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Colorectal Cancer Trends in California and the Need for Greater Screening of Hispanic Men

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Abstract

Introduction: Colorectal cancer (CRC) incidence and mortality rates have decreased dramatically since 1990, both nationally and in California, except among Hispanic males. This study examined trends in CRC incidence, mortality and survival to determine likely contributing factors for the differential trends between Hispanic males and non-Hispanic white males in California.

Methods: California Cancer Registry data were used to identify 23,157 Hispanic and 114,944 white males diagnosed with CRC between 1990 and 2012. We examined joinpoint trends in incidence, mortality and five-year relative survival by age, stage at diagnosis, and tumor location. Data used in the study was extracted from the CCR database and analyzed in 2015.

Results: Both incidence and mortality rates decreased substantially among white men between 1990 and 2012, but no corresponding decrease was observed among Hispanic men. Both groups experienced similar trends in survival and stage at diagnosis over time. White men had greater declines in CRC incidence and mortality in all age groups, particularly above 50 years of age. Hispanic males had a significantly higher proportion (65%) of tumors in the distal colon than white males (59%).

Conclusions: CRC incidence and mortality rates have decreased among white men since 1990, but not among Hispanic men. Results from this study suggest - lower screening rates may be an important reason why CRC rates in California did not decline in Hispanic men. Effective strategies aimed at both Hispanics and their healthcare providers are needed to increase CRC screening among Hispanic men and reduce their colorectal cancer burden.

Introduction

Colorectal cancer (CRC) is the third most common cancer in the U.S., affecting men and women equally. Consistent with national trends, CRC mortality rates have declined substantially in California since the mid-1970s. [1] Between 1990 and 2013, California age-adjusted CRC mortality decreased from 26.9 to 15.2 deaths per 100,000 for males, and from 18.5 to 11.3 deaths per 100,000 for females.[2] Marked declines were reported for males and females in all four major racial/ethnic groups in California except Hispanic males. While CRC mortality declined among Hispanic women, particularly since 2005, mortality rates among Hispanic men have remained essentially unchanged since 1990.[3] Historically, Hispanic men have had lower rates of CRC mortality compared to non-Hispanic men; however, mortality rates in the two groups are now similar and may soon crossover.

Several reasons may explain differences in CRC rates between non-Hispanic white (white) and Hispanic men. Routine screening for colorectal cancer has greatly increased since the 1980's, and has been largely credited for the reduction in CRC incidence.[4] However, Hispanics are less likely to be screened,[5-7] less likely to be insured,[8] and possibly less likely to utilize healthcare than other ethnic groups.[9, 10] According to state cancer profiles (http://statecancerprofiles.cancer.gov/risk/index.php), the percentage of Hispanic males compliant with CRC screening recommendations in 2014 was 46.2% in the US and 44.9% in California. Among white men, these percentages were much higher: 67.6% and 72.4%, respectively, in the US and in California. The U.S. Census Bureau estimates Hispanics now comprise 38.4% of California's population, a percentage essentially identical to whites (39.0%).[11] Exploring reasons for differences in CRC mortality between white and Hispanic males may identify opportunities for improving California's population health.

This study sought to compare trends in CRC incidence, mortality and survival between Hispanic and white men in California. We examined trends by age, stage at diagnosis and location of tumors to assess whether screening and access to healthcare might explain different CRC trends between Hispanics and white men.

Methods

Study population

Incidence and survival analyses were based on data routinely collected by the California Cancer Registry (CCR) on all persons diagnosed with invasive colorectal cancer between January 1, 1990 and December 31, 2012. The CCR collects data on cancer patient demographics, diagnosis, tumor characteristics, treatment, and follow-up. Data are collected through three SEER-affiliated regional cancer registries in California, which together cover the entire state. Mortality data were obtained from the CDPH's Center for Health Statistics Death Master Files, based on ICD-9/ICD-10 codes recorded as the underlying cause of death between January 1, 1990 and December 31, 2013 (2013 data was available for mortality but not for cancer incidence at the time of this analysis). Data used in the study were extracted and analyzed in November 2015.

Colorectal cancer was defined according to International Classification of Diseases – Oncology (ICD-O) 3rd edition codes for tumor site (C180-C189, C199, C209, and C260) excluding histology codes 9050-9055, 9140 and 9590-9992 and non-microscopically confirmed cases. Hispanic ethnicity was assigned using the North American Association of Central Cancer

Registries' Hispanic and Asian/Pacific Islander Identification Algorithm (NAPIIA).[12] NAPIIA

classifies cases as Hispanic based on race, birthplace, last name and maiden name. Hispanic

ethnicity may be assigned to persons of any race, but only non-Hispanic whites are classified as

white. Age at diagnosis was categorized as <50 years, 50-64, 65-75 and over 75. These age

groups were chosen to reflect screening recommendations, eligibility for Medicare, and effects of

aging on CRC. Tumor subsite was classified as either distal colon and rectum (C185, C186,

C187, C199, and C209) or proximal colon (C180, C181, C182, C183, and C184). Previous

studies have shown distal colon cancer to be more sensitive to screening,[4] so differences in tumor

location may reflect differences in screening. SEER Extent of Disease and Collaborative Stage

system codes were converted to the American Joint Committee on Cancer (AJCC) staging

system, based on existing guidelines at the time of diagnosis. Source of health insurance

(available for cases diagnosed after 1995) was categorized as private/military (HMO, PPO, fee-

for service, Military, Veterans Affairs, and Medicare with private supplement), Medicare,

Medicaid/Public (Medicaid, Public Health Service, County funded), not insured, and unknown

source. Information on poverty level and percent of High School graduates at the patient's

census tract of residence was obtained from the US Census.

Statistical analysis

Differences in proportions for all study variables were evaluated using R version 3.1.1.

(http://www.r-project.org/), with a significance threshold of 0.05. Changes over time in the

percent distribution of CRC cases by stage at diagnosis were evaluated graphically. SEER*Stat

version 8.1.5 (http://seer.cancer.gov/seerstat/) was used to calculate CRC incidence and mortality

rates age-adjusted to the 2000 U.S. standard population, as well as to estimate relative survival.

Joinpoint regression (http://surveillance.cancer.gov/joinpoint/) was used to evaluate trends in

incidence and mortality for white and Hispanic males by age, stage at diagnosis, and location of

tumor. In this analysis, a statistical algorithm detects points in time ("joinpoints") where the

slope of the regression line significantly changes, with APCs being estimated for each time

period. Five-year relative survival was calculated as the ratio of the observed versus expected

survival rates, using the Ederer-II[13] method and California-specific life tables. Relative survival

is a measure of excess mortality among cancer patients without requiring cause of death

information (which may be misclassified for CRC).[14] Estimates were obtained stratified by

race/ethnicity, stage, and age at diagnosis. Patient's vital status was based on the follow-up date

of last contact (or death).

Results

Between 1990 and 2012, 23,157 (16.8%) Hispanic and 114,944 (83.2%) white men were

diagnosed with CRC in California. Hispanic men tended to be younger, more likely to have

Medicaid or other publicly-funded health insurance, and more likely to have a tumor located in

the distal colon (Table 1). Hispanic males were also more likely to live in neighborhoods

characterized by low SES and lower levels of educational attainment.

Overall CRC age-adjusted incidence rates in the study period were higher among white men than

Hispanic men (Figure 1); however, the two groups exhibited very different incidence trends.

Incidence among white men declined from 71.5 in 1990 to 49.1 in 2009, and to 41.3 in 2012

(APC 1990-2009 = -1.9, p < 0.001 and APC 2009-2012 = -6.2, p = 0.016). During the same

period, incidence rates among Hispanic men increased from 43.2 in 1990 to 49.1 in 2008,

declining afterwards to 39.1 in 2012 (APC 1990-2008 = 0.1, p = 0.563 and APC 2008-2012 =

-4.8, p = 0.043). CRC incidence increased with age in both groups. Men under 50 years of age

had the lowest incidence rate (5.3 per 100,000), and men 75 years of age and older had the

highest (383.6 per 100,000, data not shown). Incidence for men under 50 years of age increased

significantly between 1990 and 2012 for both Hispanics and whites (APC = 2.5 and 1.9,

respectively; Table 2). Among white men, incidence in each age group over 50 years of age

decreased. For Hispanics, however, CRC incidence increased among men 50-64 years old (APC

= 0.5, p = 0.018) and decreased only after age 65, at a slower rate than among white men of the

same age (Table 2).

The distribution of tumor location by subsite differed between the two groups: the proportion of

tumors in the distal colon and rectum was higher among Hispanic men, while the proportion of

proximal colon tumors was higher in white men (Table 1). Incidence rates for both the proximal

and distal colon declined substantially for whites, especially near the end of the period examined.

Among Hispanics, incidence of distal colon tumors decreased at a slower rate than among

whites, but rates for proximal colon CRC did not change.

White males tended to be diagnosed at an earlier stage than Hispanics: 25% of tumors were

diagnosed at stage I among white men, versus 22% for Hispanics (Table 1, p < 0.001). Changes

in CRC stage percent distribution over time were noticed among both white and Hispanic men,

with an increase in stage I and a decline in stage II disease (Figure S1). The direction and

magnitude of changes in percent distribution were similar in both groups of men. However,

while the distribution of tumors by stage for white and Hispanic males remained similar over time, trends in age-adjusted incidence rates by stage differed between the two groups. Incidence rates among white men declined for each individual stage, with the largest decrease observed among stage II tumors diagnosed after 2000 (APC = -3.8, p < 0.001) (Table 2). Incidence of Stage II tumors also declined for Hispanic men (APC = -1.9, p < 0.001), while there was little change in the incidence of tumors diagnosed at stage I (APC = 0.6, p = 0.16), stage III (APC = 0.1, p = 0.58), and stage IV (APC = 0.0, p = 0.40).

Much like incidence, the CRC mortality rate among men in 1990 was higher among whites than Hispanics (28.2 per 100,000 versus 18.8 per 100,000), but decreased substantially through 2013 among whites while remaining flat for Hispanics (Table 2). Among men 50 years of age, CRC mortality rates increased for Hispanics (APC = 1.6, p < 0.001), but showed no statistically significant change for whites. Mortality rates for white men over 50 years of age declined significantly, while among Hispanic men a decline was detected only in men 65-74 years of age, and at a lower rate than for white men of the same age.

Five-year relative survival for CRC increased significantly in both groups, from 60.4% in 1994-1996 (95% CI: 59.4, 61.5) to 66.3% in 2006-2008 (95% CI 65.3, 67.3) among whites and from 58.0% (95% CI: 55.3, 60.6) to 63.9% (95% CI 62.0, 65.8) among Hispanics in 1990-1994 and 2006-2008, respectively. However, as 95% confidence intervals for each time period and within each stage at diagnosis overlapped, none of the differences in five-year survival between white and Hispanic men were statistically significant (results not shown).

Discussion

Trends in colorectal cancer mortality differed greatly between white and Hispanic men in California between 1990 and 2013, declining by 46% among white men but only minimally among Hispanic men. Although mortality was initially higher among white men, by 2011 mortality rates crossed over and were actually higher among Hispanic men. Possible reasons for decreased mortality include increased survival (due to earlier detection or improved treatments) and/or decreased incidence rates. Our findings suggest the difference in mortality trends may be primarily due to changes in incidence. CRC incidence among white men decreased significantly over the study period, while incidence among Hispanic men remained flat until 2008, declining afterwards. Higher screening rates among whites than Hispanics may have resulted in greater removal of polyps that could have eventually become malignant, thus contributing to lower CRC incidence rates.

Five-year relative survival estimates by year of diagnosis were not significantly better among white men. Consistent with previous studies, we found an increase in relative survival for both white and Hispanic men.[1, 15] Improvements in relative survival within each AJCC stage at diagnosis were similar for both groups. Therefore, differences in survival between white and Hispanic men cannot explain the observed differences in mortality trends.

Lower mortality may also be caused by shifts in the stage at which cancer is diagnosed. Even when survival within each stage remains constant, a larger proportion of patients diagnosed at an earlier stage of disease may lead to overall decreases in mortality. Previous research has shown there may be an overall shift toward earlier stage CRC due to increased screening.[16] However,

this study did not show a substantial shift in stage over time. Only a slight decrease in the proportion of tumors diagnosed at stage II and a slight increase in the proportion diagnosed at stage I, III or IV were observed (Figure S1). Changes in stage distribution were similar in both whites and Hispanics; therefore, shifts in the stage at diagnosis are also unlikely to explain differences in mortality trends between the two groups.

Since the difference in mortality trends cannot be readily explained by improved survival or shifts in stage at diagnosis, it is likely changes in mortality were mostly driven by trends in incidence. This hypothesis is supported by observed declines in CRC incidence rates since 1990. Rates among Hispanics did not decline until 2008 (Table 2).

Trends by age group also support the hypothesis that trends in incidence were driven mostly by differential screening. Guidelines do not recommend screening before age 50, and incidence rates between 1990 and 2012 increased for both whites and Hispanics under age 50 (although incidence rates for this age group are much lower compared to older age groups). However, from 50 to 64 years of age, white men saw a large decrease in incidence and mortality, while Hispanic men saw no significant change in mortality and only a small, statistically significant change in incidence. Both Hispanic and white men 65 to 74 years of age, when Medicare coverage begins, experienced decreases in incidence and mortality, although the decline was much greater among white men.

Location of the tumor within the colon and rectum may be partly explained by differential screening. Endoscopy is more sensitive to tumors in the distal colon than the proximal colon, and is more likely to reduce incidence and mortality of tumors in the distal colon.[17] We found

Hispanic men more likely to have distal tumors than white men, and the incidence of distal tumors decreased less among Hispanics than whites. Both of these findings are consistent with lower screening rates among Hispanic men.

Several reasons may explain why incidence and mortality declined more rapidly for whites than Hispanics. Most of the decline in CRC incidence has been attributed to increased rates of screening through colonoscopy and sigmoidoscopy, although changes in risk factors and better treatments likely contributed to the decline.[1, 4, 18] These types of screening, which includes the removal of adenomatous polyps, have been shown to reduce both CRC incidence and mortality.[18] Despite evidence of its effectiveness, Hispanic men are less likely than white men to undergo endoscopic screening, and Hispanic men in California are no exception.[19-21] Data from the California Health Interview Survey show lower screening compliance among recent immigrants (48%) and respondents who spoke limited English (44%). Differences in CRC screening between Hispanic and non-Hispanic Californian men have been well documented.[21-24] CRC screening rates among Mexican and South and Central American Hispanic males, the main Hispanic subgroups in California, are the lowest of any race/ethnic group in the country (39% and 35% respectively).[25]

Cultural values and access to healthcare may explain lower rates of cancer screening among Hispanics in California. Hispanic men are more likely to be uninsured or have Medicaid health insurance, and are less likely to have a primary care provider, all of which decrease the likelihood of CRC screening.[23, 26] Limited language proficiency may be an additional barrier. Hispanics who speak English well are more likely to undergo screening than those with limited

English proficiency; a finding even more pronounced among Hispanic men than Hispanic women.[20, 27]

Several intervention strategies may be effective in increasing knowledge and uptake of screening guidelines. Two recent reviews described successful intervention strategies for Hispanic CRC screening,[28, 29] including the use of bilingual navigators who are members of the targeted community, educational interventions aimed at providers, and culturally sensitive printed materials.[29, 30] However, even identifying unscreened individuals may be difficult since Hispanics are less likely to have a regular source of medical care.[26, 30]

Lower screening among Hispanics was associated with disparities in CRC incidence and mortality among Hispanics in Florida,[31, 32] Puerto Rico,[33] and New Mexico.[34] In several states with large Hispanic populations, rates of CRC have declined faster among whites, who now have lower CRC incidence and mortality than Hispanic men.[35] Despite these similarities, California's Hispanic population differs from the rest of the U.S. in several ways: California has a larger proportion of Hispanics of Mexican descent, a higher proportion born outside the United States, and a higher proportion speaking a language other than English at home. Tailoring interventions to the needs of these specific groups will be important in creating effective CRC prevention strategies.[23, 36]

Factors other than screening may explain some of the disparities in mortality and incidence between white and Hispanic men. CRC is associated with several lifestyle factors, including alcohol consumption, smoking, diabetes and obesity.[37-40] Recent Hispanic immigrants are less

likely to smoke and consume excessive alcohol and are more likely to have healthy dietary habits than US-born Hispanics.[41] However, as Hispanics become more acculturated they become less likely to maintain many aspects of a healthy lifestyle which may offset any improvement from increased screening.

This study has some limitations. Although the NAACCR algorithm to classify Hispanic ethnicity has been adopted by most cancer registries in the US, residual misclassification is a possibility. Misclassification has been reported for CRC as the underlying cause of death, although most of inaccuracies were due to death certificates assigning colon as the cause of death for rectal cancer patients, due to the interchangeable use of the terms colon and colorectal.[14] In addition, screening quality may differ between whites and Hispanics, which could attenuate the preventive effect of polyp removal. Despite these limitations, the size and diversity of the California population and the quality of CCR data are important factors in bringing to light the disparities uncovered in this study.

While CRC incidence and mortality rates have remained relatively flat for Hispanic men in California, CRC incidence in 2012 was lower than in any year since 1990, following three consecutive years of decline. It remains to be seen if this trend continues, translating into lower mortality in the future. Rates of screening among Hispanic men in age groups where screening is recommended are also increasing, from 42% in 2003 to 59% in 2009.[42, 43] Despite these positive signs, more effective strategies aimed at both Hispanics and their healthcare providers are needed to increase CRC screening among Hispanic men and reduce their colorectal cancer burden.

Acknowledgement

References

1. Edwards BK, Ward E, Kohler BA, et al. Annual report to the nation on the status of cancer, 1975-2006, featuring colorectal cancer trends and impact of interventions (risk factors, screening, and treatment) to reduce future rates. Cancer 2010;116(3): 544-73.
2. California Department of Public Health (CDPH) CCR. Incidence and Mortality Counts and Age-Adjusted (2000 U.S. Population) Rates per 100,000 Persons by year, Race/Ethnicity, and Sex, California, 1988-2011, Invasive Colon and Rectum Cancer, 2014.
3. Morris CM AE, Martinsen RP, Cook SN, Parikh-Patel A, Kizer KW. Trends in Cancer Incidence and Mortality in California, 1988-2010. Sacramento, CA: California Cancer Reporting and Epidemiologic Surveillance (CalCARES) Program, Institute for Population Health Improvement, University of California Davis Health System, 2014.
4. Yang DX, Gross CP, Soulos PR, Yu JB. Estimating the magnitude of colorectal cancers prevented during the era of screening: 1976 to 2009. Cancer 2014.
5. Bazargan M, Ani C, Bazargan-Hejazi S, Baker RS, Bastani R. Colorectal cancer screening among underserved minority population: discrepancy between physicians' recommended, scheduled, and completed tests. Patient Educ Couns 2009;76(2): 240-7.
6. Cronan TA, Devos-Comby L, Villalta I, Gallagher R. Ethnic differences in colorectal cancer screening. J Psychosoc Oncol 2008;26(2): 63-86.
7. Jerant AF, Fenton JJ, Franks P. Determinants of racial/ethnic colorectal cancer screening disparities. Arch Intern Med 2008;168(12): 1317-24.
8. Singh GK, Lin SC. Marked ethnic, nativity, and socioeconomic disparities in disability and health insurance among US children and adults: the 2008-2010 American community survey. Biomed Res Int 2013;2013: 627412.
9. Langellier BA, Guernsey de Zapien J, Rosales C, Ingram M, Carvajal SC. State Medicaid expansion, community interventions, and health care disparities in a United States-Mexico border community. Am J Public Health 2014;104(8): e94-e100.
10. Ortega AN, Fang H, Perez VH, et al. Health care access, use of services, and experiences among undocumented Mexicans and other Latinos. Arch Intern Med 2007;167(21): 2354-60.
11. Soto-Salgado M, Suarez E, Torres-Cintron M, Pettaway CA, Colon V, Ortiz AP. Prostate cancer incidence and mortality among Puerto Ricans: an updated analysis comparing men in Puerto Rico with US racial/ethnic groups. P R Health Sci J 2012;31(3): 107-13.
12. NAACCR Race and Ethnicity Work Group. NAACCR Asian Pacific Islander Identification Algorithm [NAPIIA v1.2.1]. In: Boscoe FP, editor. Springfield, IL: North American Association of Central Cancer Registries, 2011.
13. Cho H, Howlader N, Mariotto AB, Cronin KA. Estimating relative survival for cancer patients from the SEER Program using expected rates based on Ederer I versus Ederer II method. Surveillance Research Program, NCI, Technical Report #2011-01.

14. Yin D, Morris CR, Bates JH, German RR. Effect of misclassified underlying cause of death on survival estimates of colon and rectal cancer. J Natl Cancer Inst 2011;103(14): 1130-3.

15. Siegel R, Desantis C, Jemal A. Colorectal cancer statistics, 2014. CA Cancer J Clin 2014;64(2): 104-17.
16. Schnoor M, Waldmann A, Eberle A, Holleczek B, Katalinic A. Colorectal cancer incidence in Germany: stage-shift 6 years after implementation of a colonoscopy screening program. Cancer Epidemiol 2012;36(5): 417-20.

17. Brenner H, Hoffmeister M, Arndt V, Stegmaier C, Altenhofen L, Haug U. Protection from right- and left-sided colorectal neoplasms after colonoscopy: population-based study. J Natl Cancer Inst 2010;102(2): 89-95.

18. Zauber AG, Winawer SJ, O'Brien MJ, et al. Colonoscopic polypectomy and long-term prevention of colorectal-cancer deaths. N Engl J Med 2012;366(8): 687-96.

19. Afable-Munsuz A, Liang SY, Ponce NA, Walsh JM. Acculturation and colorectal cancer screening among older Latino adults: differential associations by national origin. J Gen Intern Med 2009;24(8): 963-70.

20. Jerant AF, Arellanes RE, Franks P. Factors associated with Hispanic/non-Hispanic white colorectal cancer screening disparities. J Gen Intern Med 2008;23(8): 1241-5.

21. Pollack LA, Blackman DK, Wilson KM, Seeff LC, Nadel MR. Colorectal cancer test use among Hispanic and non-Hispanic U.S. populations. Prev Chronic Dis 2006;3(2): A50.

22. Gorin SS. Correlates of colorectal cancer screening compliance among urban Hispanics. J Behav Med 2005;28(2): 125-37.

23. Jandorf L, Ellison J, Villagra C, et al. Understanding the barriers and facilitators of colorectal cancer screening among low income immigrant hispanics. J Immigr Minor Health 2010;12(4): 462-9.

24. Wang J, Moehring J, Stuhr S, Krug M. Barriers to colorectal cancer screening in Hispanics in the United States: an integrative review. Appl Nurs Res 2013;26(4): 218-24.

25. Cancer Facts & Figures for Hispanics/Latinos 2012-2014. Atlanta: American Cancer Society, 2012.

26. Ortiz AP, Lopez M, Flores LT, et al. Awareness of direct-to-consumer genetic tests and use of genetic tests among Puerto Rican adults, 2009. Prev Chronic Dis 2011;8(5): A110.

27. Ortiz AP, Unger ER, Munoz C, et al. Cross-sectional study of HPV-16 infection in a population-based subsample of Hispanic adults. BMJ Open 2014;4(2): e004203.

28. Colon-Lopez V, Ortiz AP, Soto-Salgado M, et al. Penile cancer disparities in Puerto Rican men as compared to the United States population. Int Braz J Urol 2012;38(6): 728-38.

29. Ricci F, Ramirez T, Marmorato R, et al. Predisposing factors for acute kidney injury in Hispanic patients treated with diuretics for decompensated heart failure. P R Health Sci J 2013;32(2): 63-7.

30. Ortiz AP, Romaguera J, Perez CM, et al. Human papillomavirus infection in women in Puerto Rico: agreement between physician-collected and self-collected anogenital specimens. J Low Genit Tract Dis 2013;17(2): 210-7.

31. Hernandez MN, Sussman DA, Lee DJ, Mackinnon JA, Fleming LE. Trends in colorectal cancer among hispanics by stage and subsite location: 1989-2006. Clin Transl Gastroenterol 2012;3: e21.

32. Pinheiro PS, Sherman RL, Trapido EJ, et al. Cancer incidence in first generation U.S. Hispanics: Cubans, Mexicans, Puerto Ricans, and new Latinos. Cancer Epidemiol Biomarkers Prev 2009;18(8): 2162-9.

33. Soto-Salgado M, Suarez E, Calo W, Cruz-Correa M, Figueroa-Valles NR, Ortiz AP. Incidence and mortality rates for colorectal cancer in Puerto Rico and among Hispanics, non-Hispanic whites, and non-Hispanic blacks in the United States, 1998-2002. Cancer 2009;115(13): 3016-23.

34. Hoffman RM, Espey DK, Rhyne RL, et al. Colorectal cancer incidence and mortality disparities in new Mexico. J Cancer Epidemiol 2014;2014: 239619.

35. Naishadham D, Lansdorp-Vogelaar I, Siegel R, Cokkinides V, Jemal A. State disparities in colorectal cancer mortality patterns in the United States. Cancer Epidemiol Biomarkers Prev 2011;20(7): 1296-302.

36. Getrich CM, Sussman AL, Helitzer DL, et al. Expressions of Machismo in Colorectal Cancer Screening Among New Mexico Hispanic Subpopulations. Qual Health Res 2012;22(4): 546-59.

37. Doubeni CA, Major JM, Laiyemo AO, et al. Contribution of behavioral risk factors and obesity to socioeconomic differences in colorectal cancer incidence. J Natl Cancer Inst 2012;104(18): 1353-62.

38. Huxley RR, Ansary-Moghaddam A, Clifton P, Czernichow S, Parr CL, Woodward M. The impact of dietary and lifestyle risk factors on risk of colorectal cancer: a quantitative overview of the epidemiological evidence. Int J Cancer 2009;125(1): 171-80.

39. Larsson SC, Wolk A. Obesity and colon and rectal cancer risk: a meta-analysis of prospective studies. Am J Clin Nutr 2007;86(3): 556-65.

40. Ortiz AP, Thompson CL, Chak A, Berger NA, Li L. Insulin resistance, central obesity, and risk of colorectal adenomas. Cancer 2012;118(7): 1774-81.

41. Tao L, Ladabaum U, Gomez SL, Cheng I. Colorectal cancer mortality among Hispanics in California: Differences by neighborhood socioeconomic status and nativity. Cancer 2014.

42. California Health Interview Survey. UCLA Center for Health Policy Research: CHIS 2009 Adult Public Use File, 2009.

43. California Health Interview Survey. UCLA Center for Health Policy Research: CHIS 2003 Adult Public Use File, 2003.

Figure 1. Colorectal cancer age-adjusted incidence[a] and mortality rates in California:

non-Hispanic white and Hispanic males[b]
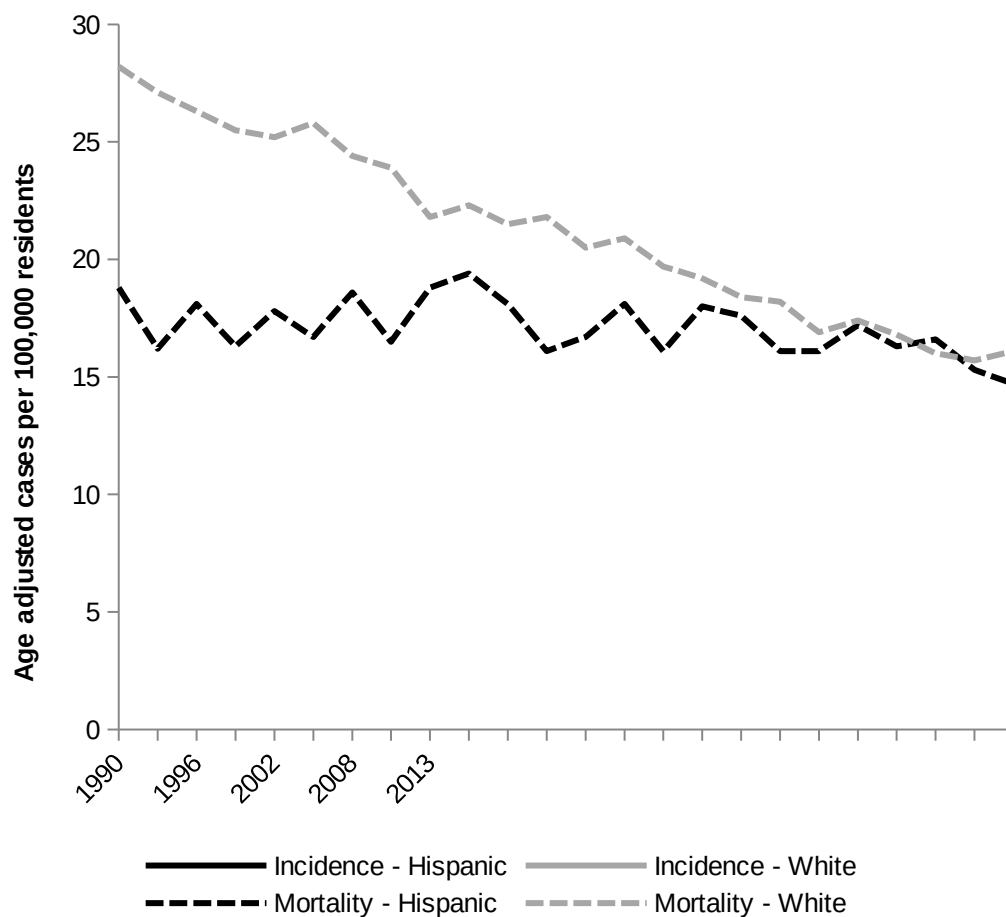
a: *In situ* cancers are excluded.

b: Race/ethnicity is mutually exclusive; Hispanic males may be of any race.

Figure 2. Percent distribution of colorectal cancer cases by AJCC[a] stage at diagnosis: non-Hispanic white and Hispanic males[b]
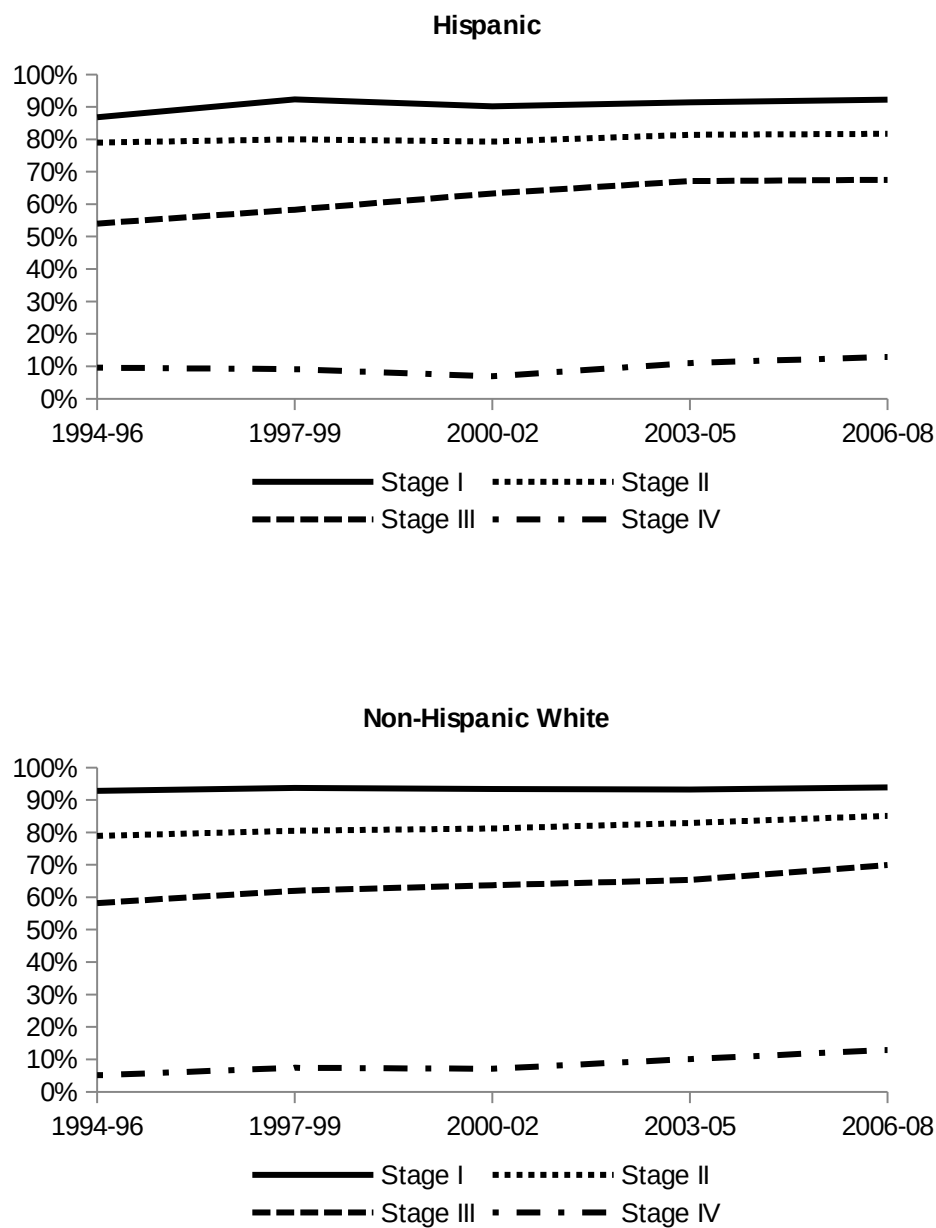
Hispanic

Non-Hispanic White

a: American Joint Committee on Cancer (AJCC) stage at diagnosis available only for cases diagnosed in 1994 forward.

b: Race/ethnicity is mutually exclusive; Hispanic males may be of any race.

Figure S1. Five-year colorectal cancer relative survival by AJCCª stage at diagnosis: non-Hispanic white and Hispanic males[b]
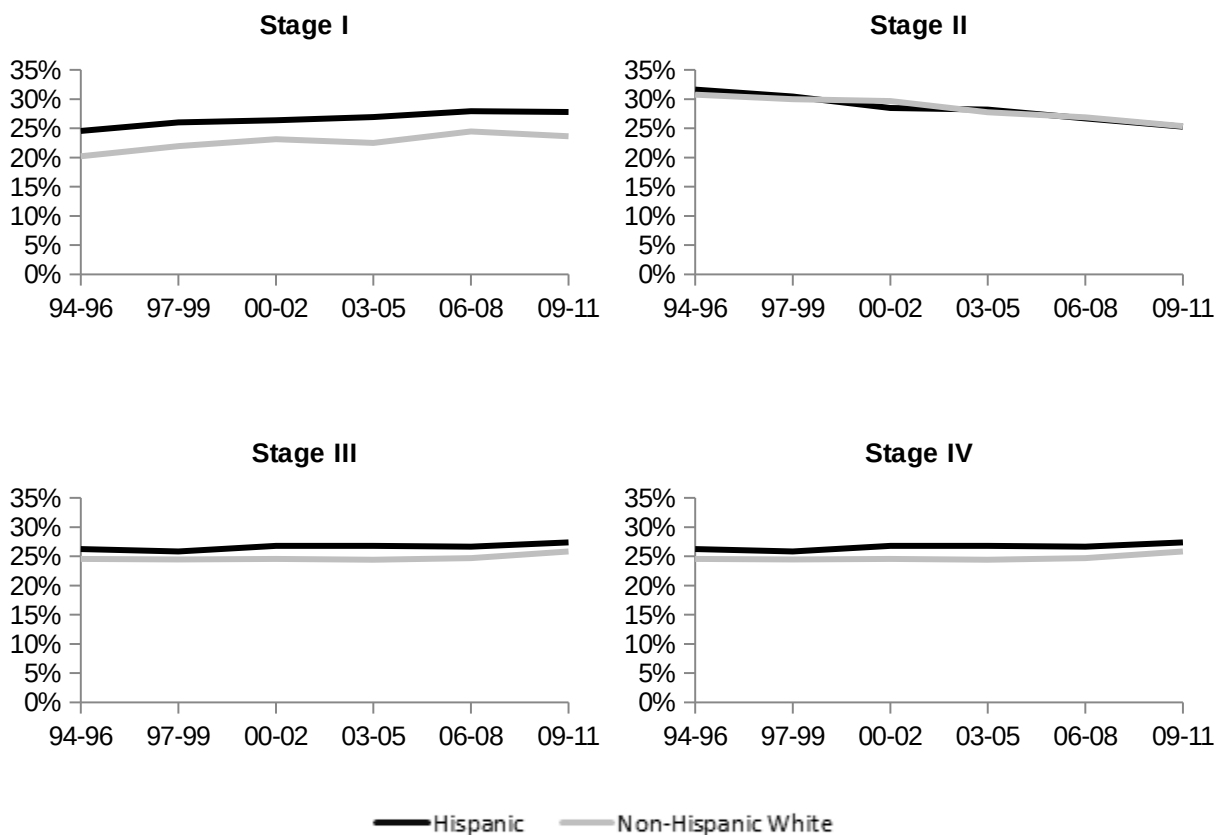
a: American Joint Committee on Cancer (AJCC) stage at diagnosis available only for cases diagnosed in 1994 forward.

b: Race/ethnicity is mutually exclusive; Hispanic males may be of any race.

Table 1. Characteristics of non-Hispanic white and Hispanic[a] males diagnosed with colorectal cancer: California, 1990-2012

	Hispanic (N = 23,157)		Non-Hispanic White (N = 114,944)		
	N	%	N	%	p-value
Age at Diagnosis					**<0.001**
< 50	3,647	16%	8,055	7%	
50-64	7,647	33%	29,359	26%	
65-74	6,322	27%	33,725	29%	
75+	5,541	24%	43,805	38%	
AJCC Stage (1994 +) [b]					**<0.001**
I	4,062	20%	21,503	24%	
II	4,920	25%	22,918	25%	
III	4,723	24%	20,125	22%	
IV	4,028	20%	16,369	18%	
Unknown	2,286	11%	9,739	11%	
Insurance[c]					**<0.001**
Not Insured	789	4%	1,081	1%	
Private/Military	11,278	58%	59,378	71%	
Medicare	2,970	15%	15,104	18%	
Medicaid/Other Public	3,579	18%	4,928	6%	
Unknown	819	4%	2,987	4%	
Subsite					**<0.001**
Distal Colon and Rectum	15,028	65%	68,309	59%	
Proximal Colon	7,305	32%	42,440	37%	
Not Specified	824	4%	4,195	4%	
Poverty[d]					**<0.001**
< 15%	3,127	14%	36,383	32%	
16% - 30%	5,762	25%	40,390	35%	
> %30	14,268	62%	38,171	33%	
High School graduates[e]					**<0.001**
>= 75%	10,477	45%	90,369	79%	
< 75%	12,680	55%	24,575	21%	
Age-Adjusted Rates	**Incidence**	**Mortality**	**Incidence**	**Mortality**	
1990	43.2	18.8	71.5	28.3	
1993	42.0	16.3	65.2	25.5	
1996	47.1	18.7	63.6	24.4	
1999	47.9	19.4	61.9	22.3	
2002	45.6	16.7	57.3	20.5	
2005	46.5	18.0	52.4	19.2	
2008	49.1	16.1	50.4	16.9	
2012	39.1	15.3	41.3	15.8	

Note: Boldface indicates statistical significance (p<0.05).

a: Race/ethnicity is mutually exclusive; Hispanic males may be of any race.

b: American Joint Committee on Cancer (AJCC) stage at diagnosis available only for cases

diagnosed in 1994 forward (Hispanic = 20,019 and white = 90,654). *In situ* cancers are

excluded.

c: Insurance information available only for cases diagnosed in 1996 forward (Hispanic=19,435

and white=83,478).

d: percentage of persons in census tract under 200% of poverty level.

e: percentage of persons 25 years and older in census tract with a high school diploma or

equivalent.

Table 2: Annual percent change (APC) in male colorectal cancer age-adjusted mortality and incidence rates in California

	Hispanic[a] Males			Non-Hispanic White Males		
	Years	**APC**	**p-value**	**Years**	**APC**	**p-value**
MORTALITY						
Overall	1990 - 2013	-0.4	**0.016**	1990 - 2013	-2.6	**< 0.001**
Age group						
< 50	1990 - 2013	1.6	**0.001**	1990 - 2013	-0.1	0.891
50-64	1990 - 2013	-0.2	0.417	1990 - 2011	-2.3	**< 0.001**
65-75	1990 - 2013	-1.2	**< 0.001**	1990 - 2004	-2.2	**< 0.001**
				2004 - 2013	-4.7	**< 0.001**
75 +	1990 - 2013	-0.3	0.295	1990 - 2013	-2.8	**< 0.001**
INCIDENCE						
Overall	1990 - 2008	0.1	0.563	1990 - 2009	-1.9	**< 0.001**
	2008 - 2012	-4.8	**0.043**	2009 - 2012	-6.2	**0.016**
Age group						
< 50	1990 - 1992	-7.9	0.501	1990 - 2012	1.9	**< 0.001**
	1992 - 2012	2.9	**< 0.001**			
50-64	1990 - 2012	0.5	**0.010**	1990 - 1997	0.3	0.463
				1997 - 2012	-1.8	**< 0.001**
65-74	1990 - 2003	0.4	0.363	1990 - 2008	-2	**< 0.001**
	2003 - 2012	-2.8	**< 0.001**	2008 - 2012	-7.1	**< 0.001**
75 +	1990 - 2012	-1.0	**0.003**	1990 - 2009	-2.8	**< 0.001**
				2009 - 2012	-8.5	**< 0.001**
Subsite						
Distal Colon	1990 - 2012	-0.7	**0.001**	1990 - 2009	-2.3	**< 0.001**
				2009 - 2012	-5.7	**0.002**
Proximal Colon	1990 - 2012	0.3	0.389	1990 - 2007	-1.1	**< 0.001**
				2007 - 2012	-4.6	**< 0.001**
Stage at Diagnosis (1994 +)[b]						
Stage I	1994 - 2008	1.7	**0.028**	1994 - 2009	-0.6	**0.011**
	2008 - 2012	-5.6	0.116	2009 - 2012	-7.2	**0.012**
Stage II	1994 - 2012	-1.9	**< 0.001**	1994 - 2000	-1.3	0.078
				2000 - 2012	-3.8	**< 0.001**
Stage III	1994 - 2012	-0.1	0.798	1994 - 2012	-1.5	**< 0.001**
Stage IV	1994 - 2012	0.3	0.384	1994 - 2012	-1.6	**< 0.001**

Note: Boldface indicates statistical significance (p<0.05).

a: Race/ethnicity is mutually exclusive; Hispanic males may be of any race.

b: American Joint Committee on Cancer (AJCC) stage at diagnosis available only for cases

diagnosed in 1994 forward (Hispanic = 18,495 and white = 85,805). *In situ* cancers are

excluded.