Comparative analysis of lifestyle factors, screening test use, and clinicopathologic features in association with survival among Asian Americans with colorectal cancer

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Background: Colorectal cancer (CRC) diagnoses and disease-specific survival (DSS) vary between ethnic groups in the United States. However, few studies have assessed differences among Asian subgroups.

Methods: The Surveillance, Epidemiology, and End Results (SEER) database was used to identify patients with invasive CRC between 1988 and 2008. Differences in clinicopathologic features, and DSS rates were compared among Asian subgroups. The California Health Interview Survey was used to examine risk factors and screening patterns for CRC.

Results: The study included 359,374 patients with 8.4% Asian. Patients in all Asian subgroups were younger (median: 68 years) at diagnosis than non-Hispanic white (NHW) patients (median: 72 years). Most Asian subgroups, except Hawaiians, had better DSS than NHW patients although Asian subgroups had more advanced disease than NHW. Indian/Pakistani patients had a higher 5-year DSS than other Asian subgroups. Obesity proportions were lower in Asian subgroups (<50.2%) than in NHW (59.8%). Vietnamese men and Korean women had the lowest proportions of CRC screening. Advance tumour stages were highly associated with worse DSS in each ethnicity group. High tumour grades were associated with worse DSS in NHW, Filipino, and Chinese. Older age at diagnosis was associated with worse DSS in most ethnicity groups except Hawaiian and Vietnamese.

Conclusion: Disparities exist between Asians and NHW with CRC, and among various Asian subgroups. Differences in cancer clinicopathologic features, patients’ behavioural habits, lifestyle, and screening patterns may explain some differences in CRC survival observed among ethnic groups.

Asian Americans constitute the fastest growing ethnic group in the United States (American community survey, 2007). Colorectal cancer (CRC) is the third most common malignancy and the third most frequent cause of cancer death in the United States for overall population, although both incidence and mortality rates have declined in recent years (Cress et al, 2006).

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Some studies have discussed the incidence of and mortality rates differences between Asian Americans and other ethnic groups, but few examined disparities among Asian subgroup populations (Chien et al, 2005; White et al, 2010). The purpose of this analysis was to determine whether there are significant differences in presentation, clinicopathologic features, treatment, and survival rates between non-Hispanic white (NHW) and Asian; and between Asian subgroups in patients with CRC. In addition, lifestyle factors and screening prevalence were analysed to determine whether any disparities exist between the Asian subgroups and other ethnic groups residing in the United States and to explore the potential associations among these difference.

### MATERIALS AND METHODS

**Patient selection and data collection.** The Surveillance, Epidemiology, and End Results (SEER) database of the National Cancer Institute was used to identify patients who were diagnosed with invasive primary CRC between 1988 and 2008. Data were obtained from all 17 US cancer registries participating in the SEER programme using SEER*Stat version 7.0.5 under a data user agreement (http://seer.cancer.gov/seerstat, access date: 23 January 2012). We included patients with invasive CRC with race coded as ‘White’ and ‘Asian or Pacific Islander,’ and ‘Non-Spanish-Hispanic-Latino’.

Ethnicity was categorised into two broad groups: NHW and Asians (including Pacific Islanders). Asian ethnic groups were further categorised into the following eight subgroups: Filipino, Chinese, Japanese, Indian/Pakistani, Korean, Vietnamese, Hawaiian/Pacific Islander, and others.

Information on the prevalence of selected lifestyle factors for cancer and the use of CRC screening tests (colonoscopy and faecal occult blood testing) were derived from the 2009 California Health Interview Survey (CHIS) data using the askCHIS tool (http://ask.chis.ucla.edu/main/default.asp, access date: 17 February 2012). The CHIS is a state-wide telephone survey that was modelled after the National Health Interview Survey and was designed to provide population-based estimates for United States civilian, noninstitutionalised Californians. The information was only available for Chinese, Japanese, Korean, Filipino, and Vietnamese subgroups.

The $\chi^2$ test was used to assess differences in patient characteristics, patient management, and outcomes among the two broad ethnic groups and among the eight Asian subgroups. The primary end point of this study is disease-specific survival (DSS), which was calculated as the number of years between the date of diagnosis and the date of CRC-related death, date last known to be alive, or 31 December 2008. Patients not experiencing this end point were censored at last follow-up. Multivariate Cox proportional hazards models were used to determine the influence of patient, tumour, and treatment factors (age at diagnosis, gender, year of diagnosis, median household income, ethnicity, tumour stage, tumour grade, tumour primary site, and primary surgery) of known or potential prognostic value on DSS. Stata SE version 10.0 statistical software (StataCorp LP, College Station, TX, USA) was used for statistical analyses. All tests were two-tailed, and statistical significance was set at $P<0.05$.

### RESULTS

**Patient and tumour characteristics.** We included 359 374 patients with CRC: 329 250 (91.6%) NHWs and 30 124 (8.4%) Asians. Table 1 presents the comparisons among two broad ethnic groups (NHW and Asian). Asian patients were significantly younger at diagnosis (median: 68 years) than NHW patients (median: 72 years). A greater percentage of Asian patients were diagnosed with stage III disease (30.5%) than NHW (25.8%).

Table 2 displays results from the comparisons among eight subgroups in the Asian cohort: Filipino (19.1%), Japanese (26.9%), Chinese (23.9%), Hawaiian/Pacific Islander (6.9%), Korean (7.5%), Indian/Pakistani (3.0%), Vietnamese (5.6%), and others (7.1%). Indian/Pakistani patients were the youngest at diagnosis (median age: 60.5 years) and Japanese patients were the oldest.

| Characteristic | Non-Hispanic white | Asian (n = 30 124) |
|---------------|---------------------|-------------------|
| **Age at diagnosis (years)** | | |
| Mean | 70.3 | 66.3 |
| Median (range) | 72 (9–108) | 68 (12–104) |
| <40 | 5323 (1.6) | 1079 (3.6) |
| 40–64 | 85 962 (26.7) | 10 490 (35.6) |
| 65+ | 231 052 (71.7) | 17 863 (60.7) |
| **Sex** | | |
| Female | 162 360 (49.3) | 14 235 (47.2) |
| Male | 166 890 (50.7) | 15 889 (52.8) |
| **Marital status at diagnosis** | | |
| Married | 185 941 (58.4) | 19 816 (67.4) |
| Other | 132 494 (41.6) | 9 625 (32.6) |
| Unknown | 10 815 | 683 |
| **Stage** | | |
| I | 81 480 (24.7) | 6947 (23.1) |
| II | 99 391 (30.2) | 8234 (27.3) |
| III | 84 983 (25.8) | 9173 (30.5) |
| IV | 63 396 (19.3) | 5770 (19.1) |
| **Surgery on primary** | | |
| Not performed | 23 310 (7.1) | 2038 (6.8) |
| Performed | 305 678 (92.9) | 28 078 (93.2) |
| Unknown | 262 | 8 |
| **Primary site** | | |
| Proximal colon | 164 936 (50.1) | 11 855 (39.4) |
| Sigmoid colon | 70 175 (21.3) | 8375 (27.8) |
| Rectum | 83 997 (25.5) | 9185 (30.5) |
| Others | 10 142 (3.1) | 709 (2.3) |
| **Tumour grade** | | |
| I | 29 169 (9.8) | 2126 (7.7) |
| II | 203 161 (68.2) | 20 264 (73.1) |
| III | 62 354 (20.9) | 5168 (18.6) |
| Undifferentiated | 3387 (1.1) | 172 (0.6) |
| Unknown | 31 179 | 2394 |
| **Median household income (in 10 $)** | | |
| Mean | 4784.4 | 5126.6 |
| Median (range) | 4644 (1581–7989) | 4982 (933–7989) |
The proportion of patients who had proximal colon cancer was much higher in the Japanese group (43.2%) than in other subgroups.

Risk factors and screening behaviours. Overweight and obesity proportions in Asian subgroups were much lower than in NHW. Smoking (current or former) was most prevalent in Korean men (56.6%). Alcohol use was much higher in NHW men (39.9%) and Korean men (36.5%). Vietnamese men had lower proportions of screening tests (52.2%) than other Asian groups. Korean women had lower proportions of screening tests (56.7%) than other Asian groups.

Table 2. Comparison of patient, tumour, and treatment characteristics among subgroups in the Asian cohort in patients with colorectal cancer (n = 30 124)

| Characteristic | Filipino (n = 5764) | Japanese (n = 8105) | Chinese (n = 7213) | Hawaiian (n = 2070) | Korean (n = 2257) | Indian/Pakistani (n = 900) | Vietnamese (n = 1690) | Other (n = 2125) |
|---------------|---------------------|---------------------|--------------------|---------------------|--------------------|-------------------------|----------------------|-----------------|
| Age at diagnosis (years) | | | | | | | | |
| Mean | 65.3 | 69.8 | 68.3 | 61.6 | 64.3 | 59.6 | 61.5 | 62.4 |
| Median (range) | 66 (12–100) | 71 (23–100) | 70 (17–102) | 62 (12–96) | 65 (17–97) | 60.5 (18–96) | 62 (19–98) | 63 (14–97) |
| < 40 | 212 (3.8) | 115 (1.5) | 188 (2.7) | 137 (6.8) | 85 (3.9) | 79 (9.0) | 124 (7.4) | 139 (6.7) |
| 40–64 | 2222 (39.5) | 2076 (26.3) | 2153 (30.4) | 966 (48.3) | 909 (41.4) | 439 (50.1) | 787 (47.3) | 938 (45.0) |
| 65+ | 3193 (56.8) | 5710 (72.3) | 4739 (66.9) | 899 (44.9) | 1201 (54.7) | 359 (40.9) | 754 (45.3) | 1008 (48.4) |
| Sex | | | | | | | | |
| Female | 2599 (45.1) | 3886 (47.9) | 3487 (48.3) | 914 (44.1) | 1089 (48.2) | 387 (43.0) | 818 (48.4) | 1055 (49.6) |
| Male | 3165 (54.9) | 4219 (52.1) | 3726 (51.7) | 1156 (55.9) | 1167 (51.8) | 513 (57.0) | 872 (51.6) | 1070 (50.3) |
| Marital status at diagnosis | | | | | | | | |
| Married | 3921 (69.5) | 5003 (62.8) | 4972 (68.4) | 1176 (58.4) | 1573 (71.3) | 667 (76.3) | 1089 (66.4) | 1415 (69.0) |
| Other | 1723 (30.5) | 2958 (37.2) | 2079 (29.5) | 838 (41.6) | 809 (41.9) | 246 (23.7) | 550 (33.6) | 636 (31.0) |
| Unknown | 120 | 144 | 162 | 56 | 50 | 26 | 51 | 74 |
| Stage | | | | | | | | |
| I | 1247 (21.6) | 2013 (24.8) | 1671 (23.2) | 428 (20.7) | 495 (21.9) | 193 (21.4) | 351 (20.8) | 549 (25.8) |
| II | 1471 (25.5) | 2268 (28.0) | 2088 (28.9) | 514 (26.1) | 612 (27.1) | 246 (27.3) | 475 (28.1) | 533 (25.1) |
| III | 1809 (31.4) | 2459 (30.3) | 2122 (29.4) | 613 (29.6) | 743 (32.9) | 279 (31.0) | 503 (29.8) | 645 (30.4) |
| IV | 1237 (21.5) | 1365 (16.8) | 1332 (18.5) | 488 (23.6) | 407 (18.1) | 182 (20.2) | 361 (21.3) | 398 (18.7) |
| Surgery on primary | | | | | | | | |
| Not performed | 492 (8.5) | 436 (5.4) | 426 (5.9) | 183 (8.8) | 147 (6.5) | 76 (8.4) | 109 (6.4) | 169 (8.0) |
| Performed | 5269 (91.5) | 7669 (94.6) | 6785 (94.1) | 1886 (91.2) | 2109 (93.5) | 824 (91.6) | 1581 (93.6) | 1955 (92.0) |
| Unknown | 3 | 0 | 0 | 1 | 1 | 0 | 0 | 1 |
| Primary site | | | | | | | | |
| Proximal colon | 1907 (33.1) | 3499 (43.2) | 3033 (42.1) | 802 (38.7) | 807 (35.7) | 331 (36.8) | 655 (38.8) | 821 (38.6) |
| Sigmoid colon | 1726 (29.9) | 2190 (27.0) | 2028 (28.1) | 524 (25.3) | 606 (26.9) | 239 (26.6) | 457 (27.0) | 605 (28.5) |
| Rectum | 1987 (34.5) | 2254 (28.7) | 1999 (27.7) | 672 (32.5) | 795 (35.2) | 299 (33.2) | 539 (31.9) | 640 (30.1) |
| Others | 144 (2.5) | 162 (2.0) | 153 (2.1) | 72 (3.5) | 49 (2.2) | 31 (3.4) | 39 (2.3) | 59 (2.8) |
| Tumour grade | | | | | | | | |
| I | 425 (8.1) | 567 (7.5) | 457 (6.9) | 147 (7.8) | 175 (8.3) | 81 (9.8) | 102 (6.5) | 172 (8.9) |
| II | 3807 (72.1) | 5766 (76.6) | 4825 (72.8) | 1413 (75.1) | 1463 (69.9) | 565 (68.3) | 1088 (69.7) | 1339 (69.5) |
| III | 1011 (19.1) | 1167 (15.5) | 1295 (19.9) | 314 (16.7) | 444 (21.2) | 172 (20.8) | 361 (23.2) | 404 (21.0) |
| Undifferentiated | 37 (0.7) | 30 (0.4) | 53 (0.8) | 8 (0.4) | 12 (0.6) | 9 (1.1) | 10 (0.6) | 13 (0.7) |
| Unknown | 484 | 575 | 583 | 188 | 163 | 73 | 131 | 197 |
| Median household income (in 10 $) | | | | | | | | |
| Mean | 5133.8 | 4974.8 | 5299.9 | 4936.9 | 4896.2 | 5456.6 | 5443.5 | 5155.5 |
| Median (range) | 4982 (2426–7734) | 4982 (1956–7989) | 5522 (2274–7989) | 4982 (933–7734) | 4289 (2986–7989) | 5595 (2315–7989) | 5316 (2713–7734) | 5191 (1906–7989) |
Table 3. Prevalence of risk factors, screening behaviours, and health care access among Asian American ethnic groups versus NHW in California*, stratified by gender

|                      | Chinese | Japanese | Korean | Filipino | Vietnamese | NHW |
|----------------------|---------|----------|--------|----------|------------|-----|
| **Male**             |         |          |        |          |            |     |
| Smoking status       |         |          |        |          |            |     |
| Current              | 8.2%    | 10.1%    | 21.5%  | 18.6%    | 30.5%      | 15.9%|
| Former               | 15.6%   | 27.5%    | 35.1%  | 22.0%    | 19.4%      | 32.9%|
| Never^               | 76.3%   | 62.3%    | 43.4%  | 59.4%    | 50.1%      | 51.2%|
| Alcohol              |         |          |        |          |            |     |
| Drinker              | 19.7%   | 12.3%    | 35.5%  | 34.8%    | 22.5%      | 39.9%|
| None in 1 year       | 80.3%   | 87.7%    | 64.5%  | 65.2%    | 77.5%      | 60.1%|
| BMI                  |         |          |        |          |            |     |
| <25                  | 70.9%   | 52.4%    | 58.9%  | 49.9%    | 75.1%      | 40.2%|
| ≥25                  | 29.1%   | 47.6%    | 41.1%  | 50.1%    | 24.9%      | 59.8%|
| Level of physical activity* |       |          |        |          |            |     |
| No                   | 18.1%   | 12.5%    | 15.6%  | 14.0%    | 23.7%      | 11.3%|
| Some                 | 52.7%   | 48.5%    | 53.4%  | 48.1%    | 54.5%      | 46.8%|
| Moderate             | 15.1%   | 17.7%    | 12.3%  | 13.2%    | 11.2%      | 19.1%|
| Vigorous             | 14.2%   | 21.3%    | 18.6%  | 24.7%    | 18.0%      | 22.9%|
| Ever had sigmoidoscopy, colonoscopy, or FOBT* |       |          |        |          |            |     |
| Never had one of them| 18.7%   | 21.8%    | 27.6%  | 31.3%    | 47.8%      | 16.5%|
| Have had one of them | 81.3%   | 78.2%    | 72.4%  | 68.7%    | 52.2%      | 83.5%|
| Type of most recent CRC screening |          |          |        |          |            |     |
| Colonoscopy          | 66.2%   | 55.3%    | 66.4%  | 45.5%    | 49.7%      | 56.4%|
| Sigmoidoscopy        | 11.1%   | 4.9%     | —      | 11.5%    | 4.7%       | 10.8%|
| FOBT                 | 22.7%   | 39.8%    | 31.3%  | 43.0%    | 45.6%      | 32.8%|
| CRC screening compliance at time of recommendation |          |          |        |          |            |     |
| Not compliant        | 25.7%   | 34.6%    | 31.3%  | 43.5%    | 50.0%      | 26.6%|
| Compliant            | 74.3%   | 65.4%    | 68.7%  | 56.5%    | 50.0%      | 73.4%|
| Health insurance     |         |          |        |          |            |     |
| Currently insured    | 90.3%   | 93.5%    | 70.1%  | 82.9%    | 90.2%      | 91.4%|
| Not                  | 9.7%    | 6.5%     | 29.9%  | 17.1%    | 9.8%       | 8.6% |
| Ever diagnosed with diabetes |       |          |        |          |            |     |
| Yes                  | 7.1%    | 12.5%    | 7.3%   | 16.1%    | 4.1%       | 7.1% |
| No                   | 92.9%   | 87.5%    | 92.7%  | 83.9%    | 95.9%      | 92.9%|
| Female               |         |          |        |          |            |     |
| Smoking status       |         |          |        |          |            |     |
| Current              | 2.9%    | 6.9%     | 9.5%   | 4.6%     | 2.0%       | 12.4%|
| Former               | 5.3%    | 18.3%    | 8.6%   | 9.2%     | 1.0%       | 27.4%|
| Never^               | 91.9%   | 74.8%    | 81.9%  | 86.3%    | 97.0%      | 60.2%|
| Alcohol              |         |          |        |          |            |     |
| Drinker              | 5.9%    | 9.0%     | 17.6%  | 16.9%    | 14.8%      | 25.7%|
| None in 1 year       | 94.1%   | 91.0%    | 82.4%  | 83.1%    | 85.2%      | 74.3%|
Survival. Overall, Asian had better DSS than did NHW (Hazard ratio (HR) 0.95, \( P = 0.001 \)). Most Asian subgroups (Indian/ Pakistani, HR 0.68, \( P < 0.0001 \), Chinese, HR 0.94, \( P = 0.025 \), and Japanese HR 0.93, \( P = 0.006 \)), except Hawaiian (HR 1.2, \( P < 0.0001 \)), had better DSS than did NHW patients. Table 4 shows the association between disease stage, tumour grade, sex, primary site of tumour, status of surgery, year of diagnosis, age at diagnosis, and median household income with DSS in each ethnicity group. Patients with distal sigmoid colon cancer had better DSS in Filipino (HR 0.8, \( P = 0.03 \)). Advance tumour stages were highly associated with worse DSS in each ethnicity group. High tumour grades were associated with worse DSS in NHW, Filipino and Chinese. Older age at diagnosis was associated with worse DSS in most ethnicity groups except Hawaiian and Vietnamese. Higher income was associated with better DSS only in NHW and Hawaiian.

### DISCUSSION

This study is one of the most comprehensive population-based analyses of CRC by ethnicity reported in the literature, and looked at not only clinicopathologic factors (with 359 374 cases included) and also the lifestyle and screening data. Many of our findings confirm previous less comprehensive studies including: Asian groups’ lower use of screening (Fenton et al, 2009); Asian patients presented with more advanced disease than NHW (Ayanian, 2010; Robbins et al, 2012); a younger average age at diagnosis in Asian patients (Koo et al, 2008; Norwood et al, 2009; Sammour et al, 2010).

Racial/ethnic disparities in CRC survival has been extensively documented in the scientific literature (Chien et al, 2005; Fenton et al, 2009; Robbins et al, 2012). We found that most Asian patients had better DSS than did NHW. Differences in tumour site distribution and genetics may explain the high survival rates observed among Asians. That is, relative to other groups, Asians have higher rates of distal colon cancer, which is associated with a decreased risk of mortality. This further confirms the findings of previous studies (Le et al, 2009). We also found that Indian/Pakistani patients had better DSS than did other groups even after adjusted by age, tumour stage, grade, and tumour site. According to US census data, Asian Indians are the wealthiest major ethnic group in the country (Goggins and Wong, 2009). Thus, it is reasonable to hypothesise that the relatively higher CRC survival for Indian/Pakistani patients results from better treatment.
Table 4. Multivariate Cox proportional hazards analysis of clinicopathologic variables associated with disease-specific survival in patients with colorectal cancer in each ethnic group

| Variable                  | NHW | Asian | Filipino | Japanese | Chinese | Hawaiian | Korean | Indian/Pakistani | Vietnamese |
|---------------------------|-----|-------|----------|----------|---------|----------|--------|-----------------|------------|
| Stage                     |     |       |          |          |         |          |        |                 |            |
| I                         |     | Referent |     |          |          |          |        |                 |            |
| II                        | 2.1 | <0.001 | 2.1     | <0.001   | 2.5     | <0.001   | 2.0    | <0.001          | 2.1        |
| III                       | 4.7 | <0.001 | 4.8     | <0.001   | 5.1     | <0.001   | 4.8    | <0.001          | 4.2        |
| IV                        | 17.3| <0.001 | 19.5    | <0.001   | 18.3    | <0.001   | 22.2   | <0.001          | 18.8       |
| Tumour grade              |     |       |          |          |         |          |        |                 |            |
| Grade I                   |     | Referent |     |          |          |          |        |                 |            |
| Grade II                  | 1.1 | <0.001 | 1.2     | <0.001   | NS      | NS       | NS     | 1.7             | 0.02       |
| Grade III                 | 1.3 | <0.001 | 1.5     | <0.001   | 1.5     | 0.007    | NS     | 1.6             | 0.002      |
| Grade IV                  | 1.2 | <0.001 | 1.6     | <0.001   | NS      | NS       | NS     | NS              | NS         |
| Male vs female            | 1.1 | <0.001 | 1.1     | 0.004    | NS      | 1.1      | 0.01   | NS              | NS         |
| Primary site              |     |       |          |          |         |          |        |                 |            |
| Proximal colon            |     | Referent |     |          |          |          |        |                 |            |
| Sigmoid colon             | 1.1 | <0.001 | 0.96    | 0.2      | 0.8     | 0.03     | NS     | 1.7             | 0.04       |
| Rectum                    | 1.3 | <0.001 | 1.2     | <0.001   | NS      | 1.2      | <0.001 | NS              | NS         |
| Other                     | 1.1 | 0.048  | NS      | 0.7      | NS      | NS       | NS     | NS              | NS         |
| Year of diagnosis         |     |       |          |          |         |          |        |                 |            |
| 1988–1997                 |     | Referent |     |          |          |          |        |                 |            |
| 1998–2008                 | 0.8 | <0.001 | 0.8     | <0.001   | 0.8    | 0.003    | 0.79   | <0.001          | 0.8        |
| Primary surgery performed vs not performed | 0.7 | <0.001 | 0.6     | <0.001   | 0.6    | 0.63     | <0.001 | 0.6             | <0.001     |
| Median household income (in 10 $) | 0.99998 | <0.001 | 0.99996 | 0.01    | NS      | NS       | NS     | 0.9998          | 0.002      |
| Age at diagnosis (year)   | 1.01| <0.001 | 1.01    | <0.001   | 1.005   | 0.04     | 1.009  | <0.001          | 1.01       |

Abbreviations: HR = hazard ratio; NHW = non-Hispanic white; NS = not significant.
Lifestyle differences may also explain some of differences in CRC survival. Obese individuals have higher morbidity and mortality for many cancers including CRC (Cress et al., 2006). Obese patients have a 50% increased risk of developing CRC and a 30% higher risk of dying from CRC than non-obese patients (Calle et al., 2003). Moreover, obese patients treated for CRC have poorer OS than normal-weight patients (White et al., 2010). According to our study, overweight and obesity proportions in Asian subgroups were much lower than in NHW. This might be another contributing factor to better survival in Asian groups.

Regarding aetiologic factors, high alcohol intake has been consistently associated with increased risk and moderate or high physical activity with decreased risk of CRC, and these factors vary by race, sex, and socioeconomic status (Murphy et al., 2011). Smoking also appears to be a strong risk factor for CRC. In our study, alcohol use was most prevalent in NHW men and Korean men and smoking was most prevalent in Korean men. In contrast to the decreasing trends in CRC incidence reported among all major racial/ethnic groups, CRC rates are actually increasing among some Asian subgroups, including the Korean population (Giddings et al., 2012). Relatively high alcohol consumption and high smoking proportions in the Korean community might be related to the significant increase in CRC incidence.

Some limitations should be considered in the interpretation of this study. First, this study was limited by its use of national administrative databases. A lack of data on the individual level socioeconomic status and the administration of systemic therapies limited us from evaluating these factors as potential confounders. Second, the lifestyle and screening data were obtained only from California and included only five Asian subgroups, which may not represent the status of entire United States. However, most Asians in SEER are from California registries.

**CONCLUSION**

Our results, which are based on a large, national population-based sample, show that there are differences in presenting clinicopathologic features between CRC patients of different races/ethnicities of the United States and that these differences may affect survival.

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