Full Length Research paper

Ethnicity and Prostate Cancer Stage

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To investigate any association between prostate cancer stage and ethnicity. We conducted a retrospective cohort study utilizing data from the Surveillance, Epidemiology, and End Results (SEER) Program of the National Cancer Institute. Inclusion in the study cohort required a diagnosis of prostate cancer from 1973 -2005 with the data reported to SEER. Our cohort included 371,748 men with prostate cancer (304,867 non-Hispanic whites, 41,108 African Americans, 11,412 Hispanic Americans, 3,107 Chinese Americans, 5,033 Japanese Americans, 4,097 Filipino Americans, 1147 Hawaiians and 977 American Indians). Compared to non-Hispanic whites, all seven races possessed significantly less stage III disease, and significantly more stage IV disease, at diagnosis. Compared to non-Hispanic whites, all seven races that were investigated possessed significantly more stage IV disease at diagnosis.

Key words: Prostate cancer, ethnicity

INTRODUCTION

Among men in the United States, prostate cancer is the most common type of non-skin cancer and is second only to lung cancer as the leading cause of cancer death. The American Cancer Society estimated that 2008 would bring 192,000 new cases of prostate cancer, with 27,000 men dying of the disease (American Cancer Society, 2009). For men in the U.S, the lifetime risk of being diagnosed with prostate cancer is 1 in 6. Although advancing age, race, nationality, family history, and diet are all known risk factors for prostate cancer, a considerable amount of risk remains unidentified (American Cancer Society, 2009). In fact, an estimated 42% of prostate cancer risk may be due to genetic factors, including androgen metabolism, carcinogen metabolism, DNA repair and chronic inflammation pathways, but as yet, researchers have found no conclusive results (Hsing and Chokkalingam, 2006).

The most common prostate cancer patient in the US is a non-Hispanic white male, 65 years old and overweight, who possesses a college level education, and who has 1 or 2 co-morbidities at presentation (Greene et al., 2005).

Even so, according to the Surveillance, Epidemiology, and End Results (SEER) Program, the incidence of prostate cancer in whites is 169.0 per 100,000 men compared to 272.0 per 100,000 blacks (Surveillance, Epidemiology, and End Results Program, 2009). Further, while the age-adjusted death rate from prostate cancer is 27.7 per 100,000 in white men, it soars to 68.1 per 100,000 in black men (Surveillance, Epidemiology, and End Results Program, 2009).

Previous research on ethnicity and prostate cancer has focused on non-Hispanic whites and African Americans. Hoffman et al. (2001) investigated a population-based cohort of 3,173 men with prostate cancer and found that African Americans possessed more than twice the risk of advanced stage disease. Socioeconomic, clinical, and pathologic factors each accounted for about 15% of the increased risk (Hoffman et al., 2001). Investigating socioeconomic status (SES) and stage of diagnosis for the five most common malignancies, Schwartz et al. (2003) found that, for prostate cancer, African-American race was an independent predictor of advanced stage. SES also was an independent predictor of stage at diagnosis for all five cancer sites, including the prostate.

The purpose of our study was to investigate the relationship between ethnicity and prostate cancer stage at diagnosis, utilizing the large National Cancer Institute

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SEER databank. We compared demographic variables, treatment variables, and cancer stage between non-Hispanic whites with prostate cancer and men of seven other ethnicities.

METHODS

We conducted a retrospective cohort study utilizing data from the Surveillance, Epidemiology and End Results Program of the National Cancer Institute. Inclusion in the study cohort required a diagnosis of prostate cancer from 1973 -2005, with patient data reported to SEER. For each case, we collected data on ethnicity and prostate cancer stage, as well as several potential confounding variables including age, radiation treatment, surgical treatment and marital status. The staging system was based on the American Joint Committee on Cancer (AJCC). We obtained Institutional Review Board approval for this study prior to data analysis.

SEER

The Surveillance, Epidemiology, and End Results (SEER) Program of the National Cancer Institute is an authoritative source of information on cancer incidence and survival in the United States. SEER began collecting data on January 1, 1973. The SEER Program currently collects and publishes cancer incidence and survival data from 14 population-based cancer registries.

SEER coverage includes: 23 percent of African Americans, 40 percent of Hispanics, 42 percent of American Indians and Alaska Natives, 53 percent of Asians, and 70 percent of Hawaiian/Pacific Islanders.

The SEER Program is considered the standard for quality among cancer registries around the world. Quality control has been an integral part of SEER since its inception. Every year, studies are conducted in SEER areas to evaluate the quality and completeness of the data being reported (Hsing and Chokkalingam, 2006).

We performed univariate analysis using chi-square and t-tests to evaluate the prevalence of confounding variables by race, then included in the regression model, those variables found to exhibit statistically significant variation between races. To investigate the adjusted risk between race and each prostate cancer stage, while controlling for any significant potential confounding variables, we used nominal regression analysis for dichotomous variables. We used SPSS (SPSS Inc., Chicago, IL) statistical software to analyze the data. Utilizing a two-tailed alpha of 0.05, a beta of 0.10 and 376,000 patients divided into eight strata, this study possessed 90% power to find a significant difference between races for any stage if they differ by at least 1%.

RESULTS

Our cohort included 371,748 men with prostate cancer [304,867 (82.0%) non-Hispanic whites, 41,108 (11.0%) African Americans, 11,412 (3.1%) Hispanic Americans, 3,107(0.8%) Chinese Americans, 5,033 (1.4%) Japanese Americans, 4,097 (1.1%) Filipino Americans, 1147 (0.3%) Hawaiians, and 977 (0.3%) American Indians]. Compared to Caucasians, African Americans, American Indians, and Hawaiians were significantly more likely never to be married, separated, or divorced (P < 0.05). African Americans and Japanese Americans were more likely to not have any surgery, and African Americans, Filipinos,

and Hawaiians were less likely to have a prostatectomy (Table 1). Hispanics and American Indians were less likely to get radiation (P < 0.05). African Americans were significantly younger at diagnosis while Chinese, Filipinos, and Japanese Americans were older (Table 2). Chinese, Japanese, and Hispanics were more likely to be alive at the end of the follow-up surveillance period (Table 3, P<0.05). Compared to non-Hispanic whites, African Americans, American Indians, Filipinos, Hawaiians and Japanese Americans were more likely to possess Stage I disease (Table 4). There was no significant difference between the eight ethnicities for Stage II disease. Compared to non-Hispanic whites, all seven ethnicities possessed significantly less Stage III disease at diagnosis but significantly more Stage IV disease.

DISCUSSION

There is significant variation among the eight ethnicities in regard to prostate cancer. Previous research demonstrated that non-Hispanic whites were significantly more likely to be in a less-advanced stage compared to African Americans (Surveillance, Epidemiology, and End Results Program, 2009; Hoffman et al., 2001) and our findings both support and expand upon those results. We found that non-Hispanic whites were less likely to be diagnosed with Stage IV prostate cancer compared to all seven other ethnicities. Previous research suggests that socioeconomic status (SES) has a significant effect on prostate cancer stage (Du et al., 2006); unfortunately, SEER does not collect a variable to approximate SES for this population. Research on the cancer knowledge of male siblings of prostate cancer patients suggests that only a minority of men take this disease seriously, even if it inflicts their brother (Pruthi et al., 2006). Only non-Hispanic, non-smoking whites had a significant improvement in their prostate cancer knowledge after their brother was diagnosed with the disease.

African Americans

The results for African Americans compared to the other races were very significant. Of all eight ethnicities, African Americans were significantly younger, less likely to be married and less likely to have surgery, and they possessed the largest percentage of Stage IV disease. These results are important, since the incidence of prostate cancer is significantly higher in African Americans. Although not recorded in SEER, the Gleason pathological score was likely higher in African Americans, since younger age is associated with a higher score. Previous research found African-American men to have higher Gleason scores (Fowler et al., 2000), higher initial prostate specific antigen (PSA) (Pan et al., 2003) and more epidermal growth factor receptor (EGFR) over expression (Shuch et al., 2004); they also are less

Table 1. Surgery.

	Non-Hispanic Whites N = 229,691	African Americans N = 29,466	American Indians N = 739	Chinese Americans N = 1954	Japanese Americans N = 3655	Filipino Americans N = 2946	Hawaiian Americans N = 795	Hispanic Americans N = 7830
No surgery	17, 239 (7.5%)	3349* (11.4%)	54 (7.3%)	95 (4.9%)	401* (11.0%)	184 (6.2%)	52 (6.5%)	474 (6.1%)
Needle biopsy	50,116 (21.8%)	6869 (23.3%)	185 (25.0%)	655 (33.5%)	1314* (36.0%)	1005* (34.1%)	262* (33.0%)	1949 (24.9%)
Prostatectomy**	45,597 (19.9%)	4259* (14.5%)	132 (17.9%)	392 (20.1%)	625 (17.1%)	345* (11.7%)	110* (13.8%)	1583 (20.2%)
All others (TURP, unknown, lymph nodes only, surgery NOS)	118,979 (51.8%)	15,263 (51.8%)	368 (49.8%)	811 (41.5%)	1312 (35.9%)	1414 (48.0%)	371 (46.7%)	3821 (48.8%)

**Prostatectomy surgeries not subdivided into types by SEER.
*P < 0.05.

Table 2. Age at diagnosis.

	Non-Hispanic Whites N = 304,867	African Americans N = 41,108	American Indians N = 977	Chinese Americans N = 3107	Japanese Americans N = 5033	Filipino Americans N = 4097	Hawaiian Americans N = 1147	Hispanic Americans N = 11,412
Age	70.90 ± 9.3	68.28 ± 9.6*	70.53 ± 10.2	72.71 ± 8.3*	73.53 ± 8.5*	73.5 ± 9.0*	70.2 ± 8.7	69.9 ± 9.6

*P < 0.05.

Table 3. Overall survival.

	Hispanic Americans N = 304867	Non-Hispanic Whites N = 41,108	African Americans N = 977	American Indians N = 3107	Chinese Americans N = 5033	Japanese Americans N = 4097	Filipino Americans N = 1147	Hawaiian Americans N = 11,412
Dead	162,340 (53.2%)	22,188 (54.0%)	574 (58.8%)	1189* (38.3%)	2338* (46.5%)	2164 (52.8%)	611 (53.3%)	5301* (46.5%)

likely to be screened if elderly (Fowke et al., 2005; Gilligan et al., 2004) and less likely to have proper follow-up after diagnosis (Zeliadt et al., 2003)

The data suggest that a greater effort must be made to raise awareness of prostate cancer in the African-American population, which then can be motivated to address this threat through early screening and comprehensive treatment (McFal et al., 2006). Indeed, some data suggest that younger African Americans are becoming more aware of prostate cancer and are being screened for the disease as frequently as non-Hispanic whites (Fowke et al., 2005). It seems clear that socioeconomic factors can confound some of the results for this population (Du et al., 2006; Wolfet al., 2006). Disparities in cancer outcomes have been observed in several malignancies for African Americans. However, most studies have had difficulty adjusting for clinical, demographic and treatment variables. Albain et al. (2009) investigated whether racial disparities in survival exist

Table 4. Ethnicity and prostate cancer stage.

	Non-Hispanic Whites N = 212,413	African Americans N = 29,907	American Indians N = 730	Chinese Americans N = 2580	Japanese Americans N = 3910	Filipino Americans N = 3095	Hawaiian Americans N = 867	Hispanic Americans N = 8630
Stage I	1.0	1.07* (1.04 -1.11)	1.04* (1.01 - 1.06)	1.03 (1.00 - 1.05)	1.04* (1.01 - 1.06)	1.05* (1.02 - 1.07)	1.05* (1.02 - 1.07)	1.02 (1.00 - 1.04)
Stage II	1.0	1.04 (0.99 - 1.08)	0.99 (0.96 - 1.03)	1.00 (0.97 - 1.03)	1.02 (0.98 - 1.05)	1.01 (0.97 - 1.04)	1.01 (0.98 - 1.04)	0.96 (0.92 - 0.99)
Stage III	1.0	0.83* (0.79 - 0.87)	0.76* (0.73 - 0.78)	0.76* (0.74 - 0.79)	0.78* (0.75 - 0.81)	0.77* (0.75 - 0.80)	0.78* (0.75 - 0.81)	0.74* (0.71 - 0.77)
Stage IV	1.0	1.24* (1.18 - 1.28)	1.30* (1.27 - 1.34)	1.31* (1.28 - 1.36)	1.39* (1.34 - 1.43)	1.35* (1.31 - 1.39)	1.37* (1.32 - 1.41)	1.32* (1.28 - 1.37)

*$P < 0.05$.

among patients enrolled in consecutive randomized clinical trials conducted by the Southwest Oncology Group (SWOG). They identified 19,457 patients with many different types of cancer over twenty-seven years of SWOG studies. 11.9% of the patients were African American. Albain found African American patients with sex-specific cancers had worse survival than white patients, despite enrollment on phase III SWOG trials with uniform stage, treatment, and follow-up. Albain et al. also found more advanced stage prostate cancer in African American men, similar to our results.

Hispanic Americans

Compared to non-Hispanic whites, individuals of Hispanic ethnicity were more likely to have surgery, more likely to go without radiation, and more likely to be alive at the end of the surveillance period. Additionally, they possessed significantly less Stage II and III disease and more Stage IV prostate cancer. Other researchers have found that, compared to non-Hispanics white, Hispanics possessed higher Gleason scores and preoperative PSA levels (Lam et al., 2004). Hispanic ethnicity, however, was not a predictor of treat-

ment failure following radical prostatectomy (Lam et al., 2004).

Chinese, Japanese and Filipino Americans

Compared to non-Hispanic whites, Japanese men were more likely to forgo surgery and more likely to have radiation. Previously, Japanese men were found to possess significantly better outcomes following radiation compared to non-Hispanic white men (Fukagai et al., 2006). We found that Chinese, Japanese, and Filipino Americans were significantly older at diagnosis compared to non-Hispanic whites. As with Hispanics, individuals of Chinese and Japanese nationality were more likely to be alive at the end of the surveillance period. Compared to non-Hispanic whites, Chinese, Japanese, and Filipino Americans had less Stage III disease and significantly more Stage IV disease. Similarly, previous research found Asian men more likely to possess more advanced stage disease compared to non-Asian men (Man et al., 2003); however, these researchers found no difference in mortality. For these three populations, the older age at diagnosis may correlate with a lower Gleason score and thus a better prognosis and survival rate.

Hawaiians and American Indians

We found no data in the literature involving prostate cancer staging and these two populations of men. Compared to non-Hispanic whites, Hawaiians and American Indians were less likely to have a prostatectomy, and they possessed less Stage III disease and significantly more Stage IV disease. Hawaiians received significantly more beam radiation than any other race, while American Indians received the least amount of radiation. American Indians possessed the highest mortality rate of all eight ethnicities. The lack of published data for these and other populations suggest that more investigation is needed to truly understand the ethnic variation of prostate cancer.

The major limitation of the SEER data-and any tumor registry-is that the data typically are collected retrospectively rather than prospectively. Although the National Cancer Cancer Institute is compulsive about data quality in SEER, prospective data is generally more accurate. However, a prospective design would significantly reduce the total population with disease that could be followed and analyzed. A further limitation of SEER is that it does not include any information that might indicate a patient's socio-economic

status, such as income or education level, and SES may well be a significant confounder (Hoffman et al., 2001).

Conclusion

There is significant ethnic variation associated with prostate cancer stage at diagnosis. Compared to non-Hispanic whites, all seven ethnicities that were investigated possessed significantly more Stage IV disease at diagnosis. Looking specifically at African Americans, we found that, compared to non-Hispanic whites, they were younger, less likely to be married, less likely to have surgery, less likely to have a prostectomy, less likely to have radiation, and more likely to possess Stage IV disease.

REFERENCES

Albain KS, Unger JM, Crowley JJ (2009). Racial disparities in cancer survival amoung randomized clinical trials patients of the southwest oncology group. J. Nat. Cancer Inst., 101: 984-992.

American Cancer Society (2009). www.cancer.org Updated September.

Du XL, Fang S, Coker AL (2006). Racial disparity and socioeconomic status in association with survival in older men with local/regional stage prostate carcinoma: findings from a large community-based cohort. Cancer, 106: 1276-1285.

Fowke JH, Schlundt D, Signorello LB (2005). Prostate cancer screening between low-income American American and Caucasian men. Urol Oncol., 23: 333-340.

Fowler JE, Bigler SA, Bowman G, Kilambi NK (2000). Race and cause specific survival with prostate cancer: influence of clinical stage, Gleason score, age and treatment. J. Urol., 163: 137-142.

Fukagai T, Namiki TS, Carlile RG (2006). Comparison of the clinical outcome after hormonal therapy for prostate cancer between Japanese and Caucasian men. BJU Int., 97: 1190-1193.

Gilligan T, Wang PS, Levin R (2004). Racial differences in screening for prostate cancer in the elderly. Arch Int. Med., 164: 1858-1864.

Greene KL, Cowan JE, Cooperberg MR (2005). Who is the average patient presenting with prostate cancer? Urology, 66S: 76-82.

Hoffman RM, Gilliland FD, Eley JW (2001). Racial and ethnic differences in advanced-stage prostate cancer: the Prostate Cancer Outcomes Study. J. Natl. Cancer Inst., 93: 388-395.

Hsing AW, Chokkalingam AP (2006). Prostate Cancer Epidemiology. Front Biosci., 11: 1388-1413.

Lam JS, Sclar JD, Desai M (2004). Is Hispanic race an important predictor of treatment failure following radical prostatectomy for prostate cancer? J. Urol., 172: 1856-1859.

Man A, Pickles T, Chi KN (2003). Asian race and impact on outcomes after radical radiotherapy for localized prostate cancer. J. Urol., 170: 901-904.

McFall SL, Hamm RM, Volk RJ (2006). Exploring beliefs about prostate cancer and early detection in men and women of three ethnic groups. Patient Educ. Couns., 61: 109-116.

Pan CC, Lee JS, Chan JL (2003). The association between presentation PSA and race in two sequential time periods in prostate cancer patients seen at a university hospital and its community affiliates. Int. J. Radiat. Oncol. Biol. Phys., 57: 1292-1296.

Pruthi RS, Tornehl C, Gaston K (2006). Impact of race, age, income, and residence on prostate cancer knowledge, screening behavior and health maintenance in siblings of patients with prostate cancer. Eur. Urol., 50: 64-69.

Schwartz KL, Crossley-May H, Vigneau FD (2003). Race, socioeconomic status and stage at diagnosis for five common malignancies. Cancer Causes Control, 14: 761-766.

Shuch B, Mikhail M, Satagopan J (2004). Racial disparity of epidermal growth factor receptor expression in prostate cancer. J. Clin. Oncol., 22: 4725-4729.

The Surveillance Epidemiology and End Results Program (2009). www.seer.cancer.gov Updated July.

Wolf MS, Knight SJ, Lyons EA (2006). Literacy, race, and PSA level among low-income men newly diagnosed with prostate cancer. Urology, 68: 89-93.

Zeliadt SB, Penson DF, Albertsen PC (2003). Race independently predicts prostate specific antigen testing frequency following a prostate carcinoma diagnosis. Cancer, 98: 496-503.