of Loudoun
	Prince William	County of Prince William; Cities of Manassas,* Manassas Park*
SOUTHWEST	Alleghany	Counties of Alleghany, Botetourt, Craig, Roanoke; Cities of Clifton Forge, Covington, Salem
	Central Virginia	Counties of Amherst, Appomattox, Bedford, Campbell; Cities of Bedford, Lynchburg
	Cumberland Plateau	Counties of Buchanan, Dickenson, Russell, Tazewell
	Lenowisco	Counties of Lee, Scott, Wise; City of Norton
	Mount Rogers	Counties of Bland, Carroll, Grayson, Smyth, Washington, Wythe; Cities of Bristol, Galax
	New River	Counties of Floyd, Giles, Montgomery, Pulaski; City of Radford
	Pittsylvania/Danville	County of Pittsylvania; City of Danville
	Roanoke	City of Roanoke
	West Piedmont	Counties of Franklin, Henry, Patrick; City of Martinsville
CENTRAL	Chesterfield	Counties of Chesterfield, Powhatan; City of Colonial Heights
	Crater	Counties of Dinwiddie, Greensville, Prince George, Surry, Sussex; Cities of Emporia, Hopewell, Petersburg
	Hanover	Counties of Charles City, Goochland, Hanover, New Kent
	Henrico	County of Henrico
	Piedmont	Counties of Amelia, Buckingham, Charlotte, Cumberland, Lunenburg, Nottoway, Prince Edward
	Richmond	City of Richmond
	Southside	Counties of Brunswick, Halifax, Mecklenberg; City of South Boston
EAST	Chesapeake	City of Chesapeake
	Eastern Shore	Counties of Accomack, Northampton
	Hampton	City of Hampton
	Norfolk	City of Norfolk
	Peninsula	Counties of James City, York; Cities of Newport News, Poquoson, Williamsburg
	Portsmouth	City of Portsmouth
	Three Rivers	Counties of Essex, Gloucester, King and Queen, King William, Lancaster, Mathews, Middlesex, Northumberland, Richmond, Westmoreland
	Virginia Beach	City of Virginia Beach
	Western Tidewater	Counties of Isle of Wight, Southampton; Cities of Franklin, Suffolk

*The cities of Manassas and Manassas Park are analyzed together with Prince William County.

Appendix C: Data Tables

Table C-1
Distribution of Prostate Cancer, Virginia, 1990-1997
Number of Cases and Percentage of Total Reported Cancer Cases
by Year of Diagnosis

Year	Count	%
1990	2,488	11.4
1991	3,410	14.3
1992	4,372	17.5
1993	4,037	15.9
1994	3,620	14.3
1995	3,532	13.5
1996	3,503	12.9
1997	3,282	12.4
1990-1997	28,244	14.0

Note. Data include in situ carcinomas.

Table C-2
Distribution of Prostate Cancer, Virginia, 1990-1997
Number and Percentage of Cases by Race and Age at Diagnosis

Age	White		Black		All races	
	Count	%	Count	%	Count	%
49 and younger	257	1.3	99	1.6	370	1.3
50-54	713	3.5	228	3.7	982	3.5
55-59	1,629	7.8	519	8.4	2,248	8.0
60-64	3,007	14.7	982	15.7	4,179	14.8
65-69	4,663	22.7	1,365	22.0	6,307	22.2
70-74	4,786	23.3	1,341	21.6	6,438	22.8
75-79	3,216	15.7	952	15.3	4,477	15.9
80 and older	2,249	11.0	726	11.7	3,243	11.5
All Ages	20,520	100.0	6,212	100.0	28,244	100.0

Note. Data include in situ carcinomas. "All races" include 217 males of a race other than white or black and 1,295 males of unknown race.

Table C-3
 Distribution of Prostate Cancer
 Number and Percentage of Cases by Age at Diagnosis, Virginia, 1970-1997
 Age-Specific Incidence Rate by Age Group, Virginia and SEER, 1990-1996

AGE	1970-1997		1990-1996	
	Count	%	Rate per	
			VA	SEER
49 and younger	501	1.1	1.5	1.9
50 to 54	1,301	2.9	70.4	91.8
55 to 59	3,253	7.3	206.9	243.9
60 to 64	6,310	14.2	446.7	527.3
65 to 69	9,610	21.7	782.0	915.6
70 to 74	9,988	22.5	1,023.9	1,256.1
75 to 79	7,226	16.3	1,068.5	1,338.0
80 to 84	3,840	8.7	926.3	1,293.2
85 and older	2,281	5.3	863.2	1,212.5
All Ages	44,310	100.0	125.4	154.7

Note. Count and percentage data for 1970-1997 include in situ carcinomas. Rates are average annual age-specific incidence rates and are based on invasive cases only.

Table C-4
 Distribution of Prostate Cancer, Virginia, 1990-1996
 Comparison of Regional Average Annual Incidence Rates to Virginia and SEER Rates

Region	1990-1996		1990	1991	1992	1993	1994	1995	1996
	Rate	Count	Rate						
Northwest	123.3	3,749	95.3	122.6	155.8	149.9	123.6	107.0	111.7
North	121.9	4,267	81.8	122.0	142.6	118.7	113.2	131.3	141.4
Southwest	94.1	4,701	79.6	96.7	110.8	105.2	93.9	93.3	80.7
Central	149.7	5,460	116.5	154.2	193.1	171.6	149.8	138.5	127.7
East	142.4	6,723	100.2	141.8	190.3	168.4	144.7	128.6	125.5
Virginia	125.4	24,900	94.2	126.2	157.3	142.2	124.5	119.0	116.3
SEER	154.7	125,924	132.5	169.2	190.8	171.1	148.4	139.2	135.7

Note. Rates are age-adjusted to the 1970 U.S. population, are per 100,000 males, and are based on invasive cases only.

Table C-5
 Distribution of Prostate Cancer, Virginia, 1990-1996
 Comparison of Regional and District Average Annual
 Age-adjusted Incidence Rates to Virginia and SEER Rates

HEALTH REGION	HEALTH DISTRICT	Count	Rate
Northwest		3,749	123.3
	Central Shenandoah	1,029	114.9
	Lord Fairfax	609	95.4
	Rappahanock	681	144.0
	Rappahanock/Rapidan	505	113.3
	Thomas Jefferson	925	157.8
North		4,267	121.9
	Alexandria	360	115.3
	Arlington	523	102.7
	Fairfax	2,684	126.6
	Loudoun	270	135.1
	Prince William	430	122.0
Southwest		4,701	94.1
	Alleghany	728	111.2
	Central Virginia	1,064	127.8
	Cumberland Plateau	200	46.4
	Lenowisco	85	22.9
	Mount Rogers	422	53.1
	New River	435	89.2
	Pittsylvania/Danville	539	114.8
	Roanoke City	512	127.6
	West Piedmont	716	129.2
Central		5,460	149.7
	Chesterfield	919	164.7
	Crater	789	156.5
	Hanover	478	138.8
	Henrico	1,102	146.3
	Piedmont	634	166.3
	Richmond City	1,071	148.8
	Southside	467	123.4
East		6,723	142.4
	Chesapeake	597	140.1
	Eastern Shore	236	102.2
	Hampton	700	178.4
	Norfolk	1,023	147.8
	Peninsula	1,148	143.7
	Portsmouth	673	178.2
	Three Rivers	782	129.1
	Virginia Beach	1,015	122.5
	Western Tidewater	549	146.1
Virginia		24,900	125.4
SEER		125,924	154.7

Note. Rates are age-adjusted to the 1970 U.S. population, are per 100,000 males, and are based on invasive cases only.

Table C-6
Distribution of Prostate Cancer
Virginia, 1970-1997, and NCDB, 1995
Number and Percentage of Cases by Histologic Type

HISTOLOGIC TYPE	Virginia 1970-1997		NCDB 1995
	Count	%	%
Adenocarcinoma, not otherwise specified (NOS)	42,511	96.0	96.1
Acinar cell carcinoma	74	0.2	1.7
Carcinoma, NOS	1,347	3.0	1.5
Transitional Cell Carcinoma, NOS	87	0.2	0.2
Other Specified Types	291	0.6	0.5
All Types	44,310	100.0	100.0

Note. Data include in situ carcinomas.

Table C-7
 Distribution of Prostate Cancer, Virginia, 1990-1997
 Number and Percentage of Cases by AJCC Stage Grouping,
 Selected Demographics, Health Region, and Year of Diagnosis

	Stage 0		Stage I		Stage II		Stage III		Stage IV		Total Staged
	Count	%	Count	%	Count	%	Count	%	Count	%	Count
RACE											
White	512	3.5	3,365	22.9	7,029	47.8	2,194	14.9	1,608	10.9	14,708
Black	117	2.7	916	21.5	1,792	42.0	532	12.5	905	21.2	4,262
AGE											
39 and younger	0	0.0	0	0.0	0	0.0	0	0.0	2	100.0	2
40 to 49	5	1.9	36	14.0	152	59.1	34	13.2	30	11.7	257
50 to 59	63	2.6	427	17.5	1,288	52.9	423	17.4	233	9.6	2,434
60 to 69	214	2.8	1,553	20.1	3,776	48.8	1,302	16.8	888	11.5	7,733
70 to 79	247	3.5	1,904	26.8	3,162	44.5	850	12.0	949	13.3	7,112
80 to 89	98	6.3	399	25.5	541	34.5	136	8.7	393	25.1	1,567
90 and older	7	5.6	31	24.6	25	19.8	14	11.1	49	38.9	126
REGION											
Northwest	89	3.0	628	20.9	1,361	45.3	487	16.2	442	14.7	3,007
North	110	3.0	869	23.4	1,892	50.9	497	13.4	348	9.4	3,716
Southwest	148	4.5	736	22.2	1,415	42.8	500	15.1	509	15.4	3,308
Central	108	2.6	878	21.3	1,979	47.9	563	13.6	603	14.6	4,131
East	179	3.5	1,239	24.4	2,297	45.3	712	14.0	642	12.7	5,069
YEAR OF DIAGNOSIS											
1990	101	7.7	350	26.6	365	27.7	200	15.2	302	22.9	1,318
1991	147	6.0	604	24.8	831	34.2	416	17.1	435	17.9	2,433
1992	152	4.7	730	22.7	1,375	42.7	536	16.7	425	13.2	3,218
1993	80	2.7	586	19.4	1,540	51.0	403	13.4	408	13.5	3,017
1994	50	1.9	606	22.9	1,368	51.8	312	11.8	306	11.6	2,642
1995	36	1.5	579	23.4	1,248	50.3	323	13.0	293	11.8	2,479
1996	31	1.5	421	20.8	1,050	51.8	322	15.9	203	10.0	2,027
1997	37	1.8	474	22.6	1,167	55.7	247	11.8	172	8.2	2,097
VIRGINIA	634	3.3	4,350	22.6	8,944	46.5	2,759	14.4	2,544	13.2	19,231

Note. Data include in situ carcinomas. There were 5,537 cases with missing values for AJCC stage and there were 3,476 cases that were unstaged. Percentages may not add to 100 due to rounding.

Table C-8
 Distribution of Prostate Cancer, Virginia, 1990-1997
 Number and Percentage of Cases by AJCC Stage Grouping and First Course of Treatment

	Stage 0		Stage I		Stage II		Stage III		Stage IV		Total Staged	
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
Surgery only	456	71.9	1,525	35.1	4,241	47.4	1,356	49.1	342	13.4	7,920	41.2
Surgery and Radiation	24	3.7	178	4.1	267	3.0	280	10.1	61	2.4	810	4.2
Surgery and Hormone	19	3.0	183	4.2	362	4.0	173	6.3	445	17.5	1,182	6.1
Radiation only	61	9.6	1,442	33.1	2,575	28.8	440	15.9	158	6.2	4,676	24.3
Radiation and Hormone	3	0.5	171	3.9	379	4.2	158	5.8	196	7.7	907	4.7
Hormone only	13	2.1	187	4.3	309	3.5	123	4.5	876	34.4	1,508	7.8
Other Treatment	1	0.2	47	1.1	108	1.2	90	3.3	149	5.9	395	2.1
No Reported Treatment	57	9.0	617	14.2	703	7.9	139	5.0	317	12.5	1,833	9.6
All Treatments	634	100.0	4,350	100.0	8,944	100.0	2,759	100.0	2,544	100.0	19,231	100.0

Note. Data include in situ carcinomas. There were 5,537 cases with missing values for AJCC stage and there were 3,476 cases that were unstaged. 'Other treatment' includes chemotherapy, immunotherapy, and other specified or unspecified cancer therapies.

Table C-9
Distribution of Prostate Cancer, Virginia, 1970-1997
Number and Percentage of Cases by First Course of Treatment, Selected Demographics, Health Region, and Year of Diagnosis

	Surgery only		Surgery and Radiation		Surgery and Hormone Therapy		Radiation only		Radiation and Hormone Therapy		Hormone only		Other Treatment		No Reop Treatment	
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
RACE																
White	10,747	33.1	1,491	4.6	1,856	5.7	6,490	20.0	1,346	4.1	3,345	10.3	677	2.1	6,538	
Black	2,598	25.3	377	3.7	879	8.6	1,518	14.8	434	4.2	1,622	15.8	273	2.7	2,555	
AGE																
39 and younger	5	27.8	1	5.6	0	0.0	1	5.6	0	0.0	0	0.0	7	38.9	4	
40 to 49	240	49.7	20	4.1	13	2.7	45	9.3	22	4.6	26	5.4	13	2.7	104	
50 to 59	2,132	46.8	228	5.0	177	3.9	641	14.1	185	4.1	287	6.3	108	2.4	796	
60 to 69	5,923	37.2	787	4.9	729	4.6	3,158	19.8	683	4.3	1,281	8.0	380	2.4	2,979	
70 to 79	3,871	22.5	762	4.4	1,130	6.6	3,893	22.6	772	4.5	2,170	12.6	352	2.0	4,264	
80 to 89	1,213	21.9	80	1.4	635	11.5	345	6.2	130	2.3	1,130	20.4	93	1.7	1,914	
90 and older	149	25.6	1	0.2	72	12.4	6	1.0	12	2.1	113	19.4	6	1.0	222	
REGION																
Northwest	2,169	30.2	292	4.1	415	5.8	1,217	16.9	306	4.3	997	13.9	122	1.7	1,666	
North	2,287	33.1	355	5.1	286	4.1	1,723	24.9	469	6.8	545	7.9	138	2.0	1,107	
Southwest	2,806	30.4	255	2.8	688	7.4	973	10.5	262	2.8	1,341	14.5	262	2.8	2,652	
Central	3,020	33.7	333	3.7	742	8.3	1,388	15.5	259	2.9	876	9.8	199	2.2	2,145	
East	3,251	27.1	644	5.4	625	5.2	2,788	23.2	508	4.2	1,248	10.4	238	2.0	2,713	
YEAR OF DIAGNOSIS																
1970-1974	4	0.3	1	0.1	2	0.2	77	6.5	46	3.9	603	50.9	24	1.9	430	
1975-1979	20	0.8	8	0.3	7	0.3	519	21.1	131	5.3	743	30.2	78	3.2	956	
1980-1984	1,068	20.9	354	6.9	478	9.4	817	16.0	190	3.7	858	16.8	188	3.7	1,154	
1985-1989	2,809	38.4	618	8.5	871	11.9	1,120	15.3	191	2.6	736	10.1	194	2.7	771	
1990	787	31.7	153	6.2	178	7.2	389	15.7	49	2.0	210	8.5	44	1.6	678	
1991	1,068	31.7	160	4.7	194	5.8	713	21.1	52	1.5	281	8.3	61	0.7	881	
1992	1,528	35.0	177	4.1	206	4.7	978	22.4	69	1.6	316	7.2	55	1.0	1,043	
1993	1,362	33.7	148	3.7	194	4.8	834	20.7	58	1.4	287	7.1	70	1.7	1,084	
1994	1,234	34.1	80	2.2	156	4.3	768	21.2	83	2.3	234	6.5	90	2.5	975	
1995	1,254	35.5	75	2.1	199	5.6	676	19.1	190	5.4	241	6.8	55	1.6	842	
1996	1,232	35.2	72	2.1	167	4.8	635	18.1	309	8.8	255	7.3	58	1.7	775	
1997	1,167	35.6	33	1.0	104	3.2	563	17.2	436	13.3	243	7.4	42	1.3	694	
VIRGINIA	13,533	30.5	1,879	4.2	2,756	6.2	8,089	18.3	1,804	4.1	5,007	11.3	959	2.2	10,283	

Note. Data include in situ carcinomas. Row percentages reflect the percentage of total cases receiving each treatment. Percentages may not sum to 100 due to rounding. 'Other treatment' includes chemotherapy, immunotherapy, and other specified or unspecified cancer therapies.

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