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Comparative analysis of breast cancer risk factors among Hispanic and non-Hispanic white women

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Abstract

Background—Hispanic and non-Hispanic white (NHW) populations within the United States have different breast cancer incidence rates, yet there is limited research on how ethnic differences in the prevalence of established risk factors and their associations with breast cancer contribute to the observed differences.

Methods—Odds ratios and population attributable risk estimates for breast cancer were determined for Hispanic and NHW women in the population-based, case-control 4-Corners Breast Cancer Study.

Results—When comparing NHW and Hispanic women, we observed differences in the prevalence of certain risk factors, as well as the magnitude and direction of their associations with breast cancer. Hispanic women were more likely to have characteristics associated with lower breast cancer risk, such as earlier age at first birth, having more children, shorter height, less hormone use, and less alcohol consumption. Among premenopausal women, ethnic differences in risk were observed with taller height and positive family history, which were not associated with breast cancer among Hispanic women. Among postmenopausal women, associations for certain risk factors were either weaker or not observed in Hispanics, such as recent estrogen plus progestin hormone therapy use and younger age at menarche. Among NHW women, an estimated 62–75% of breast cancer cases were attributed to the evaluated risk factors, as compared with 7–36% in Hispanic women.

Conclusions—Breast cancer risk factors established in NHW populations had less influence on breast cancer risk in Hispanic women. These findings reflect the need to further evaluate breast cancer risk factors among different ethnic and racial populations.

Keywords

Hispanic; breast cancer; risk factors; prevalence; association; 4-Corners Breast Cancer Study

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Introduction

Differences in breast cancer incidence rates, tumor characteristics and survival are observed among ethnic and racial populations within the United States.¹⁻⁹ Well-established risk factors for breast cancer have been identified through epidemiologic studies predominantly comprised of non-Hispanic white (NHW) women, thus limiting the understanding of their relative importance among other racial/ethnic groups. The Hispanic population is estimated to comprise almost 15% of the US population and continues to grow, yet surprisingly few studies have evaluated the independent and comprehensive impact of breast cancer risk factors among US Hispanic populations. In fact, it was not until the 1990s that Hispanics were differentiated from NHWs by the Surveillance, Epidemiology, and End Results (SEER) Program to monitor cancer incidence and mortality. According to SEER data, Hispanic women have a lower incidence rate of breast cancer than do NHW women (89.3 versus 132.5 per 100,000 women, respectively¹⁰), yet they experience a higher risk of mortality after diagnosis.^{1, 2, 5-9} Pathologic differences among breast tumors have been reported when comparing these populations, with Hispanic women more likely to have unfavorable tumor characteristics such as ER-negative status.^{1, 4, 7, 8, 11, 12} There also is evidence to support ethnic differences in the relationship between some risk factors and breast cancer risk.^{13, 14} However, the contribution of well-established risk factors to breast cancer among Hispanic populations, as compared to NHW populations, remains largely unknown.

The purpose of this study was to evaluate ethnic differences in the prevalence of established breast cancer risk factors and their associations with breast cancer among Hispanic and NHW women. For this analysis, we considered established risk factors that are well-described in the breast cancer literature¹⁵⁻¹⁷ and commonly acknowledged by major cancer organizations, such as the American Cancer Society and the Susan G. Komen Foundation.^{18, 19} These factors include reproductive history, family history of breast cancer, menstrual history, hormone use, alcohol consumption, physical activity, height and body mass index. We conducted this analysis using data collected from the 4-Corners Breast Cancer Study, which was designed to investigate factors that contribute to the difference in breast cancer incidence rates observed among Hispanic and NHW women.

Materials And Methods

Study Population

The 4-Corners Breast Cancer Study is a population-based, case-control study of breast cancer. Nearly one-third of the study population is Hispanic by self-report. Methods for selection, recruitment, and interview of subjects have been previously described in detail.¹⁴ Briefly, women ages 25-79 at diagnosis of breast cancer (or date of selection for controls) were recruited from the Southwest United States (Arizona, Colorado, New Mexico, and Utah) between the years of 2000-2005. Cases with a breast cancer diagnosed in 1999-2002 were identified through state-wide cancer registries. Hispanic ethnicity was initially identified through the cancer registry or by surname using the GUESS (Generally Useful Ethnic Search System)²⁰ algorithm in conjunction with census data. Control subjects less than 65 years old were randomly selected from computerized drivers' license lists in New Mexico and Utah, and from commercially available lists in Arizona and Colorado, while subjects aged 65 and older were selected from Center for Medicare Studies lists in all four states. Controls were frequency-matched to cases on age and ethnicity. Study participation has been previously described in detail.²¹ Overall, we were able to contact 75% of Hispanic cases, 66% of Hispanic controls, 85% of NHW cases and 75% of NHW controls. Cooperation rates were 55% for Hispanic and 64% for NHW cases, and 35% for Hispanic and 47% in NHW controls. Participants and non-participants were similar with respect to

characteristics that influenced participation.²² Informed consent was obtained from the participants, and all aspects of the study were conducted in accordance with human subjects' research protocols approved at each institution. For this analysis, we excluded all second primary breast cancers (n = 98 NHW and 47 Hispanic), and women who did not self-report as being primarily of NHW or Hispanic ethnicity (n = 42).

Study Variables

Subjects completed an in-home, laptop-administered interview by trained personnel. The interview included questions regarding body size, medical conditions, reproductive history, family history of breast cancer among first degree relatives, as well as information on diet, physical activity, hormone and alcohol use. Questions referred to exposures one year before diagnosis for cases and one year before selection for the study for controls. Participants were given the preference to have the interview administered in either English or Spanish. Approximately 32% of interviews among Hispanic women were conducted at least partially in Spanish.

Pre- and peri-menopausal women were combined to include women who were 57 years old or younger and still having regular periods, pregnant or breastfeeding, having periods and/or possibly going through menopause, or having periods while taking hormone replacement therapy. Post-menopausal status was assigned to women who reported that their periods stopped either naturally or artificially. Natural menopause was defined as not having a medically induced menopause. Recent hormone therapy use was defined as hormone therapy use during the five years prior to the referent date.

Detailed information about physical activity was assessed through a modified version of the Cross-Cultural Activity Participation Study questionnaire, which included home, work and leisure activities.²³ For each activity, the total metabolic equivalent of the task (MET-hours) value was assigned according to the Compendium of MET values for Physical Activities.²⁴ A lifetime activity score was computed based on the quartile ranking of activity during four different time periods: ages 15, 30 and 50 years plus the referent year. Alcohol consumption was evaluated by calculating an estimated average of grams of alcohol per day based on reported levels of beer, wine and liquor consumption.

Statistical Analysis

Age-specific incidence rates for female breast cancers diagnosed between 1995-2003 for NHWs and Hispanics within the 4-Corner states were obtained through the Surveillance, Epidemiology, and End Results (SEER) registry (New Mexico and Utah) or the state cancer registry (Arizona and Colorado). Data on incidence rates were initially examined among Hispanics and NHWs for each state separately. Since the states demonstrated a similar pattern with respect to ethnic differences, the data were combined to obtain overall estimates by ethnic group across all four states.

All statistical analyses were conducted using SAS, version 9.1 (SAS Institute, Cary, NC). Logistic regression models were utilized to compute odds ratios and 95% confidence intervals to evaluate the ethnic-specific relationships between established risk factors and breast cancer risk among pre- and postmenopausal women separately. The following factors were evaluated: age at menopause (<50, ≥50 years old), natural menopause (yes, no), hormone replacement therapy use during the past 5 years (none or unknown, estrogen only, estrogen plus progestin), age at menarche (≤11, 12-13, ≥14 years old), family history of breast cancer in first degree relatives (yes, no, unknown), parity (0, 1-2, 3 or more children), age at first birth (<25, 25-29, ≥30 years old), breast feeding (never/unknown, ≤12, >12 months), height (≤1.55, 1.56-1.60, >1.60 meters), body mass index at reference year (<25,

25-29, 30 kg/m²), oral contraceptives (ever, never), alcohol intake (0, >0 to ≤10, >10 grams/day), lifetime physical activity (low, moderate, high). All multivariable models were also adjusted for age (continuous), study center (Arizona, Colorado, New Mexico, Utah) and education (less than high school, HS/GED/some college, bachelors degree or more). Given that there was only a small amount of missing data, values for individuals with missing data on these covariates were imputed based on group mean values and included in the analyses.

To compute an attributable fraction estimate (PAR or population attributable risk) for each

of the risk factors, the following equation was utilized $\sum_{i=0}^k pd_i \left(\frac{RR_i - 1}{RR_i} \right)$, where pd_i represents the proportion cases falling into the i th exposure level; and RR_i is the relative risk comparing the i th exposure level with the unexposed group ($i = 0$), in the instance of the case-control study, the odds ratio (OR).²⁵ PARs were estimated from multivariate-adjusted ORs. In order to provide a summary estimate for PAR based on all evaluated risk factors, the total attributable fraction due to all risk factors (unknown or known) was assumed to be 100%. The PAR for one factor was first subtracted from 100%, which would represent the percentage of risk that is unaccounted for by that particular factor. The contribution of the next risk factor was then determined by multiplying the proportion of risk attributed to that particular factor to the remaining proportion of risk that was unaccounted for by the previous factor. This calculation was repeated for all risk factors, and the adjusted PARs were summed to estimate the combined contribution of all risk factors.

Results

Breast Cancer Incidence Rates among Women Residing in the Southwest

Figure 1 illustrates the age-specific breast cancer incidence rates among Hispanic and NHW women who were diagnosed in 1995-2003 and residing within the four Southwest states (Arizona, Colorado, New Mexico and Utah). This represents the underlying population from which breast cancer cases were selected for participation in the 4-Corners Breast Cancer Study. Overall, NHWs had a higher incidence of breast cancer compared to Hispanics for every age group examined. This difference appeared to increase with increasing age. Among women 30-50 years of age, there was an approximate 1.3-fold difference in incidence rates, whereas a 1.5-1.7-fold difference was observed for women 50-80 years of age.

Comparison of Risk Factors among Premenopausal Women

Among premenopausal controls (Table 1), a higher proportion of Hispanic women reported characteristics associated with lower risk of breast cancer when compared with NHW women, specifically an earlier age at first birth, having more children, shorter height, higher body mass index, no oral contraceptive use and less alcohol consumption. Conversely, characteristics associated with increased risk that were more likely to be reported among Hispanics included earlier age at menarche, not breast feeding and low physical activity. Risk estimates for the majority of risk factors were in the expected direction among NHW premenopausal women. Significant positive associations were observed for later age at first birth (OR, 1.57; 95% CI, 1.03-2.38), not breast feeding (OR, 1.67; 95% CI, 1.09-2.58), early age of menarche (OR, 1.51; 95% CI, 1.01-2.25), and having a positive family history (OR, 1.97; 95% CI, 1.38-2.80). Oral contraceptive use (OR, 1.32; 95% CI, 0.97-1.81), taller height (OR, 1.71; 95% CI, 0.96-3.04), lower body mass index (OR, 1.23; 95% CI, 0.86-1.76) and low physical activity (OR, 1.23; 95% CI, 0.84-1.81) had positive, although not statistically significant, associations with breast cancer risk. Among Hispanic women, these associations were generally either closer to the null or not observed. Later age at first birth was the only risk factor that was significantly associated with increased risk among both NHW and Hispanic (OR, 2.48; 95% CI, 1.36-4.53) women. A similar magnitude of

increased risk was observed for both oral contraceptive use (OR, 1.36; 95% CI, 0.96-1.92) and lower body mass index (OR, 1.23; 95% CI, 0.81-1.87). A suggestive inverse, although not statistically significant, association was observed with moderate alcohol intake among Hispanic women only (OR, 0.66; 95% CI, 0.37-1.20).

Comparison of Risk Factors among Postmenopausal Women

Among postmenopausal control subjects (Table 2), Hispanic women were more likely to report characteristics associated with lower risk of breast cancer when compared with NHW women, specifically menopause before age 50, no recent hormone therapy use, an earlier age at first birth, having more children, shorter height, no oral contraceptive use and less alcohol consumption. Characteristics associated with increased risk that were more likely to be reported among postmenopausal Hispanic women included higher body mass index, earlier age at menarche, not breast feeding and low physical activity. As observed among premenopausal women, the majority of recognized risk factors were associated with breast cancer among NHW postmenopausal women. Significant associations were observed for recent hormone therapy use (estrogen plus progestin only) (OR, 1.76; 95% CI, 1.39-2.23), younger age at menarche (OR, 1.47; 95% CI, 1.12-1.91), and family history (OR, 1.81; 95% CI, 1.44-2.27). Positive, but not statistically significant, associations were observed with later age at menopause (OR, 1.17; 95% CI, 0.95-1.44), moderate alcohol intake (OR, 1.18; 95% CI, 0.88-1.58), and taller height (OR, 1.26; 95% CI, 0.95-1.66). When compared to NHW women, family history and height were significantly associated with a similar increase in risk among Hispanic women (family history: OR, 1.59; 95% CI, 1.13-2.25, and height: OR, 1.42; 95% CI 1.04-1.94). Weaker or no associations were observed for using hormone therapy and for having had a younger age at menarche. In addition, inverse associations, although not statistically significant, were observed with both increased alcohol consumption (OR, 0.66; 95% CI, 0.39-1.09) and higher body mass index (OR, 0.72; 95% CI, 0.51-1.01) among Hispanic women only.

Population Attributable Risk Estimates

Table 3 provides a summary estimate for the population attributable risk (PAR) for all of the evaluated risk factors, individually and combined, for pre- and postmenopausal breast cancer among NHW and Hispanic women. Among premenopausal women, all factors combined accounted for 75.4% of breast cancers for NHWs compared to 36.4% for Hispanics. Among NHW women, taller height, later age of menarche, and oral contraceptive use had PAR estimates greater than 15%, while higher alcohol intake had a negative PAR due to the non-significant inverse association. Considering the subset of factors positively associated with increased risk irrespective of statistical significance (i.e. positive PAR estimates), the PAR estimates for these factors combined are more similar between NHW and Hispanic premenopausal women (77.3 versus 50.6%, respectively).

Among postmenopausal women, the estimated contribution for all factors combined was 62.1% for NHWs compared to 6.6% for Hispanics (Table 3). Similar to premenopausal women, the PAR estimates derived from subset of factors positively associated with increased risk were more comparable between NHW and Hispanic postmenopausal women (63.7% versus 40.1%, respectively). Factors that had PAR estimates greater than 15% include taller height and recent hormone therapy use for NHW women. High body mass index had the largest PAR estimate among Hispanic women (-23.9%), which was negative due to the observed significant inverse association with breast cancer risk.

Discussion

The results from this analysis provide support for notable ethnic differences in both the prevalence of risk factors and their associations with breast cancer when comparing NHW and Hispanic women. Among premenopausal women, ethnic differences were observed with height and family history, which were positively associated with breast cancer among NHW but not Hispanic premenopausal women. Among postmenopausal women, associations for some risk factors were either weaker or not observed in Hispanics, such as recent estrogen plus progestin hormone therapy use and younger age at menarche. The estimates for population attributable risk indicate that among NHW women approximately 62-75% of breast cancer cases are attributed to the evaluated risk factors, compared with 7-36% in Hispanic women. The observed differences in the associations with risk factors, in conjunction with differences in the prevalence of these factors, could explain much of the observed differences in breast cancer incidence rates between NHW and Hispanic women. These findings reflect the need for additional studies to gain a better understanding of factors that influence breast cancer development among Hispanics, as well as other ethnic and racial populations.

Among postmenopausal NHW women in this study population, the majority of suspected risk factors were positively associated with breast cancer with the exception of oral contraceptive use, late age at first birth and high body mass index. In comparison, weaker or no associations were observed among postmenopausal Hispanics for estrogen plus progestin hormone therapy use and younger age at menarche. Furthermore, Hispanics had a marginally significant lower risk of breast cancer associated with both increased alcohol consumption and higher body mass index. In general, the observed associations that differ between NHW and Hispanic postmenopausal women are risk factors related to increased exposure to estrogens. As a whole, these findings of ethnic differences in risk factors could therefore suggest that the excess of breast cancers observed in NHW postmenopausal women relative to Hispanic postmenopausal women may be attributed to a greater effect of factors related to estrogens. This could explain the approximate 1.3-fold difference in breast cancer incidence rates among women 30-50 years old versus the 1.5-1.7-fold difference for women 50-80 years old. We speculate that the observed differences related to estrogen exposure could be a consequence of genetic and/or environmental/lifestyle factors that somehow modify susceptibility to the development of postmenopausal breast cancer. Furthermore, this could contribute to the relative excess of ER positive tumors among NHW compared to Hispanic women.⁸ Incidence rates have been shown to be approximately two-fold higher for ER positive breast cancers and 1.6 fold higher for ER negative tumors.^{7, 8}

The estimates for the majority of risk factors in this analysis were in the expected direction, which supports the validity of these findings. Previously published reports on this study population that provide more extensive analyses of specific risk factors, such as reproductive factors and obesity, are consistent with the general findings from this comparative analysis.^{14, 26, 27} Furthermore, our estimate for population attributable risk among NHW women (62-75%) is relatively consistent with estimates from other published studies.²⁸⁻³⁰ In comparison, an estimated 7-36% of breast cancer cases are attributed to these risk factors among Hispanic women. The large discrepancy could be partially attributed to less stable estimates due to the relatively smaller sample size of Hispanic women, yet it is unlikely that this would account for all of the observed difference. We recognize that it is presumptuous to make claims with respect to the proportion of breast cancers that are truly preventable by modifying these factors. Healthy behaviors such as increased physical activity and decreased alcohol consumption should still be recommended for Hispanic women. However, the design of this study provides the opportunity to directly compare the impact of breast cancer risk factors among NHW and Hispanic women.

The few comparative studies that have been done have primarily focused on differences between African-American and White populations.^{16, 30, 31} In one of the most recent and largest multi-ethnic studies, Cheblowski et al. found that the differences in breast cancer incidence rates could be largely explained by differences in risk factor distribution, with the exception of African-Americans.¹⁵ Although this study included Hispanic women, the number of cases was relatively small (n=103). Results from a population-based case-control study among NHW and Hispanic women in New Mexico showed that reproductive factors explained only 17% of the ethnic difference in breast cancer incidence rates among post-menopausal women and none of the difference among pre-menopausal women.³² Overall, these studies suggest differences in risk factors across ethnic and racial populations, but there are inconsistencies with respect to which risk factors differ. There are several possible explanations for these inconsistencies, such as small sample size, differences in which factors were evaluated and how, and differences in age distributions.

In summary, these findings demonstrate that there are ethnic differences in both the prevalence of established breast cancer risk factors and their associations with breast cancer. These observed differences could at least partially explain the disparity in breast cancer incidence rates and may provide unique insight into the etiology of breast cancer. Furthermore, these data indicate that the use of models to estimate a woman's risk of breast cancer developed from studies among NHW populations, such as the Gail model³³, should be evaluated among Hispanic populations. The risk factors that differ between NHW and Hispanic postmenopausal women have been thought to be associated with breast cancer due to their effects on exposure to estrogens, which could suggest a role for ethnic differences in genetic and/or environmental/lifestyle factors that affect susceptibility to the development of breast cancer. These findings reflect the importance to further evaluate the role of breast cancer risk factors among other ethnic and racial populations.

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Figure 1.
Incidence rates for female breast cancers diagnosed between 1995-2003 among NHW and Hispanics within Arizona, Colorado, New Mexico and Utah.

Table 1

Odds ratios for breast cancer risk factors among Hispanic and non-Hispanic white premenopausal women in the 4-Corners Breast Cancer Study.

Characteristic	Non-Hispanic White			Hispanic		
	Case (n=538) No. (%)	Control (n=493) No. (%)	Adjusted Odds Ratio* (95% CI)	Case (n=321) No. (%)	Control (n=323) No. (%)	Adjusted Odds Ratio* (95% CI)
Parity (number of children)						
0	125 (23.2)	103 (20.9)	1.04 (0.60-1.79)	37 (11.5)	40 (12.4)	0.95 (0.50-1.83)
1-2	274 (50.9)	236 (47.9)	1.10 (0.77-1.56)	163 (50.8)	152 (47.1)	0.96 (0.64-1.44)
3+	139 (25.9)	154 (31.2)	1.00	121 (37.7)	131 (40.5)	1.00
Age at First Birth (years)[‡]						
<25	156 (29.0)	176 (35.7)	1.00	170 (53.0)	175 (54.2)	1.00
25-29	146 (27.1)	131 (26.6)	1.23 (0.86-1.76)	64 (19.9)	82 (25.4)	0.97 (0.63-1.48)
≥30	111 (20.6)	83 (16.8)	1.57 (1.03-2.38) [‡]	50 (15.6)	26 (8.1)	2.48 (1.36-4.53) [‡]
Breast Feeding (months)[‡]						
Never	87 (16.2)	58 (11.8)	1.67 (1.09-2.58) [‡]	88 (27.4)	73 (22.6)	1.40 (0.87-2.27)
≤12	136 (25.3)	138 (28.0)	0.99 (0.70-1.39)	110 (34.3)	115 (35.6)	1.09 (0.70-1.69)
>12	190 (35.3)	194 (39.4)	1.00	86 (26.8)	95 (29.4)	1.00
Age at Menarche (years)						
≤11	91 (16.9)	73 (14.8)	1.51 (1.01-2.25) [‡]	69 (21.5)	65 (20.1)	1.22 (0.76-1.96)
12-13	305 (56.7)	257 (52.1)	1.41 (1.05-1.89) [‡]	171 (53.3)	159 (49.2)	1.36 (0.92-2.00)
≥14	142 (26.4)	163 (33.1)	1.00	81 (25.2)	99 (30.7)	1.00
Family History						
No	409 (76.0)	425 (86.2)	1.00	282 (87.9)	284 (87.9)	1.00
Yes	117 (21.8)	61 (12.4)	1.97 (1.38-2.80) [‡]	37 (11.5)	32 (9.9)	1.21 (0.72-2.05)
Unknown	12 (2.2)	7 (1.4)	1.73 (0.62-4.86)	2 (0.6)	7 (2.2)	0.50 (0.10-2.65)
Height (meters)[§]						
≤1.55	23 (4.3)	31 (6.3)	1.00	112 (34.9)	113 (35.0)	1.00
1.56-1.60	77 (14.3)	78 (15.8)	1.32 (0.69-2.52)	83 (25.9)	82 (25.4)	1.03 (0.67-1.59)
>1.60	437 (81.2)	383 (77.7)	1.71 (0.96-3.04)	125 (38.9)	127 (39.3)	0.92 (0.62-1.36)
Body Mass Index (kg/m²)[§]						
<25	314 (58.4)	269 (54.6)	1.23 (0.86-1.76)	127 (39.6)	116 (35.9)	1.23 (0.81-1.87)

Characteristic	Non-Hispanic White			Hispanic		
	Case (n=538) No. (%)	Control (n=493) No. (%)	Adjusted Odds Ratio * (95% CI)	Case (n=321) No. (%)	Control (n=323) No. (%)	Adjusted Odds Ratio * (95% CI)
25-29.9	129 (24.0)	129 (26.2)	1.03 (0.69-1.53)	99 (30.8)	107 (33.1)	1.10 (0.72-1.67)
≥30	94 (17.5)	94 (19.1)	1.00	94 (29.3)	99 (30.7)	1.00
Oral Contraceptive Use						
No	113 (21.0)	130 (26.4)	1.00	120 (37.4)	147 (45.5)	1.00
Yes	425 (79.0)	363 (73.6)	1.32 (0.97-1.81)	201 (62.6)	176 (54.5)	1.36 (0.96-1.92)
Alcohol Intake (grams/day)						
0	210 (39.0)	205 (41.6)	1.00	167 (52.0)	155 (48.0)	1.00
>0 to <10	222 (41.3)	207 (42.0)	0.83 (0.61-1.12)	127 (39.6)	135 (41.8)	0.78 (0.55-1.12)
≥10	106 (19.7)	81 (16.4)	1.01 (0.69-1.50)	27 (8.4)	33 (10.2)	0.66 (0.37-1.20)
Lifetime Activity Score						
Low (0-3)	85 (15.8)	66 (13.4)	1.23 (0.84-1.81)	77 (24.0)	92 (28.5)	0.72 (0.47-1.10)
Moderate (4-6)	146 (27.1)	145 (29.4)	0.94 (0.70-1.26)	110 (34.3)	99 (30.7)	1.11 (0.75-1.64)
High (7-12)	307 (57.1)	282 (57.2)	1.00	134 (41.7)	132 (40.9)	1.00

CI indicates confidence interval

* Odds ratios adjusted for presented factors, as well as education, age at diagnosis or selection and study center.

[†] Values are statistically significant (P<0.05)

[‡] Frequencies based on parous women; percentages based on all women.

[§] Missing: height and BMI 2 NHW and 2 Hispanic.

Table 2

Odds ratios for breast cancer risk factors among Hispanic and non-Hispanic white postmenopausal women in the 4-Corners Breast Cancer Study.

Characteristic	Non-Hispanic White			Hispanic		
	Case (n=987)	Control (n=1107)	Adjusted Odds Ratio* (95% CI)	Case (n=459)	Control (n=581)	Adjusted Odds Ratio* (95% CI)
Age at Menopause (years)						
<50	589 (59.7)	703 (63.5)	1.00	324 (70.6)	421 (72.5)	1.00
≥50	398 (40.3)	404 (36.5)	1.17 (0.95-1.44)	135 (29.4)	160 (27.5)	1.15 (0.84-1.57)
Natural Menopause						
No	495 (50.2)	603 (54.5)	1.00	237 (51.6)	314 (54.0)	1.00
Yes	492 (49.8)	504 (45.5)	1.09 (0.88-1.37)	222 (48.4)	267 (46.0)	1.21 (0.89-1.65)
Recent HRT Use (<5 years)						
No	388 (39.3)	519 (46.8)	1.00	274 (59.7)	322 (55.4)	1.00
Yes, estrogen only	301 (30.5)	367 (33.2)	1.17 (0.93-1.47)	119 (25.9)	167 (28.8)	0.93 (0.67-1.29)
Yes, estrogen+progestin	298 (30.2)	221 (20.0)	1.76 (1.39-2.23) [‡]	66 (14.4)	92 (15.8)	0.78 (0.53-1.14)
Parity (number of children)						
0	135 (13.7)	122 (11.0)	1.16 (0.83-1.64)	38 (8.3)	43 (7.4)	1.25 (0.73-2.13)
1-2	422 (42.7)	424 (38.3)	1.20 (0.97-1.49)	158 (34.4)	155 (26.7)	1.29 (0.93-1.79)
3 or more	430 (43.6)	561 (50.7)	1.00	263 (57.3)	383 (65.9)	1.00
Age at First Birth (years)[‡]						
<25	574 (58.2)	662 (59.8)	1.00	316 (68.8)	420 (72.3)	1.00
25-29	207 (21.0)	238 (21.5)	0.97 (0.76-1.23)	69 (15.0)	84 (14.5)	1.11 (0.76-1.62)
≥30	71 (7.2)	85 (7.7)	0.83 (0.58-1.20)	36 (7.8)	34 (5.9)	1.23 (0.71-2.13)
Breast Feeding (months)[‡]						
Never	312 (31.6)	317 (28.6)	1.13 (0.87-1.48)	187 (40.7)	221 (38.0)	0.98 (0.70-1.38)
≤12	342 (34.7)	422 (38.1)	0.99 (0.77-1.28)	110 (24.0)	157 (27.0)	0.87 (0.60-1.26)
> 12	198 (20.1)	246 (22.2)	1.00	124 (27.0)	160 (27.5)	1.00
Age at Menarche (years)						
≤11	223 (22.6)	207 (18.7)	1.47 (1.12-1.91) [‡]	107 (23.3)	117 (20.1)	1.19 (0.83-1.72)
12-13	531 (53.8)	593 (53.6)	1.16 (0.94-1.44)	206 (44.9)	293 (50.5)	0.83 (0.62-1.13)
≥14	233 (23.6)	307 (27.7)	1.00	146 (31.8)	171 (29.4)	1.00
Family History						

Characteristic	Non-Hispanic White			Hispanic		
	Case (n=987)	Control (n=1107)	Adjusted Odds Ratio * (95% CI)	Case (n=459)	Control (n=581)	Adjusted Odds Ratio * (95% CI)
No	745 (75.5)	916 (82.7)	1.00	357 (77.8)	481 (82.8)	1.00
Yes	232 (23.5)	169 (15.3)	1.81 (1.44-2.27) [†]	90 (19.6)	84 (14.5)	1.59 (1.13-2.25) [†]
Unknown	10 (1.0)	22 (2.0)	0.58 (0.26-1.30)	12 (2.6)	16 (2.7)	1.12 (0.47-2.65)
Height (m)[§]						
≤ 1.55	113 (11.5)	173 (15.6)	1.00	193 (42.1)	279 (48.0)	1.00
1.56-1.60	220 (22.3)	229 (20.7)	1.32 (0.97-1.80)	101 (22.0)	143 (24.6)	0.90 (0.64-1.25)
>1.60	652 (66.1)	698 (63.1)	1.26 (0.95-1.66)	163 (35.5)	156 (26.9)	1.42 (1.04-1.94) [†]
BMI (kg/m²)[§]						
<25	413 (41.8)	458 (41.4)	1.00	131 (28.5)	135 (23.2)	1.00
25-29	316 (32.0)	320 (28.9)	1.12 (0.90-1.38)	171 (37.3)	222 (38.2)	0.78 (0.56-1.09)
≥30	256 (25.9)	322 (29.1)	0.89 (0.71-1.11)	155 (33.8)	221 (38.0)	0.72 (0.51-1.01)
Oral Contraceptive Use						
No	435 (44.1)	525 (47.4)	1.00	272 (59.3)	356 (61.3)	1.00
Yes	552 (55.9)	582 (52.6)	0.96 (0.79-1.18)	187 (40.7)	225 (38.7)	1.02 (0.76-1.36)
Alcohol Intake (grams/day)						
0	398 (40.3)	511 (46.2)	1.00	262 (57.1)	310 (53.4)	1.00
>0 to <10	449 (45.5)	454 (41.0)	1.18 (0.96-1.45)	166 (36.2)	222 (38.2)	0.88 (0.66-1.16)
≥10	140 (14.2)	142 (12.8)	1.18 (0.88-1.58)	31 (6.7)	49 (8.4)	0.66 (0.39-1.09)
Lifetime Activity Score						
Low (0-3)	228 (23.1)	216 (19.5)	1.28 (1.01-1.62) [†]	148 (32.3)	176 (30.3)	1.18 (0.86-1.63)
Moderate (4-6)	277 (28.1)	345 (31.2)	0.90 (0.73-1.11)	153 (33.3)	187 (32.2)	1.12 (0.82-1.54)
High (7-12)	482 (48.8)	546 (49.3)	1.00	158 (34.4)	218 (37.5)	1.00

CI indicates confidence interval; HRT, hormone replacement therapy

* Odds ratios adjusted for presented factors, as well as education, age at diagnosis or selection and study center.

[†] Values are statistically significant (P<0.05)

[‡] Frequencies based on parous women; percentages based on all women.

[§] Missing: height and BMI 9 NHW and 5 Hispanic.

Table 3

Estimates of population attributable risk for established breast cancer risk factors among Hispanic and non-Hispanic white women according to menopausal status.

Characteristic *	Premenopausal		Postmenopausal	
	NHW	Hispanic	NHW	Hispanic
Later Age at Menopause	---	---	5.9%	3.8%
Natural Menopause	---	---	4.1%	8.4%
Recent Hormone Therapy Use	---	---	17.5%	-6.0%
Younger Age at Menarche	22.2%	18.0%	14.7%	-5.5%
Positive Family History	11.7%	1.4%	9.8%	7.6%
Low parity	5.5%	-2.7%	9.1%	9.4%
Later Age at First Birth	12.6%	8.7%	-2.1%	3.0%
Not Breastfeeding	6.2%	10.7%	3.3%	-4.4%
Taller Height	37.2%	-2.6%	19.1%	8.1%
Body Mass Index [†]	11.6%	10.2%	0.2%	-23.7%
Oral Contraceptive Use	19.2%	16.6%	-2.3%	0.8%
Higher Alcohol Intake	-8.3%	-15.5%	9.1%	-8.4%
Less Physical Activity	1.2%	-5.9%	1.9%	8.5%
Summary of population attributable risk estimates for all factors combined				
All Factors Considered	75.4%	36.4%	62.1%	6.6%

NHW indicates non-Hispanic white.

* Characteristics are defined as presented in Table 1 and 2.

[†] Low body mass index was considered high risk for premenopausal and low risk for postmenopausal women.