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PROSTATE CANCER SURVIVAL IN NORTH CAROLINA

Evaluating the Race-Specific Differences

by

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ABSTRACT

North Carolina has the nation's highest mortality (death) rate for prostate cancer among black males. While the incidence (new cases) rates for North Carolina males do not vary greatly by race, mortality rates clearly do. We have examined prostate cancer survival to determine the possible contributing factors.

Both age and urban/rural differences were found with survival, but these did not explain all of the variability between the races. Analyses of racial differences in stage-at-diagnosis (i.e., the extent to which cancer has spread at the time of initial recognition by a physician) showed that this was the most significant determinant of survival for prostate cancer among blacks in North Carolina. Blacks with prostate cancer are diagnosed at later stages than whites (25 percent distant stage among blacks versus 12 percent for whites). Clearly, for reducing mortality, the direction of preventive measures must be closing the gap in stage-at-diagnosis between the races. This improvement in stage-at-diagnosis may also represent a substantial annual health care cost savings.

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INTRODUCTION

In October 1992, the Cancer Committee of the North Carolina Medical Society established a prostate cancer task force. This group was charged with developing recommendations to increase the rate of early detection of prostate cancers in North Carolinians. To help accomplish this mission, the task force requested the North Carolina Central Cancer Registry (NC-CCR) to conduct a study of prostate cancer and the stage-at-diagnosis difference between the races in North Carolina. At the Spring 1993 meeting a preliminary report was presented to the membership. Based on that presentation, the NC-CCR was directed to extend its study to include an analysis of survival differences for prostate cancer. This is the report of that study.

BACKGROUND

American men have a 10 percent lifetime risk of developing clinically confirmed prostate cancer, making prostate cancer the most commonly diagnosed malignancy in U.S. males.[1] In 1993, an estimated 165,000 American men were diagnosed with prostate cancer, while the disease killed approximately 35,000.[2] Prostate cancer is the second leading cause of cancer-related death among men in the United States.[3]

For black men, prostate cancer poses even more of a threat. American blacks have the highest rate of prostate cancer in the world.[4,5] Furthermore, in some areas of the country, the mortality rate among blacks is more that twice that observed in whites.[6] North Carolina is one such area. When 5-year mortality data (1986-1990) are adjusted to the age composition of the total state population, the death rate for black males is almost two and a half times that for whites (57.0/100,000 versus 23.2/100,000).[7,8] North Carolina has the highest prostate cancer mortality rate among blacks in the nation.[7] In 1990, there were 320 prostate cancer deaths to blacks in North Carolina (who comprise 23 percent of the male population), compared to 643 deaths to whites.

Stage-at-diagnosis appears to be a key factor contributing to the mortality differences between races. Several reports including some from North Carolina indicate that blacks tend to have more advanced cancer at the time of diagnosis.[8,9,10,11,12] In 1990, about 25 percent of North Carolina blacks were diagnosed with distant disease compared with only 12 percent of whites.[8] Survival rates were substantially lower in men diagnosed with prostate cancer at distant versus localized stages.[13,14]

However, survival rates depend not only on stage-at-diagnosis, but also on treatment and responses to treatment. A handful of studies suggests that although stage-at-diagnosis is an important factor contributing to survival differences between blacks and whites, other factors that may influence survival include: 1) access to medical care and behavioral patterns that delay seeking treatment, 2) treatment preferences, 3) inherited tendency and 4) socioeconomic status.[11,14,15,16] A recent assessment has been completed on the attitudes and behavioral characteristics of men responding to prostate cancer screening programs in North Carolina.[17] These results describe considerable reluctance to have prostate cancer screening tests, as well as substantial misunderstanding about the disease process. Also, there is variation in these findings by racial group.[17]

The present report explores the discrepancy in prostate cancer-related survival between blacks and whites in North Carolina.

METHODS

This study analyzes survival patterns through 1992, of prostate cancer cases diagnosed in 1988. Because the NC-CCR does not actively follow cancer patients reported to it, survival information is obtained by matching the cancer incidence files with successive annual death files.[18] Since the NC-CCR population-based coverage began in 1990, for this special study of prostate cancer survival the NC-CCR worked with cooperating hospital-based

cancer registries that had collected cancer incidence data for calendar year 1988.[19,20] Eleven hospitals responded with data on 1,080 cases. These data were edited and entered into the computerized database of the NC-CCR. Survival patterns for four years were examined.

Survival analyses were performed using the SAS software programs PHREG and LIFETEST.[21] Non-resident cases were excluded from analysis, leaving 1,003 cases available for analysis. Subgroup survival analyses were performed by race groups (black versus white), urban/rural status (U.S. Census definitions or the presence of a state-of-the-art medical facility), age of patient, and stage at diagnosis. Also, comparisons of North Carolina prostate cancer survival were made to national prostate cancer survival patterns.[22,23]

Statistics for comparing the observed versus expected numbers of cases (chi-square) were used for interpreting the results throughout this study. The chi-square statistic can be quite sensitive for analyses involving large numbers of cases. This means that even small percentage differences between the observed and expected numbers can result in quite large values of chi-square. Owing to the large sample sizes of the national databases, the observed/expected calculations were always made with the North Carolina data in an attempt to lessen the possibility of artificial sensitivity to relatively small differences.

Finally, a comparison was made between the average charges for hospitalization between blacks and whites. The NC-CCR 1991 database was linked to the 1991 hospital discharge data from the North Carolina Medical Database Commission.

RESULTS

In the course of the survival analyses, it quickly became apparent that North Carolina prostate cancer data were different than the national databases that had been selected for comparison.[22,23] This finding led to a series of separate analyses to evaluate these differences. In this section, the survival outcomes are presented first, since they were the defining motivation for the study.

North Carolina Survival Patterns

Table 1 shows the chi-square statistics for each of the four variables being studied for their effect on survival. The statistical significance for each of these factors as single predictors of poorer survival is presented as well. The variation in survival for each of these single effects is presented in Figures 1-4. The risk ratios, for poorer survival, for each factor are shown in Table 1.

Table 1
Single Effects on Four-Year Relative Prostate Cancer Survival, North Carolina, 1988-92 (Risk Associated with Poorer Survival)

Variable	Chi-Square	p value < Chi-Square	Risk Ratio*
Age	2.02	0.155	
< 65			1.00
≥ 65			1.20
Race	5.77	0.016	
White			1.00
Black			1.23
Stage	92.09	0.0001	
Local			1.00
Regional			1.06
Distant			2.00
Urban/Rural	1.41	0.234	
Rural			1.00
Urban			1.14

*The referent group for each comparison is represented by 1.00.

Figure 1 shows that younger cases tended to have better survival than older people, although when age was treated as two groups (65 years or older versus younger), no statistically difference in survival was observed (chi-square 2.02, 1 df, p = 0.155). Race was a strong predictor of prostate cancer survival in this special study (chi-square 5.77, 1 df, p = 0.016)(Figure 2). Survival by race is comparable for the first two years, but diverges afterwards. As shown in Figure 3, there was a strong difference for survival of prostate cancer across the stages of diagnosis (chi-square 92.09, 1 df, p = 0.0001). People diagnosed at a distant stage were far more likely to die than those diagnosed at a local or regional stage. Survival varied little by urban versus rural residence (Figure 4)(chi-square 1.41, 1 df, p = 0.234).

FIGURE 1

Variation in Prostate Cancer Survival Trends Among Age Groups
North Carolina, 1988-1992

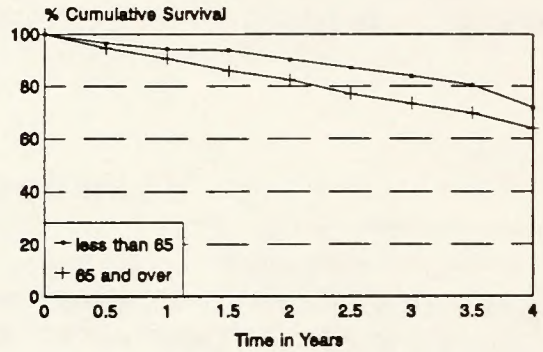


FIGURE 2

Variation in Prostate Cancer Survival Trends Among Race Groups
North Carolina, 1988-1992

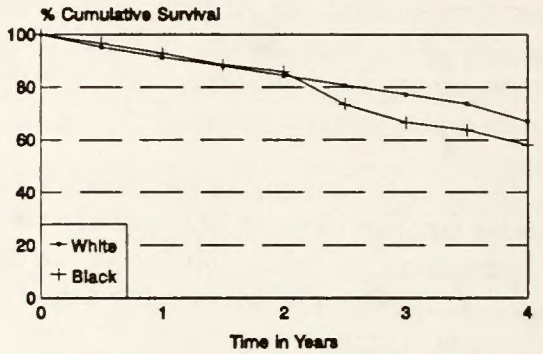


FIGURE 3

Prostate Cancer Survival Trends in Relation to State-at-Diagnosis
North Carolina, 1988-1992

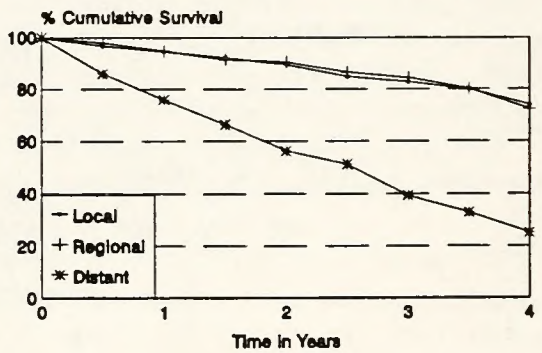
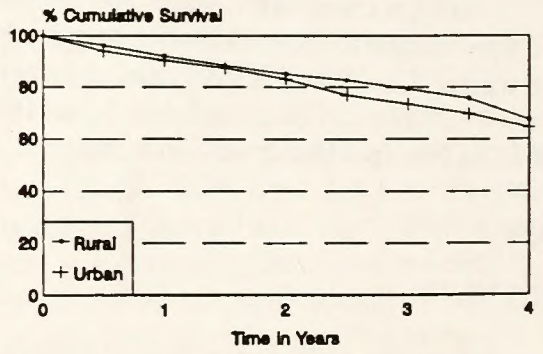


FIGURE 4

Variation in Prostate Cancer Survival Trends Between Urban and
Rural Residents, North Carolina, 1988-1992



In Table 2, these four factors in prostate cancer survival were evaluated in a multi-variable model. Age was entered as a dichotomous factor (65 years old and over versus under 65 years). The impact of race was reduced by this adjustment for effects from multiple variables. The effects of age and rural/urban status changed very little. Stage-at-diagnosis remained a significant predictor for survival for prostate cancer. The substantive racial difference in stage-at-diagnosis (Figure 5) has been reported previously.[7,8] Urban/rural and regional stage-at-diagnosis patterns are shown in Figures 6 and 7.

Table 2
Analyses for Effects of Multiple Variables, Four-Year Relative Prostate Cancer Survival, North Carolina, 1988-92

Variable	Chi-Square	p value > Chi-Square	Adjusted Risk Ratio
Age	1.57	0.2100	1.17
Race	2.13	0.1443	1.15
Stage	108.46	0.0001	1.25
Rural/Urban	1.11	0.2928	1.12

FIGURE 5
Prostate Cancer Stage by Race
North Carolina, 1990

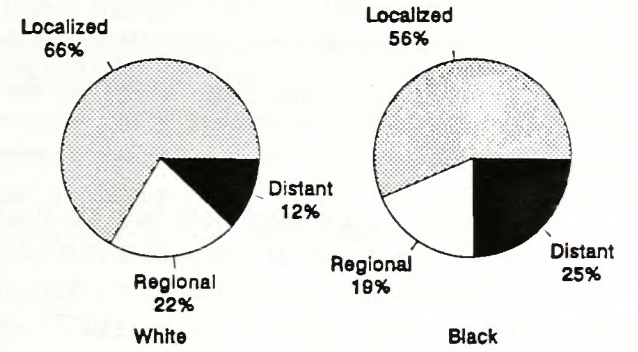


FIGURE 6
Prostate Cancer Stage by Urban/Rural
North Carolina, 1990

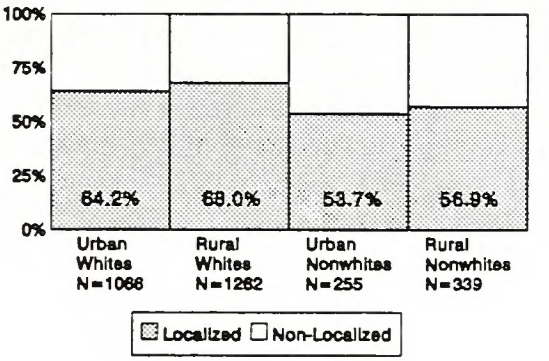
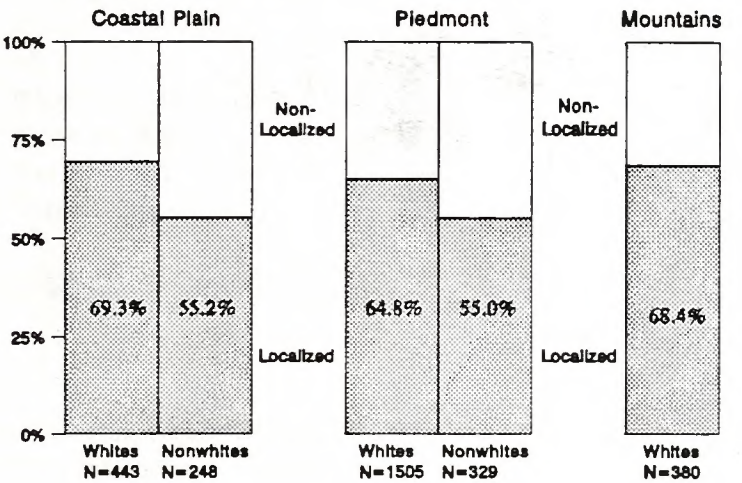


FIGURE 7
Prostate Cancer Stage by Geographic Regions
North Carolina, 1990



Comparison of North Carolina Survival Patterns to National Databases

A comparison of North Carolina prostate cancer survival with the American College of Surgeons (ACoS) is shown in Table 3.[22] Survival patterns are quite consistent through four years. For whites, the survival patterns are virtually identical between the ACoS and the NC-CCR. Among blacks however, North Carolina survival is slightly better for the first two years, then declines to poorer than the ACoS for the third and fourth years. This variability in survival between the first two years and the second two years for North Carolina black prostate cancer cases was also seen in Figure 2. The ACoS survival data by stage-at-diagnosis was available only from a published report,[22] and the categorization of stage was not exactly the same between ACoS and the NC-CCR data (Table 4). However, the results of this comparison are generally consistent (Table 4). Only a small difference is seen between the localized and regional stages. Survival for the distant stage category (ACoS stage IV) is somewhat poorer for the NC-CCR data.

Table 3
Comparisons of NC-CCR with ACoS Prostate Cancer Survival Patterns, by Race

ACoS[22] Race	Start	1st Year	2nd Year	3rd Year	4th Year
Black	100	91	79	71	61
White	100	92	84	76	68
NC-CCR Race	**Start**	**1st Year**	**2nd Year**	**3rd Year**	**4th Year**
Black	100	93	86	67	58
White	100	91	84	77	67

Table 4
Comparisons NC-CCR with ACoS Prostate Cancer Survival Patterns, By Stage-At-Diagnosis

ACoS[22] Stage*	Start	1st Year	2nd Year	3rd Year	4th Year
I	100	95	89	82	75
II	100	96	90	84	78
III	100	94	86	80	69
IV	100	81	63	51	40
NC-CCR Stage	**Start**	**1st Year**	**2nd Year**	**3rd Year**	**4th Year**
Local	100	95	90	83	74
Regional	100	95	91	84	72
Distant	100	76	56	39	25

*ACoS stage categories are not directly comparable to summary staging groups. However, stage I is quite similar to Local and Stage IV is comparable to Distant. Stages II and III are subdivisions of what might be considered Regional spread.

As a part of these comparisons with the available national data, the most compatible published data for the National Cancer Institute's Surveillance, Epidemiology and End Results (SEER) registries was for overall survival.[23] In Table 5, comparisons are made, by year, with the SEER survival for 1985-89 (their most recent available time period).[23] These results show relatively good agreement between the databases in terms of overall trends. Both the ACoS and NC-CCR overall survival data are consistently poorer than for SEER.

Table 5
Comparisons of SEER (1985-89) Prostate Cancer Survival Patterns With North Carolina (1988-1992) and American College of Surgeons (1988-1991)

Group	SEER[23]	NC-CCR	ACoS[22]
1-year	95.0	91.2	91.9
2-year	88.9	84.0	83.5
3-year	84.2	75.5	75.5
4-year	79.8	65.7	67.3

Comparison of Cost for Black Versus White Patients

The average amount billed at initial hospitalization in 1991 for white prostate cancer patients was $9,199. Compared to black prostate cancer patients (average amount billed $9,712), the difference is over $500. If this difference is related to stage-at-diagnosis, based on the number of cases for each race, over $350,000 per year could be saved annually in initial hospitalization costs by blacks experiencing the same stage-at-diagnosis pattern as whites. This shift in stage-at-diagnosis for blacks could also mean the saving of about 55 lives a year.

DISCUSSION

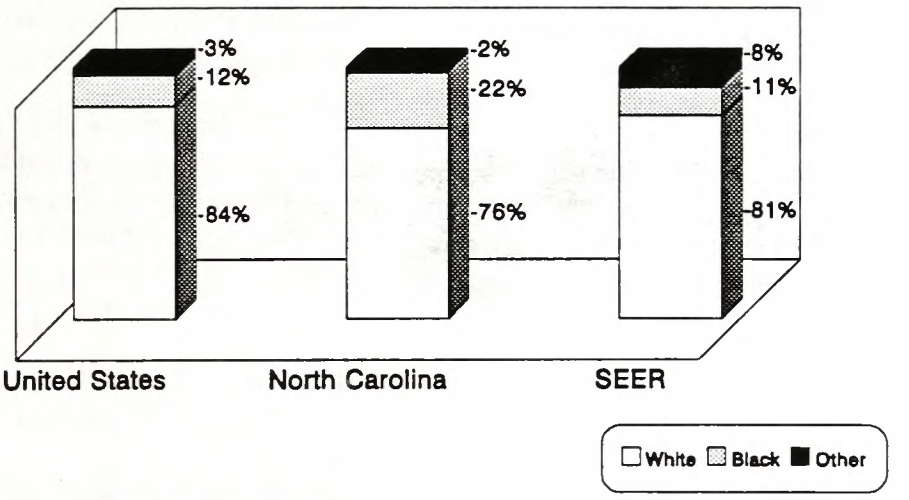
North Carolina prostate cancer cases have higher mortality than do the prostate cancer cases represented in the national databases.[22,23] The factors responsible for this excess mortality are differences in survival, stage-at-diagnosis, and racial proportions. Overall, North Carolina prostate cancer patients are diagnosed at more advanced stages than those in either of the national databases.

Stage-at-diagnosis is later for blacks as compared to whites; this is evident in all three of the databases. Because North Carolina is largely a rural state, neither SEER (whose rural populations are predominantly white) nor the ACoS can adequately provide an appropriate comparison for the state's prostate cancer experience (see Figure 8). North Carolina has a larger percentage of blacks than the national databases; this difference is associated with the state's poorer overall prostate cancer survival. These differences suggest that cases represented by the three databases may not be entirely comparable. It is also important to keep in mind that the NC-CCR survival data do not represent the entire state.

North Carolina's prostate cancer data are quite different from the ACoS' since a larger fraction of North Carolina's prostate cancer cases are diagnosed in smaller hospitals than in the ACoS data.[22] Advanced stage prostate cancer cases that are seen at smaller, rural facilities may be managed less productively, leading to poorer survival. Also, the abundance of and referral to Comprehensive Cancer Centers or state-of-the-art treatment facilities

FIGURE 8

Racial Distributions for the United States, North Carolina, and the SEER Database



Population is averaged over 1985-1989

means that North Carolina's late-staged prostate cancer cases are also more likely than are cases in the ACoS database to receive care at these larger, more "state-of-the-art" facilities. This North Carolina survival analysis will be affected by these complex influences.

The differences in stage by region and urban/rural residence may be affected by a systematic error in staging practices observed in smaller hospitals. Generally speaking, smaller facilities tend to assign lower levels of stage to prostate cancer cases. This pattern was observed by the NC-CCR Quality Control Unit and a special study was performed on the staging practices.

Many factors are involved in the cost of cancer care including other simultaneous illnesses (comorbidity), age, distance to travel, insurance coverage, etc. However, difference in stage-at-diagnosis is a major consideration since more extensive care is required for patients diagnosed at more advanced stages. The over $500 difference in average cost for black versus white prostate cancer patients for initial hospitalization is not dramatic (both population's initial hospitalizations costs average over $9,000). However, if this difference is related to stage-at-diagnosis, closing this gap between the races could save about $350,000 annually in initial hospitalization costs in North Carolina. If subsequent hospitalizations for follow-up care were also considered, the potential savings from closing the stage-at-diagnosis gap would likely be much greater.

CONCLUSION

North Carolina has a higher proportion of blacks than the nation. Blacks, generally, have prostate cancer diagnosed at a later stage. Cancers that are diagnosed at later stages have poorer survival, resulting in higher mortality rates. This pattern for later stage diagnoses and poorer survival combined with a higher proportion of blacks (who also have a higher incidence rate) is the major reason for North Carolina's high prostate cancer mortality rates. Differences in use of state-of-the-art medical care may also contribute to racial differences in survival. At this time, the most effective course for reducing prostate cancer mortality is to close the gap between the races in stage-at-diagnosis.

Several initiatives related to this recommendation have arisen in North Carolina.

- The prostate cancer task force established by the Committee of the North Carolina Medical Society has now evolved into a statewide coalition to focus on this goal.

- The Prostate Cancer Action Team, overseen by the Cancer Control Committee of the North Carolina Division of the American Cancer Society, has used the results from this study to establish priorities for education efforts and for promoting prostate cancer screening in high risk population groups.

- Building on these findings, the Division of Adult Health Promotion, collaborating with Cancer Center at Duke University, has initiated a study of the behaviors, attitudes, and practices associated with later stage diagnoses. The study will expressly compare differences between black and white prostate cancer cases.

- The data reported are being used by the North Carolina Cancer Control and Coordination Committee as they seek to develop a statewide plan for cancer control.

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