**Colorectal cancer incidence trends by age, stage, and racial/ethnic group in California, 1990-2014**

Libby Ellis1,2,, Renata Abrahão1, Meg McKinley1, Juan Yang1, Ma Somsouk3, Loic Le Marchand4, Iona Cheng1,5, Scarlett Lin Gomez1,5, Salma Shariff-Marco1,2

1 Greater Bay Area Cancer Registry, Cancer Prevention Institute of California, Fremont, CA

2 Stanford Cancer Institute, Stanford, CA

3 Department of Medicine, University of California, San Francisco, CA

4 University of Hawaii Cancer Center, Honolulu, HI

5 Department of Epidemiology and Biostatistics, University of California, San Francisco, CA

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Corresponding author: Libby Ellis, Cancer Prevention Institute of California, 2201 Walnut Avenue, Suite 300, Fremont, CA 94538, Tel: 510-608-5278, Elizabeth.Ellis@cpic.org

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**ABSTRACT**

**Background**: The incidence of colorectal cancer (CRC) in the US declined substantially over the last 20 years, but evidence suggests that among younger adults (under 50 years at diagnosis), incidence is increasing. However, data on age- and stage-specific incidence trends across racial/ethnic groups are limited.

**Methods**: All incident cases of CRC diagnosed from 1990 through 2014 in adults aged 20 years and older were obtained from the California Cancer Registry. Incidence rates (per 100,000), incidence rate ratios, and triannual percent changes in incidence were estimated for each age group at diagnosis (20-49, 50–74, 75+ years), sex, stage, and race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, and 7 Asian American groups).

**Results**: Of 349,176 incident CRC cases diagnosed from 1990 through 2014, 9% were in adults younger than 50 years. Increases in incidence of early-onset CRC, especially in regional/distant stage disease, were observed in most racial/ethnic groups (statistically significant for non-Hispanic Whites and Hispanics, ranging from 0.9-2.9% every 3 years). Incidence also increased in Vietnamese and other Southeast Asian groups of screening age (50-74 years). The incidence of CRC in non-Hispanic Blacks aged 50+ declined over the 25-year period, but remained significantly higher than in non-Hispanic Whites.

**Conclusion**: Further research is needed to understand the causes of the increasing incidence of early-onset CRC. The rising incidence of CRC among Southeast Asians of screening age, and the persistently high incidence in non-Hispanic Blacks also warrants attention.

**Impact**: Our findings may have implications for revisiting screening guidelines in the United States.

**INTRODUCTION**

In the US, colorectal cancer (CRC) is the third most common malignancy and the second and third leading cause of cancer death among men and women, respectively.[1](#_ENREF_1) Over the last 20 years, there has been a substantial decline in the incidence of CRC, largely attributable to the introduction of screening for adults aged between 50 and 75 years and a reduction in modifiable risk factors such as smoking.[2](#_ENREF_2) However, recent evidence suggests that the incidence of early-onset CRC (i.e. in adults aged less than 50 years) is rising,3-6 prompting debate about the most effective starting age for CRC screening, and a call for investigation into the risks and benefits of screening before age 50.6-10

In the US, CRC disproportionately affects the Non-Hispanic (NH) Black population, who consistently experience one of the highest incidence rates of all racial/ethnic groups. Over the period 2009-2013, the incidence of CRC among NH Black men was 58 per 100,000 compared to 46 among NH White men, 43 among Hispanic men, and 38 among Asian American and Pacific Islander (AAPI) men.11 Whilst AAPI populations combined have a comparatively low incidence of CRC, ethnicities within this classification have very different cancer profiles. In 2004-2008, the incidence of CRC among Japanese men was 67 per 100,000, compared to 23 among Indian and Pakistani Asians.12 There is also evidence to suggest that CRC incidence rates in these populations are increasing, both in young adults6,13 and among those eligible for screening.12,14

California has the largest and most diverse racial/ethnic population in the US: in 2016 the population was 39% Hispanic, 38% NH White, 15% AAPI, and 6% NH Black.15 Using data from the California Cancer Registry (CCR), we examined trends in incidence of CRC among detailed racial/ethnic groups by age and stage over the 25-year period 1990-2014, with a specific focus on young adults.

**METHODS**

**Study population**

The California Cancer Registry (CCR, www.ccrcal.org), a statewide population-based cancer surveillance system comprising three SEER registries, has collected detailed information on patients diagnosed with cancer in California since 1988. Data from the CCR were obtained on all cases of CRC diagnosed in adults aged 20 years and older from 1990 through 2014 (n=349,176). Age group at diagnosis was defined as 20-49 years, 50-74 years (screening age), and 75 years or older. In supplementary analyses, tumor subsite was stratified as right colon (C18.0-C18.4), left colon (C18.5-C18.7), and rectum (C19.9, C20.9).

Stage at diagnosis was based on the Surveillance Epidemiology and End Results (SEER) Summary Stage16 and categorized as: early stage (in situ and localized tumors) and late stage (regional and distant tumors). Race/ethnicity was obtained from medical records and categorized as: NH White, NH Black, Hispanic, Chinese, Japanese, Filipino, Korean, South Asian (Indian and Pakistani), Vietnamese, and other Southeast Asian (Thai, Hmong, Cambodian, Laotian). Hispanic and Asian ethnicity were additionally coded based on birthplace and surnames using the validated North American Association of Central Cancer Registries (NAACCR) Hispanic Identification Algorithm (NHIA)17 and Asian Pacific Islander Identification Algorithm (NAPIIA)18. For Asian American groups, trends in CRC incidence in California were compared to national trends for the same time period (1990-2014) using specialized SEER incidence data for detailed Asian/Pacific Islander groups in SEER 9 registries.19

**Statistical Analysis**

Annual cancer incidence rates (per 100,000 population) for each strata defined by sex, age, race/ethnicity and stage at diagnosis were calculated and age-adjusted to the 2000 US standard population using the SEER\*Stat software (version 8.3.4).20 A minimum of 5 incident cases per strata were required for incidence rate calculations. Annual population counts were estimated using linear interpolation and extrapolation of 1990, 2000, and 2010 Census counts. Incidence rates by sex, age, race/ethnicity, and stage are presented for the most recent 5-year period (2010-2014), and incidence rate ratios (IRR) reported for each racial/ethnic group compared to NH Whites. Trends in incidence over the 25-year period 1990-2014 are presented by sex, age, race/ethnicity, and stage. Joinpoint regression models21 were used to characterize the magnitude and direction of incidence trends. The simplest Joinpoint models were fitted (zero joinpoints, linear trend), with one annual percentage rate change (APC) reported for the entire period.22 To accommodate for the small number of cases in some strata, three-year cumulative incidence rates were used to improve the stability of annual percent change statistics (tAPC).

**RESULTS**

Of the 68,884 incident cases of CRC diagnosed in California in the period 2010-2014, 10.9% (n=7,572) occurred in adults aged less than 50 years, but the proportion varied substantially by racial/ethnic group. Approximately 21% of South Asians and 20% of Southeast Asians were younger than 50 years at diagnosis, compared to 8.6% of NH Whites and Japanese. Patients younger than 50 years were more likely to present with late stage disease: approximately 66% of early-onset CRCs were classified as late-stage (regional or distant disease) at diagnosis, compared to 54% of cases in adults aged 50 years and older.

**Incidence rates and IRRs (2010-2014)**

The incidence of CRC varied dramatically across age and racial/ethnic groups (Table 1). In the 20-49 year age group, there was no difference in incidence between NH Blacks and NH Whites for either early or late stage disease (Table 2). In Hispanics, the incidence of early-onset CRC (early and late stage) was 20-30% lower than in NH Whites, and in several Asian American groups (Korean and South Asian men and women, and Chinese women) the incidence of late stage CRC was 30-60% lower.

In the screening age group (50-74 years), the high incidence of CRC in NH Blacks was particularly evident. Compared to NH Whites, NH Black men had 50% higher incidence of early stage CRC (IRR 1.5, 95% CI 1.4-1.6) and 40% higher incidence of late stage disease (IRR 1.4, 95% CI 1.3-1.5), whilst NH Black women had 60% higher incidence of early stage (IRR 1.6, 95% CI 1.4-1.7) and 40% higher incidence of late stage CRC (IRR 1.4, 95% CI 1.3-1.5).

**Trends in CRC incidence (1990-2014)**

Over the period 1990-2014, the incidence of early-onset CRC increased in nearly all racial/ethnic groups in California, and was most pronounced for regional/distant stage. Increases were statistically significant in NH White men (by +0.9% every 3 years for early stage; +1.9% for late stage) and Hispanic men (+1.6% for early stage; +2.2% for late stage) (Table 3, Figures 1A & 1B). Similarly, the incidence of early-onset CRC in women increased significantly in NH Whites (by +1.9% every 3 years for early stage; +2.4% for late stage), Hispanics (+2.1% for early stage; +0.7% for late stage), and Southeast Asians (+2.7% for late stage) (Table 3, Figures 1C & 1D). At the national level, as represented by SEER data, the incidence of early-onset CRC increased significantly in South Asian men and women, and Filipino, Vietnamese, and other Southeast Asian men (Supplementary Figure 1). There were statistically significant increases in incidence for all subsites (left colon, right colon, and rectum), with the largest increases seen for left colon and rectal cancer in NH Whites and Hispanics (Supplementary Table 1).

There were large declines in the incidence of CRC in adults aged 50 and older in California over the period 1990-2014. For screening-aged adults, significant decreases in the incidence of early-stage CRC were seen for NH White men (by -1.9% every 3 years), NH White women (-1.3%), and Japanese men (-2.2%) (Table 3, Supplementary Figure 2). More widespread declines were found for late-stage CRC, with significant decreases for NH White, NH Black, Hispanic, Chinese and Japanese men and women, by approximately -1% to -3% every 3 years. Declines in incidence in adults aged 50 and older were most notable for left colon and rectal cancers (Supplementary Table 1). In contrast, the incidence of early stage CRC increased in Vietnamese women by +1.5% every 3 years, and the incidence of late stage CRC increased in Southeast Asian men by +4.1% every 3 years, and in Southeast Asian women by +2.7% every 3 years (Table 3, Supplementary Figure 2). The increasing trend in CRC incidence for Vietnamese and other Southeast Asian women of screening age was also seen at a national level (Supplementary Figure 3).

**DISCUSSION**

We leveraged high-quality contemporary data from the CCR to investigate trends in the incidence of CRC over a 25-year period (1990-2014) by race/ethnicity, including seven Asian American ethnic groups, with attention to examining trends among young adults. In California, the most populous and racially/ethnically diverse state in the US, we found increases in the incidence of advanced stage early-onset CRC among nearly all racial/ethnic groups, with statistically significant increases for NH White and Hispanic adults. While the incidence of CRC among adults of screening age has declined in most racial/ethnic groups, we observed increasing incidence among Vietnamese and other Southeast Asian groups (Thai, Hmong, Cambodian, and Laotian). The high incidence of CRC in screening-age and older NH Blacks persisted over this 25-year period, although there is evidence of a decline in these age groups.

Reports of rising CRC incidence among young adults in the US, as well as among vulnerable populations such as immigrants23, are mounting. In our study, statistically significant increases in the incidence of early-onset CRC were limited to NH White and Hispanic populations, the two largest racial/ethnic groups in California. Although the number of CRC cases in young adults remains small compared to older adults, long-term projections suggest that by 2030, 11% of colon cancers and 23% of rectal cancers in the US will occur in individuals younger than 50 years.11 The rising incidence of early-onset CRC does not appear to be unique to the US,24 with similar patterns reported in Canada,25 Australia,26,27 and Asia.28,29 The underlying causes of the increasing incidence in this age group are unclear, though poor diet, sedentary lifestyles, and increasing rates of obesity are likely to be contributing.30

There is robust evidence that effective screening strategies can reduce the incidence of and mortality from CRC through early diagnosis and removal of precancerous lesions (adenomatous polyps)31-33, and eliminate racial/ethnic disparities.34 The US Preventive Services Task Force35 currently recommends that average-risk adults aged 50-75 years have either a high-sensitivity fecal occult blood test (FOBT), fecal immunochemical test (FIT), or multitargeted stool DNA test (FIT-DNA) every year; flexible sigmoidoscopy every 5 years, or every 10 years with FIT every year; or colonoscopy every 10 years. Except for those at increased risk of the disease (e.g. those with inflammatory bowel disease, history of familial adenomatous polyposis or hereditary nonpolyposis, a previous adenomatous polyp, or a family history of CRC), adults under 50 are not included in these guidelines. Some reports suggest that screening initiated at age 45 years is cost effective,36 and could achieve a more favorable balance between benefit (life-years gained) and burden,37 but the debate on the risks and benefits of screening before age 50 for asymptomatic average-risk adults continues.

For adults aged 50-75 years, CRC screening recommendations have been in place in some form since the mid-1990s, but uptake has been lower than expected23,38 and varies considerably by race/ethnicity. 23,38-39 In 2008, only 55% of the US population was up-to-date with CRC screening.40 Whilst there has been some improvement over time, a report by the US Centers for Diseases Control and Prevention (CDC) found that by 2015 only 62% of screening eligible adults were up-to-date with CRC screening, still short of the Healthy People 2020 target of 70.5%.41

Yet, we found widespread declines in the incidence of CRC among screening age adults in most racial/ethnic groups in California, commensurate with improved screening uptake over time. Two notable exceptions were in screening-aged Vietnamese and other Southeast Asian men and women, for whom there has been an increase in CRC incidence. In non-Vietnamese Southeast Asians, the increase of 3-4% every 3 years is striking; by 2000-2014, the incidence of late stage CRC in men was higher than in NH Black men. The reasons behind this increase are unclear, and could be partially explained by a low uptake of screening,40 in addition to increases in CRC risk factors including obesity. Klabunde et al. identified a number of population groups with consistently low uptake of CRC screening, such as recent immigrants (those who have been in the US for less than 10 years), and those with poor education, low income and lack of health insurance,23 but the relevance of these factors to Southeast Asian populations is difficult to assess, due to the lack of information specific to this Asian American ethnic group.

The incidence of CRC in NH Blacks aged 50 and over was consistently high throughout the study period. In addition to a high prevalence of lifestyle-related risk factors, it has been postulated that a low uptake of screening in this population could be the underlying cause of this trend, although data from the California Health Interview Survey (CHIS)42 and CDCs Behavioral Risk Factor Surveillance System (BRFSS)43 report equivalent screening rates for NH Black and NH White populations (78% and 72%, respectively, in 2014).43 Whilst our finding of declining incidence in NH Blacks of screening age is a positive one, the faster rate of decline in NH Whites means Black/White disparities persist. In 2017, in response to the higher incidence and younger mean age of CRC onset in African Americans, the US Multi-Society Task Force on Colorectal Cancer recommended beginning screening at age 45 in this population.44 It is worth noting that in our study, the incidence of early-onset CRC in 2010-2014 was similar for NH Black and NH White populations, and even higher for some Asian American ethic groups.

Our study has several limitations that are inherent to cancer registry data. We did not have access to important information on family history of CRC or other lifestyle-related risk factors (obesity, smoking, diet, physical activity), clinical data such as microsatellite instability, or genetic data (KRAS mutation). We also lacked data on Hispanic country of origin, nativity and immigration history. It has been suggested that the acculturation of recent immigrants may result in a higher prevalence of risk factors for CRC, including obesity, lack of physical activity, smoking and alcohol consumption.45,46 We found increases in the incidence of early-onset CRC in most racial/ethnic groups in California, but due to the small number of cases in some strata, especially for the AAPI groups, increases were only statistically significant for NH White and Hispanic groups. To assess whether the incidence of CRC is increasing in AAPI groups at the national level, we examined SEER incidence data for AAPI groups over the period 1990-2014,19 and found statistically significant increases in CRC incidence for South Asian men and women, and Filipino, Vietnamese and other Southeast Asian men aged under 50, and non-significant increases for Japanese, Chinese and Koreans.

In summary, our results emphasize the need to investigate the causes of the rising incidence rates of CRC among young adults and among Southeast Asians of screening age, as well as the persistently high incidence among screening age and older NH blacks. The heterogeneity of incidence rates across Asian American ethnic groups reinforces the need to disaggregate cancer statistics for this population. Improvements in CRC awareness among patients and physicians, the promotion and availability of recommended screening test, and the early initiation of screening for high-risk populations are crucial to decrease the burden of CRC.

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Figure legends

**Figure 1**. Trends in the incidence of early-onset colorectal cancer by race/ethnicity in California, 1990-2014: A) Men, early stage, B) Men, late stage, C) Women, early stage, D) Women, late stage

**Footnote to Figure 1**: Solid line indicates a statistically significant linear trend, dashed line indicates a non-statistically significant trend. Trend for Southeast Asians (women aged 20-49, early stage) could not be calculated due to ≤5 cases diagnosed in at least one tri-annual period.

**Table 1. Number of cases† and five-year cumulative age-adjusted incidence rates (IR) of colorectal cancer by sex, age at diagnosis, stage at diagnosis and race/ethnicity: California 2010-2014**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **Early stage** | | | | | | **Late stage** | | | | | |
| **20-49 years** | | **50-74 years** | | **75+ years** | | **20-49 years** | | **50-74 years** | | **75+ years** | |
| N | IR (95% CI) | N | IR (95% CI) | N | IR (95% CI) | N | IR (95% CI) | N | IR (95% CI) | N | IR (95% CI) |
| **Men** | |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Chinese | 45 | 3.2 (2.4, 4.4) | 404 | 47.8 (43.2, 52.8) | 233 | 117.7 (103.1, 133.8) | 93 | 6.6 (5.3, 8.1) | 440 | 51.5 (46.8, 56.7) | 262 | 132.4 (116.8, 149.4) |
|  | Japanese | 16 | 5.0 (2.8, 8.2) | 123 | 60.2 (49.8, 72.1) | 63 | 88.6 (67.2, 114.4) | 26 | 8.2 (5.3, 12.1) | 151 | 68.2 (57.5, 80.3) | 93 | 129.8 (103.7, 160.4) |
|  | Filipino | 47 | 3.6 (2.7, 4.8) | 387 | 52.0 (46.8, 57.5) | 96 | 86.8 (70.2, 106.1) | 84 | 6.5 (5.2, 8.0) | 402 | 54.1 (48.8, 59.8) | 133 | 121.5 (101.6, 144.1) |
|  | Korean | 24 | 4.7 (3.0, 7.0) | 139 | 49.4 (41.5, 58.3) | 60 | 130.7 (99.6, 168.6) | 17 | 3.3 (1.9, 5.3) | 172 | 60.9 (52.1, 70.7) | 64 | 142.7 (109.7, 182.5) |
|  | South Asian | 20 | 2.4 (1.4, 3.7) | 91 | 29.5 (23.6, 36.3) | 26 | 66.0 (42.7, 97.8) | 36 | 4.5 (3.1, 6.2) | 99 | 32.6 (26.4, 39.8) | 37 | 103.0 (71.8, 143.3) |
|  | Vietnamese | 29 | 4.0 (2.7, 5.8) | 217 | 60.5 (52.6, 69.3) | 57 | 98.2 (74.1, 127.8) | 54 | 7.6 (5.7, 9.9) | 226 | 63.6 (55.4, 72.6) | 75 | 133.9 (104.9, 168.6) |
|  | Southeast Asian | ≤10 | 3.7 (1.7, 6.9) | 38 | 32.3 (22.5, 44.8) | ≤10 | 44.7 (16.4, 97.8) | 25 | 9.9 (6.4, 14.6) | 92 | 77.1 (61.5, 95.3) | ≤10 | 74.3 (35.6, 137.2) |
|  | NH White | 588 | 3.8 (3.5, 4.1) | 5,848 | 47.2 (46.0, 48.5) | 3,110 | 114.7 (110.7, 118.8) | 1,245 | 8.1 (7.7, 8.6) | 6,748 | 53.8 (52.5, 55.1) | 3,741 | 136.8 (132.4, 141.3) |
|  | NH Black | 96 | 4.0 (3.2, 4.8) | 891 | 68.9 (64.4, 73.7) | 286 | 145.6 (129.1, 163.5) | 204 | 8.4 (7.3, 9.6) | 967 | 74.7 (70.0, 79.7) | 317 | 163.6 (146, 182.7) |
|  | Hispanic | 401 | 2.8 (2.5, 3.0) | 2,092 | 43.5 (41.6, 45.5) | 658 | 94.2 (87.2, 101.7) | 895 | 6.1 (5.7, 6.5) | 2,611 | 53.8 (51.7, 56.0) | 894 | 128.4 (120.1, 137.1) |
| **Women** | |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Chinese | 56 | 3.3 (2.5, 4.3) | 332 | 32.8 (29.3, 36.6) | 168 | 66.3 (56.5, 77.1) | 76 | 4.4 (3.5, 5.5) | 334 | 32.4 (28.9, 36.1) | 276 | 106.2 (93.9, 119.6) |
|  | Japanese | 21 | 4.7 (2.9, 7.3) | 98 | 36.3 (29.4, 44.3) | 118 | 76.7 (63.2, 92.1) | 26 | 6.1 (4.0, 9.0) | 116 | 43.1 (35.6, 51.8) | 185 | 121.9 (104.7, 141.1) |
|  | Filipino | 46 | 2.8 (2.1, 3.8) | 333 | 32.0 (28.6, 35.7) | 140 | 67.0 (56.4, 79.1) | 99 | 6.2 (5.0, 7.5) | 353 | 33.7 (30.3, 37.5) | 162 | 77.6 (66.1, 90.5) |
|  | Korean | 17 | 2.7 (1.6, 4.4) | 119 | 33.6 (27.8, 40.2) | 60 | 85.2 (65.0, 109.6) | 27 | 4.3 (2.9, 6.3) | 162 | 45.3 (38.6, 52.9) | 60 | 85.0 (64.9, 109.4) |
|  | South Asian | 18 | 2.6 (1.5, 4.1) | 43 | 15.6 (11.2, 21.0) | 19 | 46.5 (27.8, 73.0) | 35 | 5.4 (3.7, 7.5) | 62 | 22.4 (17.1, 28.8) | 24 | 58.0 (36.9, 86.8) |
|  | Vietnamese | 27 | 3.6 (2.3, 5.2) | 157 | 38.4 (32.5, 45.1) | 50 | 74.7 (55.4, 98.5) | 62 | 8.2 (6.3, 10.5) | 194 | 48.5 (41.8, 55.9) | 67 | 100.3 (77.7, 127.3) |
|  | Southeast Asian | ≤10 | 1.7 (0.6, 3.9) | 43 | 30.4 (21.7, 41.4) | ≤10 | 44.8 (20.3, 85.1) | 29 | 9.0 (6.0, 12.9) | 75 | 50.7 (39.4, 64.1) | 12 | 55.0 (28.1, 97.0) |
|  | NH White | 589 | 4.0 (3.6, 4.3) | 4,294 | 33.1 (32.1, 34.1) | 3,627 | 91.9 (88.9, 95.1) | 1,078 | 7.4 (6.9, 7.8) | 5,160 | 39.4 (38.3, 40.5) | 4,532 | 111.9 (108.6, 115.3) |
|  | NH Black | 95 | 3.9 (3.1, 4.8) | 765 | 51.6 (47.9, 55.4) | 284 | 89.5 (79.4, 100.6) | 171 | 7.3 (6.2, 8.5) | 837 | 55.9 (52.1, 59.9) | 394 | 126.5 (114.3, 139.7) |
|  | Hispanic | 425 | 3.0 (2.7, 3.3) | 1,717 | 30.7 (29.3, 32.3) | 677 | 64.3 (59.6, 69.4) | 716 | 5.1 (4.7, 5.5) | 1,976 | 35.1 (33.5, 36.7) | 919 | 86.9 (81.3, 92.7) |

† Cells with 10 or fewer cases have been suppressed

**Table 2. Five-year cumulative age-adjusted incidence rate ratios (IRRs, compared to NH Whites) of colorectal cancer by sex, age at diagnosis, stage at diagnosis and race/ethnicity: California 2010-2014**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **Early stage** | | | | | | **Late stage** | | | | | |
|  | | **20-49 years** | | **50-74 years** | | **75+ years** | | **20-49 years** | | **50-74 years** | | **75+ years** | |
| IRR | 95% CI | IRR | 95% CI | IRR | 95% CIs | IRR | 95% CI | IRR | 95% CI | IRR | 95% CI |
| **Men** | |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Chinese | 0.9 | 0.6, 1.2 | 1.0 | 0.9, 1.2 | 1.0 | 0.9, 1.2 | 0.8 | 0.6, 1.0 | 1.0 | 0.8, 1.1 | 1.0 | 0.8, 1.1 |
|  | Japanese | 1.3 | 0.8, 2.2 | 1.3 | 1.0, 1.6 | 0.8 | 0.6, 1.0 | 1.0 | 0.7, 1.5 | 1.3 | 1.0, 1.5 | 0.9 | 0.8, 1.2 |
|  | Filipino | 1.0 | 0.7, 1.3 | 1.1 | 0.9, 1.3 | **0.8** | **0.6, 0.9** | 0.8 | 0.6, 1.0 | 1.0 | 0.9, 1.2 | 0.9 | 0.7, 1.1 |
|  | Korean | 1.3 | 0.8, 1.9 | 1.0 | 0.9, 1.3 | 1.1 | 0.9, 1.5 | **0.4** | **0.3, 0.7** | 1.1 | 0.9, 1.4 | 1.0 | 0.8, 1.3 |
|  | South Asian | 0.6 | 0.4, 1.0 | **0.6** | **0.5, 0.8** | **0.6** | **0.4, 0.8** | **0.6** | **0.4, 0.8** | **0.6** | **0.5, 0.8** | 0.8 | 0.5, 1.0 |
|  | Vietnamese | 1.1 | 0.7, 1.6 | **1.3** | **1.1, 1.5** | 0.9 | 0.7, 1.1 | 0.9 | 0.7, 1.2 | 1.2 | 1.0, 1.4 | 1.0 | 0.8, 1.2 |
|  | Southeast Asian | 1.0 | 0.5, 1.9 | 0.7 | 0.5, 1.0 | **0.4** | **0.2, 0.9** | 1.2 | 0.8, 1.8 | **1.4** | **1.1, 1.8** | 0.5 | 0.3, 1.0 |
|  | NH White | Ref |  | Ref |  | Ref |  | Ref |  | Ref |  | Ref |  |
|  | NH Black | 1.1 | 0.8, 1.3 | **1.5** | **1.4, 1.6** | **1.3** | **1.1, 1.4** | 1.0 | 0.9, 1.2 | **1.4** | **1.3, 1.5** | **1.2** | **1.1, 1.3** |
|  | Hispanic | **0.7** | **0.6, 0.9** | 0.9 | 0.8, 1.0 | **0.8** | **0.8, 0.9** | **0.7** | **0.7, 0.8** | 1.0 | 0.9, 1.1 | 0.9 | 0.8, 1.0 |
| **Women** | |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Chinese | 0.8 | 0.6, 1.1 | 1.0 | 0.8, 1.2 | **0.7** | **0.6, 0.8** | **0.6** | **0.5, 0.8** | 0.8 | 0.7, 1.0 | 0.9 | 0.8, 1.1 |
|  | Japanese | 1.2 | 0.8, 1.9 | 1.1 | 0.9, 1.4 | 0.8 | 0.7, 1.0 | 0.8 | 0.6, 1.2 | 1.1 | 0.9, 1.4 | 1.1 | 0.9, 1.3 |
|  | Filipino | 0.7 | 0.5, 1.0 | 1.0 | 0.8, 1.1 | **0.7** | **0.6, 0.9** | 0.8 | 0.7, 1.1 | 0.9 | 0.7, 1.0 | **0.7** | **0.6, 0.8** |
|  | Korean | 0.7 | 0.4, 1.1 | 1.0 | 0.8, 1.3 | 0.9 | 0.7, 1.2 | **0.6** | **0.4, 0.9** | 1.2 | 0.9, 1.4 | 0.8 | 0.6, 1.0 |
|  | South Asian | 0.7 | 0.4, 1.1 | **0.5** | **0.3, 0.6** | **0.5** | **0.3, 0.8** | **0.7** | **0.5, 0.9** | **0.6** | **0.4, 0.7** | **0.5** | **0.3, 0.8** |
|  | Vietnamese | 0.9 | 0.6, 1.4 | 1.2 | 1.0, 1.4 | 0.8 | 0.6, 1.1 | 1.1 | 0.8, 1.5 | 1.2 | 1.0, 1.5 | 0.9 | 0.7, 1.2 |
|  | Southeast Asian | 0.4 | 0.2, 1.1 | 0.9 | 0.7, 1.3 | **0.5** | **0.3, 0.9** | 1.2 | 0.8, 1.8 | 1.3 | 1.0, 1.7 | **0.5** | **0.3, 0.9** |
|  | NH White | Ref |  | Ref |  | Ref |  | Ref |  | Ref |  | Ref |  |
|  | NH Black | 1.0 | 0.8, 1.2 | **1.6** | **1.4, 1.7** | 1.0 | 0.9, 1.1 | 1.0 | 0.8, 1.2 | **1.4** | **1.3, 1.5** | 1.1 | 1.0. 1.3 |
|  | Hispanic | **0.8** | **0.6, 0.9** | 0.9 | 0.8, 1.0 | **0.7** | **0.6, 0.8** | **0.7** | **0.6, 0.8** | 0.9 | 0.8, 1.0 | **0.8** | **0.7, 0.9** |

**Table 3**. Tri-annual percentage change (tAPC) in colorectal cancer incidence in California over the period 1990-2014, by sex, age group, stage at diagnosis, and race/ethnicity

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **Early stage** | | | | | | **Late stage** | | | | | |
| **20-49 years** | | **50-74 years** | | **75+ years** | | **20-49 years** | | **50-74 years** | | **75+ years** | |
| tAPC | 95% CI | tAPC | 95% CI | tAPC | 95% CI | tAPC | 95% CI | tAPC | 95% CI | tAPC | 95% CI |
| **Men** | |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Chinese | 0.4 | -2.0, 2.9 | -0.5 | -1.4, 0.4 | **-1.9** | **-3.2, -0.6** | 0.9 | -0.8, 2.6 | **-2.0** | **-2.9, -1.1** | **-3.6** | **-4.6, -2.6** |
|  | Japanese | 1.5 | -2.0, 5.0 | **-2.2** | **-3.4, -1.0** | -2.5 | -6.2, 1.4 | 0.9 | -2.4, 4.5 | **-2.7** | **-3.8, -1.7** | **-3.1** | **-6.0, -0.1** |
|  | Filipino | 1.1 | -1.1, 3.3 | 1.2 | -0.2, 2.5 | -0.1 | -2.6, 2.4 | 0.5 | -0.9, 1.8 | -0.9 | -2.0, 0.2 | **-1.9** | **-3.4, -0.3** |
|  | Korean | 0.7 | -1.8, 3.3 | 0.2 | -2.3, 2.7 | 0.8 | -2.4, 4.1 | 0.0 | -6.8, 7.3 | -0.7 | -2.0, 0.6 | -1.5 | -4.5, 1.4 |
|  | South Asian | -0.9 | -5.7, 4.2 | 0.0 | -2.5, 2.7 | -1.6 | -6.4, 3.5 | 0.2 | -3.2, 3.8 | -1.2 | -3.9, 1.6 | 0.8 | -2.2, 3.9 |
|  | Vietnamese | 1.1 | -3.9, 6.2 | 2.1 | -0.1, 4.3 | -1.3 | -4.1, 1.7 | 1.8 | -1.9, 5.7 | 0.4 | -0.3, 1.0 | -1.8 | -4.2, 0.5 |
|  | Southeast Asian | -1.0 | -3.8, 1.9 | 1.4 | -1.4, 4.2 | ~ |  | 2.7 | -0.7, 6.2 | **4.1** | **1.9, 6.3** | ~ |  |
|  | NH White | **0.9** | **0.4, 1.4** | **-1.9** | **-2.6, -1.1** | **-3.0** | **-3.7, -2.3** | **1.9** | **1.4, 2.4** | **-2.6** | **-2.9, -2.3** | **-3.4** | **-3.6, -3.1** |
|  | NH Black | -0.9 | -2.2, 0.4 | -0.6 | -1.7, 0.5 | **-1.2** | **-2.4, -0.1** | -0.1 | -1.3, 1.2 | **-1.9** | **-2.6, -1.2** | **-2.5** | **-3.4, -1.5** |
|  | Hispanic | **1.6** | **0.3, 2.9** | -0.5 | -1.2, 0.1 | -1.4 | -3.1, 0.4 | **2.2** | **1.6, 2.7** | **-0.9** | **-1.5, -0.3** | **-1.9** | **-2.7, -1.1** |
| **Women** | |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Chinese | 0.1 | -2.1, 2.4 | -0.4 | -1.4, 0.7 | **-2.4** | **-4.7, -0.1** | -1.8 | -3.6, 0.1 | **-2.1** | **-3.7, -0.5** | **-2.9** | **-4.3, -1.5** |
|  | Japanese | 0.5 | -3.1, 4.1 | -1.5 | -3.2, 0.3 | -2.1 | -4.9, 0.8 | 1.7 | -2.3, 5.8 | **-3.0** | **-4.8, -1.1** | **-2.2** | **-4.2, -0.2** |
|  | Filipino | -0.6 | -3.5, 2.4 | 1.4 | -0.1, 2.9 | 0.6 | -1.7, 2.9 | 0.7 | -0.4, 1.8 | -0.7 | -2.1, 0.7 | -1.4 | -3.9, 1.1 |
|  | Korean | 0.8 | -3.8, 5.5 | 0.4 | -2.5, 3.5 | 1.3 | -1.5, 4.2 | -1.9 | -4.8, 1.2 | 0.9 | -0.7, 2.6 | -1.4 | -4.0, 1.2 |
|  | South Asian | 4.3 | -2.0, 10.9 | -1.3 | -4.9, 2.5 | 1.0 | -3.0, 5.1 | 2.2 | -1.7, 6.2 | -0.8 | -2.9, 1.5 | ~ |  |
|  | Vietnamese | -0.5 | -3.1, 2.2 | **1.5** | **0.6, 2.5** | -1.5 | -4.0, 1.1 | 1.8 | -1.5, 5.2 | -0.4 | -1.9, 1.1 | **-2.4** | **-4.3, -0.4** |
|  | Southeast Asian | ~ |  | 3.1 | -0.9, 7.3 | ~ |  | **2.7** | **0.5, 4.9** | **2.7** | **1.2, 4.2** | 0.9 | -6.8, 9.3 |
|  | NH White | **1.9** | **0.8, 2.9** | **-1.3** | **-1.9, -0.6** | **-1.9** | **-2.5, -1.3** | **2.4** | **1.9, 3.0** | **-2.4** | **-2.7, -2.0** | **-2.8** | **-3.4, -2.2** |
|  | NH Black | 0.3 | -0.7, 1.4 | -0.4 | -1.3, 0.6 | **-2.1** | **-3.2, -1.0** | -0.3 | -1.8, 1.2 | **-1.8** | **-2.8, -0.7** | **-2.3** | **-3.7, -0.9** |
|  | Hispanic | **2.1** | **1.2, 3.1** | 0.3 | -0.3, 1.0 | -1.2 | -2.7, 0.2 | **0.7** | **0.1, 1.3** | **-1.2** | **-1.5, -0.8** | **-2.2** | **-2.8, -1.6** |

Figures in **bold** represent a statistically significant change in CRC incidence over the period 1990-2014

~ Tri-annual percent change could not be calculated due to fewer than 5 cases diagnosed in at least one tri-annual period