
RESEARCH COMMUNICATION

Comparison of Bladder Cancer Survival Among Japanese, Chinese, Filipino, Hawaiian and Caucasian Populations in the United States

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Abstract

Background: Racial differences for bladder cancer survival have been reported for Caucasians and African-Americans. However, the survival experience of bladder cancer patients in Asian and Pacific Islander ethnic groups in the United States have not been fully explored. The purpose of this study was to compare the bladder cancer survival rates of Japanese, Chinese, Filipinos, Hawaiians and Caucasians in the U.S. population.

Materials and Methods: The data was from the Surveillance, Epidemiology, and End Results (SEER) Program of the National Cancer Institute between 1973 and 1998. Cox proportional hazard models and Kaplan-Meier's estimates were used to study differences in survival between the ethnic groups, adjusting for factors including age at diagnosis, gender, year of diagnosis, histological grade, stage, surgery type, and radiation therapy.

Results: The overall bladder cancer survival was 66% for Japanese patients, 64% for Chinese patients, 61% for Caucasians, 59% for Filipino patients and 52% for Hawaiian patients. Differences in bladder cancer survival rates between Japanese and Chinese populations in the United States were not observed. In the Asian population, higher relative risks and lower 5-year survival were observed with increasing age at diagnosis (p for trend<0.0001), grade (p for trend<0.0001), and stage (p for trend<0.0001). Asian women had lower survival and a higher risk of death due to bladder cancer than Asian men.

Conclusions: Japanese and Chinese bladder cancer patients had higher overall survival rates than Caucasians, while Filipino and Hawaiian patients had lower survival than Caucasians.

Key Words: Bladder Neoplasms - Asian Americans - Survival Analysis

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Introduction

Bladder cancer is the 4th most common cancer for men and 10th most common cancer for women in the United States (Cancer Facts & Figures, 2003). The American Cancer Society predicts that 57,400 bladder cancer cases and 12,500 deaths due to bladder cancer will occur in 2003. Overall survival for bladder cancer patients is associated with occupational exposures, cigarette smoking, dietary factors, as well as genetic and familial factors. Clinical

factors such as age at diagnosis, histological grade, disease stage, treatment and tumor size also appear to affect survival from bladder cancer (Narayana et al., 1983; Li et al., 1995).

Many studies have explored differences in cancer survival between African-American and Caucasian patients. The 5-year survival for bladder cancer was 82% among Caucasians and 65% among African-Americans (Cancer Facts & Figures, 2003). Mayer and McWhorter (1989) reported that Caucasian patients survived longer than African-American patients because more Caucasian patients

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received treatment. Meanwhile, Miller et al. (1996) attributed the difference in survival between Caucasians and African-Americans to the fact that a larger proportion of Caucasian bladder cancer patients were diagnosed at an earlier more treatable stage. Other studies have also shown consistently higher survival rates for Caucasian patients (Smart, 1990; Young et al., 1984; Hankey and Myers, 1987). Few papers have addressed the survival experience of bladder cancer patients among the Asian and Pacific Islander ethnic groups in the United States. Young et al. (1984) observed that among bladder cancer patients in the SEER (Surveillance, Epidemiology, and End Results) data between 1973-79, Japanese male patients had the highest 5-year survival rates among all ethnic groups, and that the 5-year survival rate was higher for males than females within each ethnic group except for Caucasians.

The aim of this study is to compare the bladder cancer survival patterns among four Asian and Pacific Islander groups including Japanese, Chinese, Filipino and Hawaiian and to compare the bladder cancer survival of these Asian groups to Caucasians. We will also examine the distribution of age at diagnosis, year of diagnosis, gender, grade, stage, surgery and radiation therapy of bladder cancer patients among these race/ethnic groups.

Materials and Methods

The data was collected by the SEER program of the National Cancer Institute from 1973 to 1998. For this analysis, only patients who were Japanese, Chinese, Filipino, Hawaiian and Caucasian, diagnosed with bladder cancer as a single or first primary tumor were included (n=85,334). Bladder cancer diagnosis was based on the ICD-9 code for primary site. Subjects from other Asian ethnicities were not included due to limited sample size: Korean (65 incident cases, 22 deaths), Asian Indian/Pakistani (42 incident cases, 8 deaths), Vietnamese (19 incident cases, 5 deaths), Laotian (11 incident cases, 4 deaths), Thai (2 incident cases, 1 death), Asian not specified (31 incident cases, 3 deaths). Of the 85,334 subjects, there were 625 Chinese, 920 Japanese, 372 Filipino, 199 Hawaiian, and 83,218 Caucasian patients. The variables used to compare the differences in survival between patients from these four race groups were: age at diagnosis, year of diagnosis, gender, grade, stage, radiation therapy, and surgery. Some of these variables had missing information: grade (n=10,877), stage (n=4,761), surgery (n=4,030) and radiation therapy (n=1,245).

For survival time, we used the variable "survival time recode" in the SEER data, which is defined as the time from the date of diagnosis to the date of death or date last known to be alive or last date of follow-up (December 31, 1998 for this data). Since 17 Asian subjects were missing the survival time information, a total of 2,099 Asian patients with 1,058 subsequent deaths were included in the survival analysis. The overall survival refers to the endpoint of death due to any cause after having bladder cancer. Cause of death was available in ICDA-8 or ICD-9 code in the SEER data. For

specific survival the endpoint was deaths caused by bladder cancer. Among the 2,099 Asian subjects, 413 deaths had occurred due to bladder cancer. A total of 82,737 Caucasian subjects with 47,088 overall deaths were included to compare the survival rates of Asians to Caucasians. Among the total deaths, 15,063 deaths had occurred due to bladder cancer among Caucasians.

Age was categorized into 10 year intervals: <60, 60-69, 70-79 and ≥ 80 years. Surgery was categorized into local, cystectomy, and not specified. Local surgery included local tumor destruction and local tumor excision. Cystectomy included partial cystectomy, simple/total/complete cystectomy, radical cystectomy (male only), pelvic exenteration and unspecified cystectomy. Surgery was dichotomized in the multivariate analyses due to small sample size.

Chi-square tests were performed to compare the clinical pathological factors by ethnic group categories. Using the log-rank test, univariate analysis was conducted to study the association of each of the covariates on survival. Kaplan-Meier's survival curves and the log-rank test were also used to compare survivals between the ethnic groups by stratifying on other covariates.

Results

The distributions of age, gender, and other clinical factors for bladder cancer patients by ethnicity are shown in Table 1. The majority of Japanese, Chinese, Filipino and Caucasians were diagnosed at age 70 years and above, where as the majority of Hawaiians were diagnosed under 70 years. The male to female ratio was 2.5 for Japanese, 2.9 for Chinese, 3.6 for Filipinos, 1.8 for Hawaiians and 2.9 for Caucasians. Japanese and Caucasian patients had higher percentages of bladder cancers diagnosed at the localized stage. The majority of patients had local surgery, which included local tumor destruction and local tumor excision. The overall survival from bladder cancer among the Asian ethnic groups is shown in Table 2. Differences in overall survival were seen when comparing the 4 Asian groups (p=0.0031) and also when comparing the Asian groups to the Caucasian group (p=0.0008). The median survival time was the highest for Japanese patients at 9.6 years, followed by Chinese patients at 8.8 years, Caucasians at 7.9 years, Filipinos at 7.5 years and Hawaiians at 5.5 years. The 5-year survival was similarly highest for the Japanese (66%), the lowest for the Hawaiians (52%) and intermediate for Caucasians (61%). With the Japanese patients as the referent group, the risk of death among Chinese patients was not strongly elevated but the risks among Filipinos and Hawaiians were slightly elevated. When Caucasian patients are the referent group, the relative risk for Japanese and Chinese were protective, while the risk for Hawaiians was somewhat elevated. Higher relative risks and lower 5-year survival were observed with increasing age (p for trend<0.0001), grade (p for trend<0.0001) and stage (p for trend<0.0001). Diagnosis in the 80's and 90's appeared to

be protective relative to diagnosis in the 70's. Women had a lower 5-year survival than men but the difference in survival rates was not statistically significant ($p=0.1209$). Various types of surgery were protective but radiation therapy was not associated with overall survival.

Table 3 shows the comparison of 5-year survival among Japanese, Chinese, Filipino, Hawaiian and Caucasian groups, stratified by various factors. Within strata of age, gender and radiation, Japanese and Chinese patients generally had the highest survival and Hawaiians had the lowest. Caucasians generally had higher 5-year survival than Filipinos and Hawaiians but a lower 5-year survival than Japanese and Chinese patients. A difference in the survival rates for the 5 ethnic groups was seen in most strata of these variables, according to the log-rank test. However, for patients who were 80 years and older or had distant stage or high grade, differences in survival rates were not observed.

The specific survival from bladder cancer among the four Asian ethnic groups and Caucasians is shown in table 4. The 5-year survival from death due to bladder cancer was 80% among Asians. The log-rank test did not suggest any differences in the survival rates among the Asian and Pacific Islander groups. A difference was suggested however, when comparing the Asian groups to Caucasians. Increasing age at diagnosis and higher grade and stage were associated with lower 5-year survival and risk of death. Later years of diagnosis was increasingly protective (p for trend <0.0001). The risk of death due to bladder cancer appeared higher for women (RR=1.5, 95% CI=1.2, 1.8). Surgery appeared to be protective while radiation was associated with decreased survival.

The Kaplan-Meier survival curve for overall bladder cancer survival for the 4 Asian ethnic groups is shown in figure 1. The plot shows that Japanese patients had a slightly

Table 1. Comparison of Clinical Factors for Japanese, Chinese, Filipino, Hawaiian and Caucasians Patients with Bladder Cancer

| | Japanese n (%) | Chinese n (%) | Filipino n (%) | Hawaiian n (%) | Caucasian n (%) | χ^2 p-value |
|--------------------------|-------------------|------------------|-------------------|-------------------|--------------------|------------------|
| Total | 920 | 625 | 372 | 199 | 83218 | |
| Mean age | 69.8 | 70.0 | 68.6 | 64.7 | 68.4 | <0.0001* |
| Age at diagnosis (years) | | | | | | |
| <60 | 185 (20.1) | 96 (15.4) | 76 (20.4) | 61 (30.7) | 18184 (21.9) | <0.0001 |
| 60-69 | 247 (26.9) | 176 (28.2) | 102 (27.4) | 61 (30.7) | 23547 (28.3) | |
| 70-79 | 262 (28.5) | 234 (37.4) | 118 (31.7) | 57 (28.6) | 25788 (31.0) | |
| ≥ 80 | 226 (24.6) | 119 (19.0) | 76 (20.4) | 20 (10.1) | 15699 (18.9) | |
| Gender | | | | | | |
| Male | 660 (71.7) | 465 (74.4) | 291 (78.2) | 127 (63.8) | 62072 (74.6) | 0.0009 |
| Female | 260 (28.3) | 160 (25.6) | 81 (21.8) | 72 (36.2) | 21146 (25.4) | |
| Male:Female Ratio | 2.5 | 2.9 | 3.6 | 1.8 | 2.9 | |
| Year of diagnosis | | | | | | |
| 1973-1979 | 171 (18.6) | 92 (14.7) | 59 (15.9) | 46 (23.1) | 18754 (22.5) | <0.0001 |
| 1980-1989 | 336 (36.5) | 250 (40.0) | 134 (36.0) | 64 (32.2) | 32587 (39.2) | |
| 1990-1998 | 413 (44.9) | 283 (45.3) | 179 (48.1) | 89 (44.7) | 31877 (38.3) | |
| Grade | | | | | | |
| I | 139 (17.7) | 87 (16.2) | 69 (21.7) | 35 (20.0) | 15330 (21.1) | <0.0001 |
| II | 279 (35.5) | 204 (38.0) | 125 (39.3) | 62 (35.4) | 29596 (40.7) | |
| III | 312 (39.8) | 205 (38.2) | 97 (30.5) | 66 (37.7) | 21717 (29.9) | |
| IV | 55 (7.0) | 41 (7.6) | 27 (8.5) | 12 (6.9) | 5999 (8.3) | |
| missing | 135 | 88 | 54 | 24 | 10576 | |
| Stage | | | | | | |
| Localized | 706 (78.8) | 429 (72.3) | 252 (70.4) | 127 (66.2) | 60834 (77.5) | <0.0001 |
| Regional | 152 (17.0) | 137 (23.1) | 87 (24.3) | 49 (25.5) | 15246 (19.4) | |
| Distant | 38 (4.2) | 27 (4.6) | 19 (5.3) | 16 (8.3) | 2454 (3.1) | |
| missing | 24 | 32 | 14 | 7 | 4684 | |
| Surgery | | | | | | |
| None | 8 (1.0) | 8 (1.4) | 9 (2.8) | 1 (0.6) | 887 (1.2) | <0.0001 |
| Local | 491 (60.2) | 283 (50.6) | 201 (62.6) | 88 (53.0) | 41236 (55.2) | |
| Cystectomy | 58 (7.1) | 48 (8.6) | 19 (5.9) | 21 (12.7) | 4413 (5.9) | |
| Not specified | 259 (31.7) | 220 (39.4) | 92 (28.7) | 56 (33.7) | 28163 (37.7) | |
| missing | 104 | 66 | 51 | 33 | 8519 | |
| Radiation | | | | | | |
| None | 823 (89.8) | 545 (88.8) | 329 (88.9) | 165 (84.2) | 74252 (90.6) | 0.0100 |
| Yes | 94 (10.3) | 69 (11.2) | 41 (11.1) | 31 (15.8) | 7740 (9.4) | |
| missing | 3 | 11 | 2 | 3 | 1226 | |

* Anova

Table 2. Overall Survival from Bladder Cancer among Asian Ethnic Groups

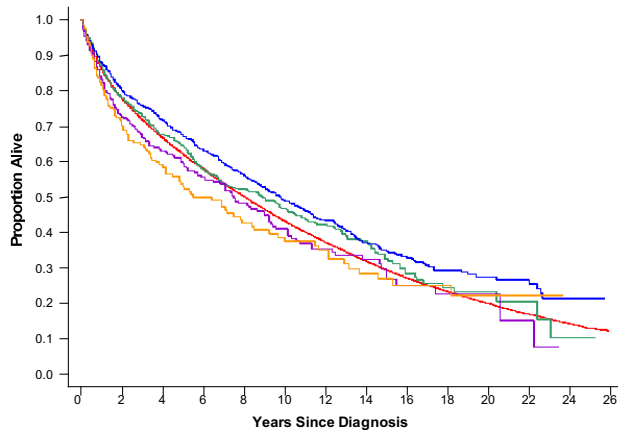
| | Subjects | Deaths | Median Survival (yrs) | 5-year survival | Log-rank p-value | Crude Relative Risk | 95% CI | Adjusted* Relative Risk | 95% CI |
|---------------------------------|----------|--------|-----------------------|-----------------|------------------|---------------------|------------|-------------------------|-----------|
| Total | 2099 | 1058 | 8.8 | 0.6302 | | - | - | | |
| Asian and Caucasian Ethnicities | | | | | | | | | |
| Caucasian | 82737 | 47088 | 7.9 | 0.6134 | 0.0008 | 1.0 | | 1.0 | |
| Japanese | 917 | 446 | 9.6 | 0.6630 | | 0.8 | 0.8, 0.9 | 0.8 | 0.7, 0.9 |
| Chinese | 617 | 313 | 8.8 | 0.6386 | | 0.9 | 0.8, 1.0 | 0.8 | 0.7, 0.9 |
| Filipino | 368 | 188 | 7.5 | 0.5904 | | 1.1 | 0.9, 1.2 | 1.0 | 0.9, 1.2 |
| Hawaiian | 197 | 111 | 5.5 | 0.5231 | | 1.2 | 1.2, 1.4 | 1.3 | 1.1, 1.6 |
| Asian Ethnicities | | | | | | | | | |
| Japanese | 917 | 446 | 9.6 | 0.6630 | 0.0031 | 1.0 | | 1.0 | |
| Chinese | 617 | 313 | 8.8 | 0.6386 | | 1.1 | 1.0, 1.3 | 1.0 | 0.9, 1.2 |
| Filipino | 368 | 188 | 7.5 | 0.5904 | | 1.3 | 1.1, 1.5 | 1.4 | 1.1, 1.7 |
| Hawaiian | 197 | 111 | 5.5 | 0.5231 | | 1.4 | 1.1, 1.7 | 1.6 | 1.2, 2.0 |
| Age at diagnosis | | | | | | | | | |
| <60 | 417 | 120 | 22.4 | 0.8353 | <0.0001 | 1.0 | | 1.0 | |
| 60-69 | 583 | 247 | 11.5 | 0.7544 | | 2.0 | 1.6, 2.5 | 2.1 | 1.6, 2.6 |
| 70-79 | 666 | 379 | 6.3 | 0.5639 | | 3.6 | 2.9, 4.4 | 4.0 | 3.1, 5.1 |
| ≥80 | 433 | 312 | 2.6 | 0.3479 | | 7.0 | 5.7, 8.8 | 6.4 | 5.0, 8.2 |
| P for trend | | | | | | <0.0001 | | <0.0001 | |
| Year of diagnosis | | | | | | | | | |
| 1973-1979 | 364 | 302 | 6.0 | 0.5412 | 0.0004 | 1.0 | | 1.0 | |
| 1980-1989 | 777 | 472 | 9.5 | 0.6544 | | 0.8 | 0.7, 0.9 | 0.6 | 0.5, 0.7 |
| 1990-1998 | 958 | 284 | — | 0.6493 | | 0.8 | 0.6, 0.9 | 0.6 | 0.5, 0.7 |
| P for trend | | | | | | 0.0011 | | <0.0001 | |
| Gender | | | | | | | | | |
| Male | 1530 | 774 | 8.8 | 0.6514 | 0.1209 | 1.0 | | 1.0 | |
| Female | 569 | 284 | 8.4 | 0.5726 | | 1.1 | 1.0, 1.3 | 0.9 | 0.8, 1.1 |
| Grade | | | | | | | | | |
| I | 330 | 121 | 15.1 | 0.8102 | <0.0001 | 1.0 | | 1.0 | |
| II | 668 | 275 | 11.2 | 0.7435 | | 1.4 | 1.1, 1.8 | 1.3 | 1.0, 1.6 |
| III | 678 | 390 | 5.3 | 0.5141 | | 2.6 | 2.1, 3.2 | 1.7 | 1.4, 2.2 |
| IV | 135 | 91 | 2.2 | 0.3816 | | 3.7 | 2.7, 4.8 | 1.9 | 1.4, 2.5 |
| P for trend | | | | | | <0.0001 | | <0.0001 | |
| Stage | | | | | | | | | |
| Localized | 1512 | 644 | 11.6 | 0.7422 | <0.0001 | 1.0 | | 1.0 | |
| Regional | 424 | 279 | 2.8 | 0.4033 | | 2.5 | 2.2, 2.9 | 2.0 | 1.7, 2.4 |
| Distant | 96 | 87 | 0.4 | 0.0258 | | 12.7 | 10.0, 16.1 | 7.7 | 5.7, 10.5 |
| P for trend | | | | | | <0.0001 | | <0.0001 | |
| Surgery | | | | | | | | | |
| None | 18 | 15 | 0.9 | 0.1905 | <0.0001 | 1.0 | | 1.0 | |
| Local tumor | 1063 | 421 | 9.3 | 0.6801 | | 0.2 | 0.1, 0.3 | 0.4** | 0.3, 0.5 |
| Cystectomy | 146 | 66 | 9.3 | 0.5919 | | 0.2 | 0.1, 0.3 | | |
| Not specified | 627 | 448 | 9.0 | 0.6369 | | 0.2 | 0.1, 0.3 | | |
| Radiation | | | | | | | | | |
| None | 1854 | 858 | 9.6 | 0.6732 | <0.0001 | 1.0 | | 1.0 | |
| Yes | 235 | 192 | 1.3 | 0.3175 | | 2.4 | 2.0, 2.8 | 1.1 | 0.9, 1.4 |

* adjusted for all other variables in table.

** Relative risk for any type of surgery

higher survival than Caucasians, while the Chinese patients' survival curve is similar or higher than that of Caucasian patients. Both Chinese and Japanese patients had higher survival than Filipino and Hawaiian patients. The log-rank test also showed that there was a difference in survival between these five ethnic groups ($p=0.0008$). Filipinos were observed to have a higher survival rate than Hawaiians

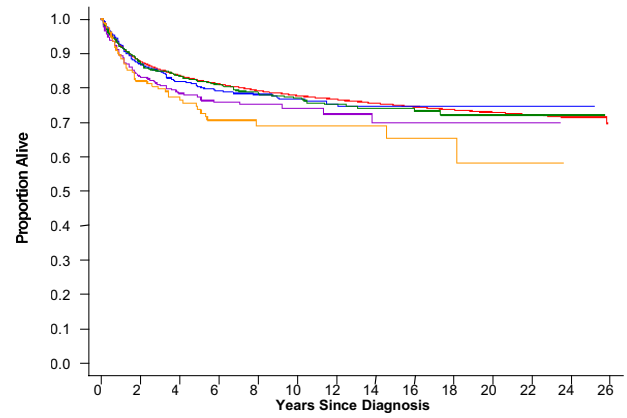
though the survival curves of these two groups sometimes overlapped. Figure 2 shows the separate survival curves of the 4 Asian ethnicities and Caucasians for deaths due to bladder cancer. The survival of Japanese and Chinese patients appears similar to that of Caucasian patients but the survival rates of Filipinos and Hawaiians were still lower than Caucasians.



| | Patients | Deaths | 5-year Survival |
|-----------|----------|--------|-----------------|
| Caucasian | 82,737 | 47,088 | 0.6134 |
| Japanese | 917 | 446 | 0.6630 |
| Chinese | 617 | 313 | 0.6386 |
| Filipino | 368 | 188 | 0.5904 |
| Hawaiian | 197 | 111 | 0.5231 |

Log-rank test: p = 0.0008

Figure 1. Survival from Bladder Cancer by Race



| | Patients | Deaths | 5-year Survival |
|-----------|----------|--------|-----------------|
| Caucasian | 82,737 | 15,063 | 0.8182 |
| Japanese | 917 | 176 | 0.8122 |
| Chinese | 617 | 114 | 0.8020 |
| Filipino | 368 | 76 | 0.7718 |
| Hawaiian | 197 | 47 | 0.7369 |

Log-rank test: p = 0.2054

Figure 2. Specific Survival of Bladder Cancer by Race

Discussion

Survival from overall death among bladder cancer patients differed among Japanese, Chinese, Filipino, Hawaiian and Caucasian ethnicities. Japanese and Chinese patients had the highest survival rates, Caucasians had intermediate rates, while Filipinos and especially Hawaiians often had the lowest survival rates. Overall survival of bladder cancer patients for the 4 Asian ethnic groups was associated with age at diagnosis, year of diagnosis, grade, stage, and surgery type. For the risk of death due to bladder cancer, the survival rates did not differ between the Asian and Pacific Islander groups.

Interestingly, Japanese and Chinese bladder cancer patients did not differ in their risk of death. The mean age at diagnosis was very similar among Japanese patients (69.6 years) and Chinese patients (70.0 years). Furthermore, both overall 5-year survival (66% for Japanese, 64% for Chinese) and specific 5-year survival (81% for Japanese, 80% for Chinese) were similar. This phenomenon of similar survival patterns for Japanese and Chinese patients may be due to closeness in cultural background and dietary habits, relative to other Asian ethnicities.

In a previous study of SEER data for the period 1973-79 (Smart, 1990), Japanese bladder cancer patients had the highest 5-year relative survival rate. This study confirmed that Japanese as well as Chinese patients had a higher survival rate than Filipinos, Hawaiians and Caucasians for the SEER data for the period 1973-98. One possible explanation for the higher survival rates of Japanese and

Table 3. Comparing 5-year Survival among the 4 Asian Ethnicities and Caucasians

| | Japanese | Chinese | Filipino | Hawaiian | Caucasian |
|--------------------------|----------|---------|----------|----------|-----------|
| Age at diagnosis (years) | | | | | |
| <60 | 0.8685 | 0.8835 | 0.7846 | 0.7136 | 0.8421 |
| 60-69 | 0.8129 | 0.7814 | 0.6911 | 0.5409 | 0.7041 |
| 70-79 | 0.6303 | 0.5540 | 0.5063 | 0.3923 | 0.5496 |
| ≥80 | 0.3416 | 0.3676 | 0.3773 | 0.1980 | 0.3060 |
| Year of diagnosis | | | | | |
| 1973-1979 | 0.5882 | 0.5934 | 0.3793 | 0.4667 | 0.5726 |
| 1980-1989 | 0.6758 | 0.6908 | 0.6153 | 0.4844 | 0.6180 |
| 1990-1998 | 0.6850 | 0.5997 | 0.6656 | 0.6057 | 0.6368 |
| Gender | | | | | |
| Male | 0.6856 | 0.6523 | 0.5968 | 0.5949 | 0.6178 |
| Female | 0.6052 | 0.5952 | 0.5784 | 0.3997 | 0.6004 |
| Grade | | | | | |
| I | 0.8413 | 0.7827 | 0.7931 | 0.7902 | 0.7886 |
| II | 0.7868 | 0.7466 | 0.6740 | 0.6532 | 0.7079 |
| III | 0.5669 | 0.5244 | 0.4638 | 0.3217 | 0.4569 |
| IV | 0.3957 | 0.4148 | 0.2297 | 0.4167 | 0.3476 |
| Stage | | | | | |
| Localized | 0.7488 | 0.7576 | 0.7476 | 0.6435 | 0.7121 |
| Regional | 0.4865 | 0.4117 | 0.2480 | 0.3895 | 0.3491 |
| Distant | 0.0000 | 0.0000 | 0.0694 | 0.0714 | 0.0612 |
| Surgery | | | | | |
| None | 0.2295 | 0.3110 | 0.2059 | 0.1875 | 0.3387 |
| Yes | 0.6937 | 0.6571 | 0.6262 | 0.5559 | 0.6321 |
| Radiation | | | | | |
| None | 0.7076 | 0.6619 | 0.6469 | 0.5894 | 0.6535 |
| Yes | 0.3069 | 0.4787 | 0.2034 | 0.1383 | 0.2763 |

Table 4. Specific Survival from Bladder Cancer among Asian Ethnic Groups

| | Subjects | Deaths | Median Survival (yrs) | 5-year survival | Log-rank p-value | Crude Relative Risk | 95% CI | Adjusted* Relative Risk | 95% CI |
|---------------------------------|----------|--------|-----------------------|-----------------|------------------|---------------------|------------|-------------------------|-----------|
| Total | 2099 | 413 | - | 0.7957 | | - | - | | |
| Asian and Caucasian Ethnicities | | | | | | | | | |
| Caucasian | 82737 | 15063 | - | 0.8182 | 0.0236 | 1.0 | | 1.0 | |
| Japanese | 917 | 176 | - | 0.8122 | | 1.0 | 0.9, 1.2 | 0.9 | 0.8, 1.1 |
| Chinese | 617 | 114 | - | 0.8020 | | 1.0 | 0.9, 1.2 | 0.8 | 0.7, 1.0 |
| Filipino | 368 | 76 | - | 0.7718 | | 1.3 | 1.0, 1.6 | 1.3 | 1.0, 1.7 |
| Hawaiian | 197 | 47 | - | 0.7369 | | 1.5 | 1.1, 1.9 | 1.2 | 0.9, 1.6 |
| Asian Ethnicities | | | | | | | | | |
| Japanese | 917 | 176 | - | 0.8122 | 0.1156 | 1.0 | | 1.0 | |
| Chinese | 617 | 114 | - | 0.8020 | | 1.0 | 0.8, 1.3 | 0.9 | 0.7, 1.2 |
| Filipino | 368 | 76 | - | 0.7718 | | 1.2 | 0.9, 1.6 | 1.5 | 1.1, 2.0 |
| Hawaiian | 197 | 47 | - | 0.7369 | | 1.4 | 1.0, 1.9 | 1.3 | 0.9, 1.9 |
| Age at diagnosis | | | | | | | | | |
| <60 | 417 | 46 | - | 0.8978 | <0.0001 | 1.0 | | 1.0 | |
| 60-69 | 583 | 91 | - | 0.8672 | | 1.6 | 1.1, 2.3 | 1.5 | 1.0, 2.3 |
| 70-79 | 666 | 145 | - | 0.7537 | | 2.7 | 1.9, 3.7 | 3.0 | 2.0, 4.3 |
| ≥80 | 433 | 131 | - | 0.6317 | | 4.8 | 3.4, 6.8 | 3.9 | 2.6, 5.7 |
| P for trend | | | | | | <0.0001 | | <0.0001 | |
| Year of diagnosis | | | | | | | | | |
| 1973-1979 | 364 | 122 | - | 0.7128 | <0.0001 | 1.0 | | 1.0 | |
| 1980-1989 | 777 | 166 | - | 0.8044 | | 0.6 | 0.5, 0.8 | 0.5 | 0.4, 0.7 |
| 1990-1998 | 958 | 125 | - | 0.8311 | | 0.5 | 0.4, 0.7 | 0.5 | 0.4, 0.7 |
| P for trend | | | | | | <0.0001 | | <0.0001 | |
| Gender | | | | | | | | | |
| Male | 1530 | 251 | - | 0.8330 | <0.0001 | 1.0 | | 1.0 | |
| Female | 569 | 162 | - | 0.6935 | | 1.9 | 1.6, 2.4 | 1.5 | 1.2, 1.8 |
| Grade | | | | | | | | | |
| I | 330 | 20 | - | 0.9969 | <0.0001 | 1.0 | | 1.0 | |
| II | 668 | 74 | - | 0.8928 | | 2.1 | 1.3, 3.4 | 1.8 | 1.1, 3.0 |
| III | 678 | 194 | 10.3 | 0.6906 | | 6.7 | 4.2, 10.6 | 3.3 | 2.0, 5.4 |
| IV | 135 | 60 | 3.7 | 0.4642 | | 11.8 | 7.1, 19.7 | 3.5 | 2.0, 6.0 |
| P for trend | | | | | | <0.0001 | | <0.0001 | |
| Stage | | | | | | | | | |
| Localized | 1512 | 152 | - | 0.9079 | <0.0001 | 1.0 | | 1.0 | |
| Regional | 424 | 167 | 8.1 | 0.5520 | | 5.6 | 4.5, 7.0 | 3.6 | 2.7, 4.7 |
| Distant | 96 | 71 | 0.6 | 0.0385 | | 30.5 | 22.6, 41.1 | 14.0 | 9.4, 20.7 |
| P for trend | | | | | | <0.0001 | | <0.0001 | |
| Surgery | | | | | | | | | |
| None | 18 | 7 | 1.6 | 0.4836 | <0.0001 | 1.0 | | 1.0 | |
| Local tumor | 1063 | 156 | — | 0.8446 | | 0.2 | 0.1, 0.3 | 0.4** | 0.3, 0.6 |
| Cystectomy | 146 | 33 | — | 0.7541 | | 0.3 | 0.1, 0.6 | | |
| Not specified | 627 | 161 | — | 0.7879 | | 0.2 | 0.1, 0.5 | | |
| Radiation | | | | | | | | | |
| None | 1854 | 289 | - | 0.8413 | <0.0001 | 1.0 | | 1.0 | |
| Yes | 235 | 121 | 3.2 | 0.4377 | | 4.4 | 3.6, 5.5 | 1.4 | 1.1, 1.8 |

* adjusted for all other variables in table.

** Relative risk for any type of surgery

Chinese patients may be differences in income and access to medical care relative to Filipino and Hawaiian patients. Although Hawaiians were diagnosed at earlier age, they tended to be diagnosed at late stage. There was also a higher percentage of women among the bladder cancer patients who were Hawaiian compared to other ethnicities. Hawaiian women seemed to have a very low 5-year survival (40%)

from bladder cancer. However, an increased risk of death for Hawaiians persisted after adjustment for age, gender, stage and radiation therapy, thus other factors may play a role in the lower survival. The distribution of age, gender and stage was not especially different for Filipino bladder cancer patients, but there seemed to be a slightly higher percentage of patients who did not receive surgery. Survival

rate differences between Asian and Caucasian groups were not apparent among patients diagnosed at age 80 years and above, nor among patients with high grade or distant stage.

Radiation therapy was a stronger risk factor for specific death than for overall death among Asian and Pacific Islanders. The majority of patients did not receive radiation therapy in all 5 ethnicities. Among patients who did receive radiation therapy, Hawaiians had the lowest 5-year survival and the Chinese had the highest survival. Radiation therapy may possibly be a strong risk factor for specific survival but not overall survival because radiation may cause a second primary tumor in the bladder, which can decrease survival greatly.

Among Asian and Pacific Islanders, male patients had higher survival rates than female patients, similar to the results in a previous study (Narayana et al., 1983). Though a difference in survival rates were not obvious for overall survival ($p=0.1209$), differences were observed for specific survival ($p<0.0001$). Gender differences were weakened after adjustment for age, grade, stage, surgery and radiation possibly because the mean age at diagnosis for female Asian patients (70.2 years) was greater than the mean age for Asian males (67.8 years, $p<0.0001$). Of the female patients, 26% were diagnosed at age 80 or above, compared to 17% of the male patients diagnosed at age 80 or above. Though the relative risk decreased after adjustment, gender remained a risk factor for deaths due to bladder cancer.

One limitation of this study was that information on socioeconomic status, genotypes and environmental factors was not available in the SEER data. A previous study had shown that socioeconomic status was an important predictive factor of ethnic survival differences (Franco, 1996). Studies have also shown that specific genes, such as p53, interact with environmental factors and may affect the incidence rate and survival rate of cancers (Miyao et al., 1993; Dalbagni et al., 1993). More importantly, previous studies have found that smoking was an important confounder to predict survival rate (Cole et al., 1971), and that it might be useful to explore ethnic bladder cancer patient survival differences with respect to smoking status (Hankey and Myers, 1987). Unfortunately, data on smoking or other epidemiologic factors, such as occupational exposures and dietary information is not available in the SEER data.

In conclusion, Japanese, Chinese, Filipino, Hawaiian and Caucasian bladder cancer patients had different survival rates. Japanese and Chinese patients had similar survival rates which were generally higher than that of Caucasians. Filipinos and Hawaiians had bladder cancer survival rates lower than Caucasians. It may be of interest to further examine socioeconomic status, dietary patterns and medical care access as potential explanations for the survival patterns observed in this study.

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