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Award Number: DAMD17-98-1-8218

TITLE: Obesity, Hormone Receptor Status, and Breast Cancer
Occurrence and Survival in New Mexico Hispanic and
Non-Hispanic White Women

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REPORT DATE: October 2002

TYPE OF REPORT: Annual Summary

PREPARED FOR: U.S. Army Medical Research and Materiel Command
Fort Detrick, Maryland 21702-5012

DISTRIBUTION STATEMENT: Approved for Public Release;
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REPORT DOCUMENTATION PAGEForm Approved
OMB No. 074-0188

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1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE October 2002	3. REPORT TYPE AND DATES COVERED Annual Summary (1 Oct 99 - 30 Sep 02)	
4. TITLE AND SUBTITLE Obesity, Hormone Receptor Status, and Breast Cancer Occurrence and Survival in New Mexico Hispanic and Non-Hispanic White Women			5. FUNDING NUMBER DAMD17-98-1-8218	
6. AUTHOR(S) Diane D. Crumley, Ph.D.				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) University of New Mexico Health Sciences Center Albuquerque, New Mexico 87131 E-Mail: crumley@mail.unm.edu			8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) U.S. Army Medical Research and Materiel Command Fort Detrick, Maryland 21702-5012			10. SPONSORING / MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES Report contains color.				
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for Public Release; Distribution Unlimited				12b. DISTRIBUTION CODE
13. ABSTRACT (Maximum 200 Words) In New Mexico, over the past 30 years, breast cancer incidence rates among Hispanic women have doubled, and mortality rates have increased over 50%. The factors responsible for these trends are not currently understood. This post-doctoral training project was designed to: 1) investigate ethnic differences in the prevalence, and the timing of the development of obesity in relation to breast cancer risk, and 2) to determine whether ethnic differences in body composition and tumor hormone receptor status contribute to breast cancer survival among New Mexico women. Analyses completed in Year 3 utilized data from the 1996-1999 New Mexico HEAL study (n=650 total cases, 498 invasive cases). Over-all survival (estimated from 1648 person-years of follow-up) was reduced among Hispanic (H) women compared to Non-Hispanic white (NHW) women (H 85% vs. 91.5% NHW), and the percentage of deaths due to breast cancer was higher (11% H vs. 4% NHW, P < 0.007). Body mass index was not significantly associated with breast cancer survival. However, the risk of developing breast cancer (determined from the 1992-94 New Mexico Womens' Health Study case-control data set) was 2.4 (95% CI 1.4-4.0) for Hispanic women whose adult wt. gain was >30 lbs. Significant factors associated with breast cancer death included ER negative status (3.1; 95% CI 1.3-7.4) and stage at diagnosis (TNM Stage IIB vs. Stage I, 3.8; 95% CI 1.3-10.8). After adjusting for age, menopausal status, tamoxifen, stage, and ER status, Hispanic women's risk of breast cancer death was twice that of NHW (2.0; 95% CI .9-4.2, p < .07). Future research with this cohort is warranted in order to identify additional factors that contribute to the ethnic disparity in breast cancer survival.				
14. SUBJECT TERMS breast cancer, obesity, Hispanics, epidemiology				15. NUMBER OF PAGES 39
				16. PRICE CODE
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT Unlimited	

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Background

The unequal burden from the severity of cancer at diagnosis and the reduced survival often experienced by ethnic minorities currently represents an important public health challenge (1,2). As a result, one of the goals of the U.S. Department of Health and Human Services' *Healthy People 2010* program is to address the racial and ethnic disparities in health care and outcomes (3). Regarding breast cancer, a relatively large effort has been devoted to investigating the often-observed reduction in breast cancer survival experienced by African American women compared to white women (4,5,6,7). Hypothesized factors frequently proposed to account for this pattern include: (1) differences in access to, or attitudes toward, seeking health care that can contribute to a delay in diagnosis, or differences in treatment; (2) differences in tumor biology which may be affected by ethnic differences in environmental exposures, genetic susceptibility, health-related behaviors, and obesity (8).

Currently, relatively less is known regarding breast cancer survival among Hispanic women in the US. In two recent studies from northern and southern California that utilized population-based registry data, it was found that breast cancer mortality was significantly higher among Hispanics compared to non-Hispanic white (NHW) women, even after adjusting for differences in stage at diagnosis (9,10). In New Mexico, over the past 30 years, breast cancer incidence rates among Hispanic women have doubled, and mortality rates have increased over 50%. The factors responsible for these trends are currently not well understood. Also of concern are the results of a study examining ethnic differences in breast cancer survival among members of a large HMO in New Mexico, which included Hispanic, Native American and non-Hispanic white breast cancer patients. They found that Hispanic 5-year relative survival was comparable to that of NHW women in 1973-1982, but it was significantly worse during 1983-1992 (11).

This post-doctoral training project was designed to contribute to the understanding of the factors responsible for the recent lack of improvement in breast cancer survival observed among New Mexico Hispanic women.

Objectives of the post-doctoral training project as stated in the original proposal include the following:

- _ to investigate the relationships between measures of body composition and breast cancer risk in Hispanic and NHW New Mexico women;
- _ to investigate the relationships between body composition, hormone receptor status and survival;
- _ to determine whether ethnic differences in obesity, central fat patterning, and the prevalence of positive and negative estrogen receptor status contributes to differences in survival.

The proposed research has utilized existing data from two statewide, case-control studies of breast cancer risk factors. These include the New Mexico participants from the CDC's 1980-1982 Cancer and Steroid Hormone Study (CASH), and the 1992-1994 New Mexico Women's Health Study (NMWHS). Data was also utilized from the 1996-1999 New Mexico Health, Eating, Activity and Lifestyle (HEAL) Study, a breast cancer cohort study that has been conducted in collaboration with the New Mexico Tumor Registry and the National Cancer Institute.

Summary of Research Accomplished during Year One

During *Year One* of this training grant, analytic data sets for the 834 cases with complete information for reported body mass index (BMI) and receptor status in the CASH and NMWHS were compiled. Five-year survival after breast cancer diagnosis (all-cause mortality) was calculated and compared by ethnic group using Kaplan-Meier survival analysis. Relative 5-year survival was also calculated utilizing 1980 U.S. Life Tables that were gender, age, and ethnic specific. When 5-year survival following breast cancer diagnosis was compared by ethnicity *within* studies (CASH and NMWHS separately), there were no significant ethnic differences observed. However, part of the reason for this pattern is likely to be due to the fact that *cause of death* is unevenly distributed by ethnicity in this population, with relatively larger proportions of NHW women dying of causes other than breast cancer. This can potentially obscure the pattern of increased breast cancer death rates in Hispanics, so further analyses performed in *Year Two* and *Year Three* used "death from breast cancer" as the outcome of interest.

These preliminary analyses demonstrated that high BMI was significantly associated with increased all-cause mortality for NHW, but not Hispanic breast cancer patients. Survival was significantly reduced among NHW women with estrogen/progesterone negative (ER-/PR-) receptor status. The magnitude of the difference in survival by ER/PR status was smaller, and did not reach statistical significance for Hispanic women. These preliminary results of all-cause mortality were presented in a platform presentation at the Era of Hope DOD Breast Cancer Research Program meeting in Atlanta, GA in June 2000.

Summary of Research Accomplished during Year Two

During *Year Two* of this training grant, the data from the 1996 -1999 HEAL study became available for editing, verification and for merging with the other two study data sets. The HEAL study is part of a multi-center, cohort study funded by the National Cancer Institute to investigate the role of weight history, body composition, diet, exercise and hormones on breast cancer prognosis. In New Mexico, our cohort consists of 650 incident breast cancer cases that have completed interviews, body composition assessments and blood draws for endogenous hormones. These cases were combined with the earlier two cohorts that were used in the analyses conducted in *Year One* of this training grant.

There were 1484 cases in the combined data set utilized for the 5-year breast cancer survival analysis. In contrast to what was observed for all-cause mortality described above (i.e. no ethnic difference within study cohorts), Hispanic women had significantly increased breast cancer mortality in this combined data set. More specifically, the ethnic difference in breast cancer survival was observed among women diagnosed with regional disease (5-year survival 85% NHW vs. 76% Hispanics, $p < 0.02$). There were no ethnic differences observed in mortality from localized breast cancer. Breast cancer mortality was not significantly associated with BMI, when the three cohorts were combined. Women diagnosed with ER-/PR- tumors experienced significantly higher 5-year breast cancer mortality compared to cases with ER+/PR+ tumors. In a subset of cases from the HEAL 1996-99 cohort that had measures of total weight from fat obtained from DXA scans ($n=353$, 84 H, 269 NHW), it was found that the odds of being ER negative increased 9% for every one kg. increase in body fat for Hispanic women only.

Research Accomplished during Year Three

In order to more thoroughly investigate the causes for the observed ethnic difference in regional stage breast cancer survival described above, the 1996-1999 HEAL study cohort was utilized, due to the more detailed information available including self-reported tamoxifen use, abstracted treatment prescribed, *measured* body composition features (including BMI and waist-to-hip ratio WHR), more complete estrogen and progesterone receptor status, and verified mammography screening intervals. As was mentioned in the Introduction section of this report, it has been commonly hypothesized that ethnic differences in breast cancer survival may be a result of differences in socioeconomic status, lifestyle behaviors, obesity, and/or tumor biology that may impact stage at diagnosis and outcomes (12).

In order to examine the potential impact of these factors on breast cancer survival, the 498 cases of *invasive* breast cancer from the 1996-1999 HEAL study were used for the following analyses. These cases included women who had completed the baseline assessment interview, had been diagnosed at AJCC TNM Stage I, IIA, IIB or IIIA, and had not been previously diagnosed with another primary breast cancer. There were 374 NHW and 124 Hispanic women eligible for this analysis. Vital status (as of July 2002) was established from monthly updates from the New Mexico Bureau of Vital Statistics and Social Security Administration, and through annual contact with patients' physicians and annual study newsletter mailings.

Hispanic women were significantly younger at diagnosis, were more likely to report total household incomes that were \$20,000 or less, were less likely to be college graduates, and were more likely to be overweight according to World Health Organization standards (BMI 25-29.9). Hispanic women were diagnosed with larger tumors, were more likely to be prescribed chemotherapy, and to have estrogen receptor negative breast cancer. There were no significant ethnic differences in TNM stage at diagnosis, in previous mammography screening interval, or the use of tamoxifen. With respect to breast cancer mortality, 11% of Hispanic women died of breast cancer during the 5-year follow-up period, compared to 4.5% of NHW women. Hispanic women were also more likely to be diagnosed with recurrence or new primary breast cancer within the 2.5 years after initial diagnosis (Hispanics 7% vs. 2% NHW). There were no ethnic differences in percent of deaths due to other causes in this cohort.

Similar to what was seen in the earlier analysis using all three cohorts, there was no ethnic difference in breast cancer mortality among women with early, Stage I breast cancer, but among the 195 women diagnosed with Stage IIA, IIB or IIIA, Hispanics had significantly reduced breast cancer survival ($p < 0.007$, Figure 2 next page). Comparing survival curves for ER status shown in Figures 3 and 4, (next page) it can be seen that ER negative breast cancer was associated with decreased survival among both NHW and Hispanic women ($p < 0.02$ and 0.0003 respectively), however the magnitude of difference is clearly much larger for Hispanic women in this cohort. Additionally, in the 1996-1999 HEAL cohort used in this analysis, there was a significant ethnic difference in the prevalence of ER negative tumors (NHW 15% ER neg. vs. Hispanics 26% ER neg. , $p < 0.006$; in the earlier two cohorts it did not reach significance).

Figure 1. Survival by Ethnicity (TNM Stage 1)
(lower curve represents Hispanics)

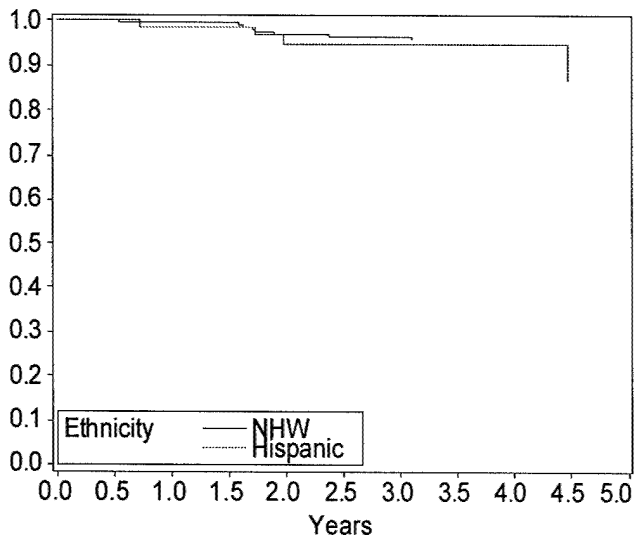


Figure 2. Survival by Ethnicity (TNM Stage IIA-III A)
(lower curve represents Hispanics)

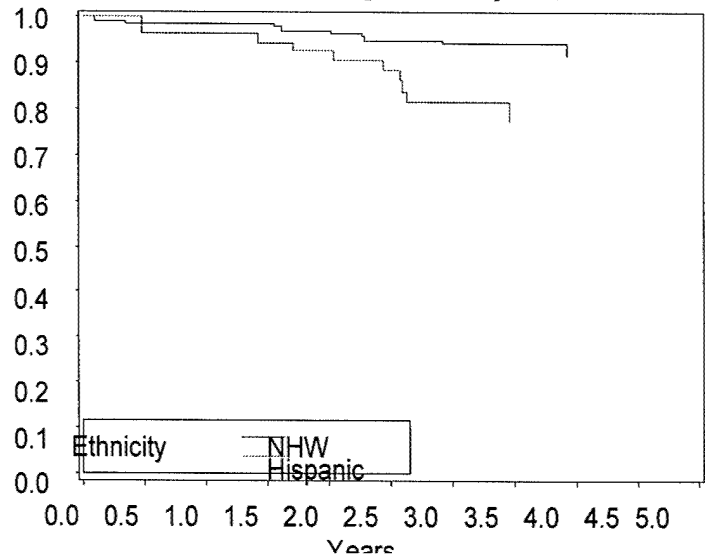


Figure 3. NHW BC Survival by ER Status
(lower curve is ER negative)

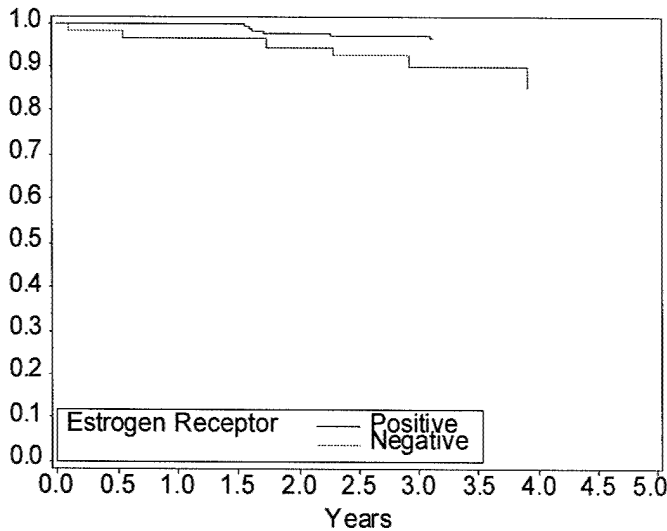


Figure 4. Hispanic BC Survival by ER Status
(lower curve is ER negative)

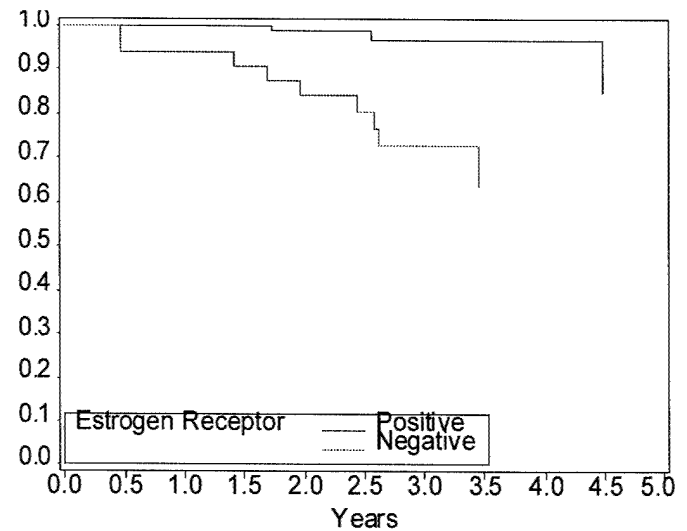


Figure 5. Multivariate Cox Proportional Hazards Model of Breast Cancer Mortality
(also adjusted for age, menopause status, treatment, income and body mass index)

	Hazard Ratio	95% Hazard Ratio CI	Chi-square	p-value
TNM Stage				
I	1.00	--	--	
IIA	1.21	(0.50 - 2.96)	0.6707	
IIB	3.81	(1.34 - 10.83)	0.0120	
IIIA	6.22	(0.70 - 55.44)	0.1014	
	p*=0.0779			
Estrogen Receptor				
Positive	1.00	--	--	
Negative	3.12	(1.32 - 7.38)	0.0097	
Unknown	1.61	(0.36 - 3.75)	0.8023	
	p*=0.0250			
Ethnicity				
NHW	1.00	--	--	
Hispanic	1.98	(0.93 - 4.20)	0.0771	
	p*=0.0771			

• p-value for overall chi-square test

Therefore, Hispanic women in the HEAL cohort were more likely to have ER negative tumors AND also displayed a larger increase in mortality associated with this tumor type. The results of this analysis indicate that more research into the factors responsible for developing ER negative vs. ER positive breast cancer is necessary.

The following sociodemographic factors were not significantly associated with breast cancer mortality and were thus excluded from the multivariate Cox proportional hazards model: income, education, prior mammography screening interval, treatment, and BMI. Waist-to-hip ratio (WHR), a measure of centralized obesity, was not significant overall, but the highest tertile approached significance with a relative risk of breast cancer death of 3.36 (95% CI 0.96-11.75, $p < 0.06$) compared to women in the lowest tertile of WHR. This result is of interest for two reasons: 1) women with large WHR often have higher levels of insulin which is associated with increased proliferation of both normal and malignant breast tissue; and 2) New Mexico Hispanic women are more likely to have higher WHR than NHW (H 42% vs. NHW 31% in the highest tertile in the HEAL cohort).

In the final model, after adjusting for age, menopausal status, and tamoxifen, the relative risk of breast cancer death was significantly increased for women diagnosed with TNM stage IIB (OR 3.81; 95% CI 1.34-10.83) compared to women with localized Stage I disease, and among those with ER negative tumors (OR 3.12; 95% CI 1.32-7.38). And finally, after controlling for all the previously mentioned factors, Hispanic women's risk of death from breast cancer was nearly twice that of NHW (OR 1.98; 95% CI 0.93-4.20). Continued research with this cohort is warranted in order to determine the as yet unidentified factors that explain the ethnic disparity in breast cancer survival.

Given the ethnic differences in stage-specific survival in this cohort, an analysis was performed to investigate factors associated with stage at diagnosis. This analysis included both *in situ* and invasive cases ($n=616$; 466 NHW and 150 Hispanics). Patient characteristics including age, menopausal status, income, education, BMI and health behaviors (including smoking status, fruit/vegetable consumption, physical activity, and mammography screening interval) were examined in relation to stage at diagnosis (*in situ* vs. invasive). Factors significantly associated with odds of invasive stage at diagnosis included lack of prior mammography screening and participation in 5 or more hrs/wk of moderate to vigorous sports activity (≥ 5 hrs/day reduced the odds of invasive stage; adjusted OR 0.48 95% CI 0.27-0.85). Neither of these factors were significantly associated with ethnicity in this cohort, however, national surveys have shown that Hispanic women report use of screening mammography at the lowest levels of any ethnic group, and also report the lowest participation in physical activity (13).

Ethnicity, body weight, and breast cancer risk

There is a large body of research examining the relationship between body weight and breast cancer risk, however very few studies have examined this among Hispanic women. An analysis was performed in *Year Three* utilizing the 1992-1994 New Mexico Womens' Health Study (NMWHS) case-control data set to address this question. The sample size for this analysis included 694 Hispanic women (315 cases, 379 controls) and 813 NHW women (372 cases, 441 controls) who had complete data for physical activity, weight/height at 18, and usual weight/height. Body mass index was categorized in the analysis according the World Health Organization's criteria: BMI < 22 , BMI 22- < 25 , overweight (BMI 25-25.9) and obesity (BMI ≥ 30). Adult weight gain was calculated by subtracting weight at 18 from usual weight, and these were categorized according to quartiles calculated from the controls.

Risk of breast cancer among Hispanic women was significantly associated with weight gain since age 18 in the combined sample containing *both* pre-and postmenopausal women. Odds of developing breast cancer among Hispanic women in the highest quartile of weight gain (> 30 lbs.) was 2.41; (95% CI 1.45-4.01) compared to the lowest quartile of weight gain (< 9 lbs.). In contrast, among non-Hispanic white women, a significantly increased risk associated with the highest quartile of weight gain was only observed among postmenopausal women (OR 2.27; 95% CI 1.09-4.73).

The majority of studies examining the role of weight gain and breast cancer risk have found that obesity is associated with postmenopausal breast cancer risk, and that high BMI as a premenopausal women is associated with a *reduction* in risk of breast cancer (14). The mechanisms commonly proposed to account for these patterns include the following: 1) weight gain as a postmenopausal woman is often centralized around the abdominal region, and this is associated with increases in insulin levels (a mitogen for breast cells) and decreases in sex-hormone-binding-globulin (which results in an increase in unbound, bio-available estrogens that are produced in fat tissue); 2) weight gain in premenopausal women is less likely to be centralized (contributing less to insulin increase) and has been associated with reductions in estrogen and progesterone levels, which in turn may slow breast cell proliferation. It is important to note that the majority of

the studies on weight gain, body composition, menopausal status and breast cancer risk have been conducted in populations of non-Hispanic white women, and therefore the results may not apply to Hispanic women. In New Mexico, Hispanic women are more likely to develop centralized obesity than NHW in general, and this is particularly apparent among premenopausal women. Therefore, the pattern observed here showing that weight gain was associated with increased breast cancer risk among *both* pre- and postmenopausal Hispanic women, but *only* postmenopausal NHW women may be explained due to the ethnic differences in the *timing* of central, abdominal fat deposition, and the associated hormonal consequences. This has the potential to have important implications for the health of Hispanic women for the following reasons:

- 1) they represent the ethnic group with the largest increase in prevalence of obesity in the United States between 1991-1998; an 80% increase for Hispanic women, and a 47% increase for NHW (15);
- 2) three recent studies with younger breast cancer patients observed a significant relationship between overweight (BMI > 25) premenopausal women and the development of ER negative breast cancer tumors (16);
- 3) Hispanic women in the New Mexico HEAL cohort were more likely to develop ER negative tumors, and also exhibited poorer survival associated with them, compared to NHW;
- 4) weight gain in New Mexico Hispanic women is more likely to be centralized and thus may be associated with larger increases in insulin, which may increase breast cancer risk, and breast cancer mortality, via the proliferative action of insulin on tumor growth.

In summary, obesity in New Mexico Hispanic women appears to increase the risk of developing breast cancer in general, and among younger women, may also increase the risk of developing estrogen receptor negative tumors, which in turn is associated with reduced survival.

Training Accomplishments Year 3: Continued Education

Epidemiology Seminar, Public Health 522, Fall 2001, *Professional Paper Preparation*, Public Health 596, Spring 2002, *Epidemiologic Data Analysis: Introduction to STATA*, Public Health 560, Fall 2002
Masters in Public Health Program, University of New Mexico, Health Sciences Center

Key Research Accomplishments: Year 3

- Organized and reviewed the medical abstraction of recurrence, new breast cancer primaries, and cause of death data for the 1996-1999 New Mexico HEAL study cohort (n=650);
- Performed Kaplan-Meier and Cox proportional Hazards analyses of the effects of socioeconomic, demographic, treatment, body composition, and tumor characteristics on 5-year breast cancer survival for the invasive cases (n=498) of the NM HEAL cohort;
- Examined the effects of ethnicity, income, education, and health behaviors (smoking, fruit/vegetable consumption, BMI, physical activity and mammography screening) on stage at diagnosis in the HEAL cohort;
- Conducted logistic regression analyses to determine the relationship between *usual body weight, adult weight gain*, and breast cancer risk by ethnicity, utilizing cases (315 H, 372 NHW) and controls (379 H and 441 NHW) from the 1992-1994 New Mexico Womens' Health Study (a statewide, population-based, case-control study of breast cancer risk factors);

Reportable Outcomes: Year 3

- Presented poster and platform presentation at DOD Era of Hope Breast Cancer Research Program meeting, Sept. 25-28, 2002 (Please refer to Appendix for a copy of this presentation);
- *Oncology News International* is publishing an article in December 2002 describing the results of the *Year Three* research that I presented at the 2002 DOD Era of Hope presentation mentioned above ;
- Wrote and submitted an NIH R-01 grant to study the role of socioeconomic status and ethnicity on the development of centralized obesity during the menopause transition among Hispanic and NHW women based on results from Year Two and Three analyses conducted during this training grant;
- Letter of Academic Title renewed in the Dept. of Internal Medicine, University of New Mexico, based on the progress of research conducted as part of this training grant;
- Draft of manuscript based on 2002 presentation at Era of Hope meeting is included in Appendix of this report.

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Ethnic Differences in Breast Cancer Prognosis and Short-Term Survival Among New Mexico Women

**Diane D. Crumley, W. Curtis Hunt, Frank D. Gilliland,
Richard N. Baumgartner, Kathy B. Baumgartner and
Rachel Ballard-Barbash**

Era of Hope
Dept. of Defense
Breast Cancer Research Program Meeting
September 25-28, 2002



Introduction

- **This presentation summarizes results from analyses conducted during the third year of my postdoctoral training grant awarded by the Dept. of Defense, Breast Cancer Research Program.**
- **Analyses utilize survival data obtained as part of the Health, Eating, Activity, and Lifestyle (HEAL) study, a multi-site, population-based cohort study of breast cancer prognosis funded by the National Cancer Institute's SEER Special Studies program.**
- **The HEAL study is designed to assess the effects of modifiable factors including body composition, diet, physical activity and hormone levels on breast cancer prognosis and survival.**



Acknowledgements

**Rick Baumgartner, PhD, University of New Mexico
Health, Eating, Activity, and Lifestyle (HEAL) Study
Principal Investigator**

**Frank Gilliland, MD, PhD, University of Southern California
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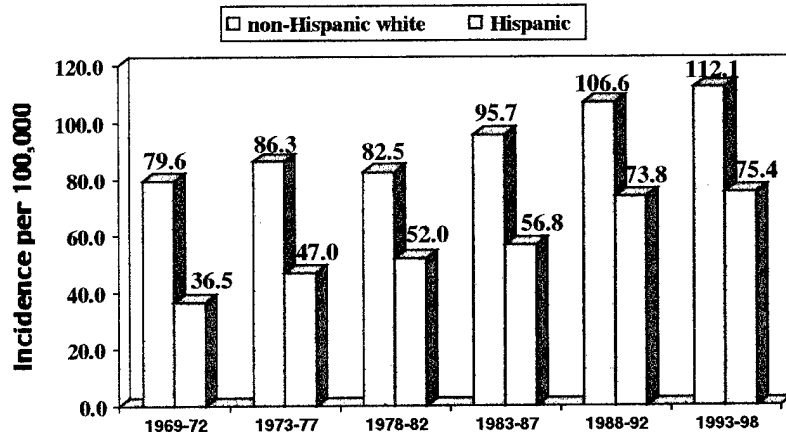


Outline of presentation

- **An introduction to the research problem (ethnic differences in breast cancer stage at diagnosis and mortality rates in New Mexico)**
- **An introduction to the HEAL Study design**
- **Description of ethnic differences in demographic and prognostic factors in the New Mexico HEAL cohort**
- **Results from univariate and multivariate survival analyses**
- **Suggestions and plans for future research**



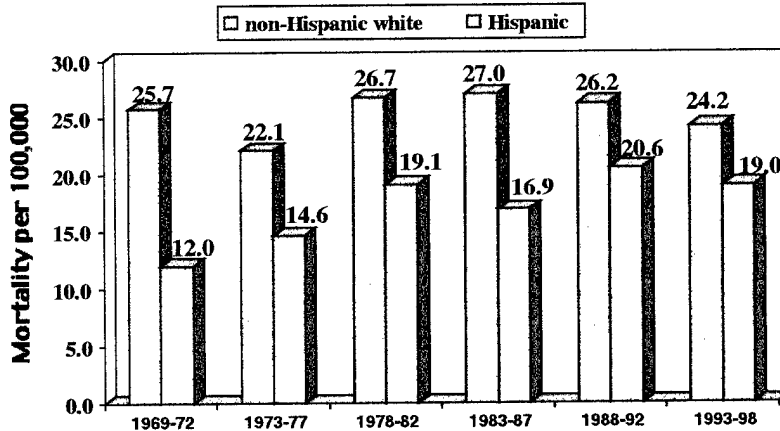
Breast Cancer Incidence Rates* New Mexico Females, 1969-1998



*Age-adjusted to 1970 standard population



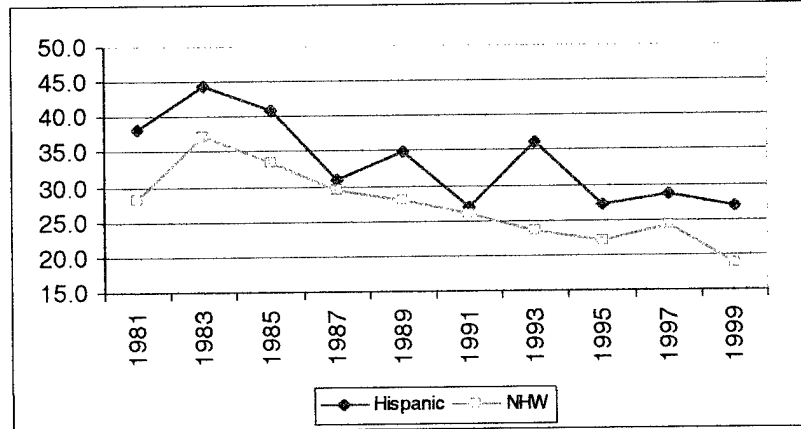
Breast Cancer Mortality Rates* New Mexico Females, 1969-1998



*Age-adjusted to 1970 standard population



Percent Diagnosed with Regional Stage Breast Cancer New Mexico 1981 - 1999



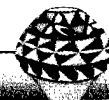
Regional disease decreases through time for both ethnic groups, with Hispanics consistently higher during each time period.



HEAL Study Cohort

- Study Phases

- Baseline assessments (within 6 to 9 months of DX) included interview, body composition measures, and blood draw for hormone assays and genetic susceptibility (n=654)
 - AJCC Stages 0, I, IIA, IIB and IIIA
 - Diagnosed between July 1996 and March 1999
 - 24% Hispanic and 76% non-Hispanic white (NHW)
 - Ages 29 - 91 years old
- 24-month Follow-up (n=526) included interview, body composition assessment, fasting blood draw and medical abstraction of all self-reported events of recurrence
- 36 to 48-month Health-Related Quality of Life self-administered questionnaire
- 60-month telephone interview (in progress)



Methods

- Subjects in these analyses included 498 invasive breast cancer cases who completed the Baseline assessments (374 NHW and 124 Hispanic)
- Vital status (as of July 2002) established by monthly updates from the New Mexico Bureau of Vital Statistics and Social Security Administration, and through contact with patients' physicians and annual newsletter mailings
- Chi-Squared tests for ethnic differences in demographic and prognostic characteristics
- Kaplan-Meier survival analysis to assess role of patient characteristics on short-term (~3 year) breast cancer survival by ethnicity
- Cox Proportional Hazards models to assess multivariate factors on short-term breast cancer survival




Demographic Characteristics by Ethnicity


	NHW (n = 374)		Hispanic (n = 124)		Chi-Square p-value
	N	%	N	%	
Age at Diagnosis					0.0028
<40	18	5 %	12	10 %	
40-49	60	16 %	37	30 %	
50-59	106	28 %	31	25 %	
60-69	95	25 %	24	19 %	
70-79	67	18 %	15	12 %	
80+	28	8 %	5	4 %	
Income					<0.0001
<\$10,000	31	8 %	22	18 %	
\$10,000-\$20,000	48	13 %	25	20 %	
\$20,000-\$50,000	146	39 %	50	40 %	
>\$50,000	125	33 %	16	13 %	
Unknown or refused	24	7 %	11	9 %	



Subject Characteristics by Ethnicity					
	NHW (n = 374)		Hispanic (n = 124)		Chi-Square p-value
	N	%	N	%	
Months since prior screen*					0.3284
4 – 15 months	190	51 %	52	43 %	
16 – 27 months	85	23 %	30	25 %	
> 28 months	54	15 %	19	16 %	
No prior	42	11 %	20	16 %	
BMI at baseline					0.0339
< 25	192	51 %	47	38 %	
25 – 30	109	29 %	47	38 %	
30 +	73	20 %	30	24 %	
WHR at baseline*					0.0724
< 0.80	108	31 %	28	24 %	
0.80 – 0.86	132	38 %	40	34 %	
0.87 +	106	31 %	49	42 %	
*Months since prior screen: n = 6 unknown (2 %); WHR: n = 35 unknown (7 %)					




Prognostic Characteristics by Ethnicity					
	NHW (n = 374)		Hispanic (n = 124)		Chi-Square p-value
	N	%	N	%	
TNM Stage*					0.4374
I	219	62 %	64	55 %	
IIA	100	28 %	35	30 %	
IIB	32	9 %	15	13 %	
IIIA	3	1 %	2	2 %	
Estrogen receptor					0.0063
Positive	275	74 %	73	59 %	
Negative	56	15 %	32	26 %	
Unknown/Not done	43	11 %	19	15 %	
Progesterone receptor					0.0071
Positive	229	61 %	56	45 %	
Negative	89	24 %	43	35 %	
Unknown/Not done	56	15 %	25	20 %	
*invasive tumor size unknown: n = 28 (6 %)					



Prognostic Characteristics by Ethnicity

	NHW (n = 374)		Hispanic (n = 124)		Chi-Square p-value
	N	%	N	%	
Tumor Size					0.0382
≤ 10 mm	152	43 %	38	33 %	
> 10 mm	202	57 %	78	67 %	
Treatment*					0.0233
Surgery alone	116	32 %	41	34 %	
Surgery & Radiation (no chemo)	162	44 %	37	30 %	
Surgery & Chemo	88	24 %	44	36 %	
Using tamoxifen at baseline					0.1877
No	207	55 %	76	61 %	
Yes	166	45 %	46	37 %	

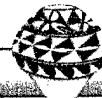
*Tamoxifen unknown: n = 3 (2%)



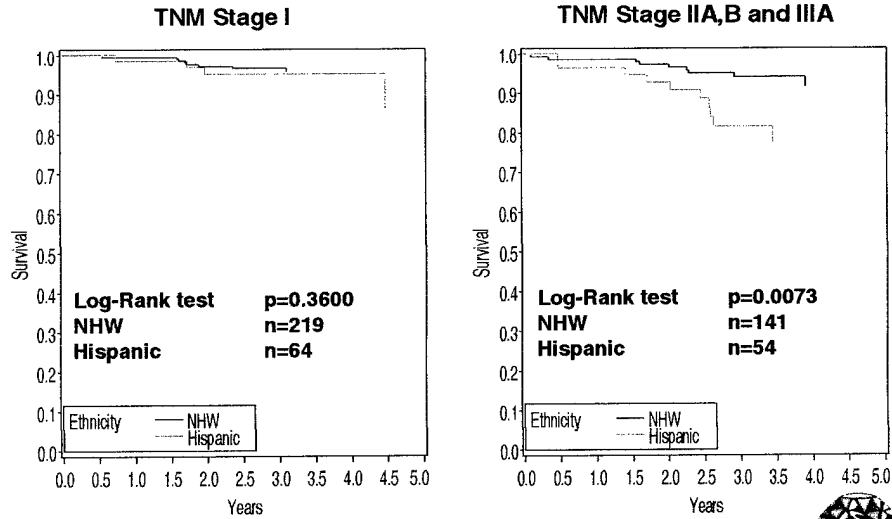
Distribution of Vital Status by Ethnicity

	NHW (n = 374) 1255		Hispanic (n = 124) 393		Chi-Square p-value
	N	%	N	%	
Person-years of follow-up					
Mean follow-up time (yrs)	3.3		3.2		
Vital Status					
Alive	339	91 %	105	85 %	0.0642
Dead	35	9 %	19	15 %	
Death : Breast Cancer	17	4.5 %	14	11 %	0.0071
Death : Other Causes	18	4.5 %	5	4 %	0.3958
Recurrence at 24 months*	9	2 %	9	7 %	0.0121
Age at DX: Death BC					
< 40	2	12 %	2	14 %	
40-49	3	17.5 %	5	36 %	
50-64	3	17.5 %	4	29 %	
65 +	9	53 %	3	21 %	

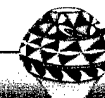
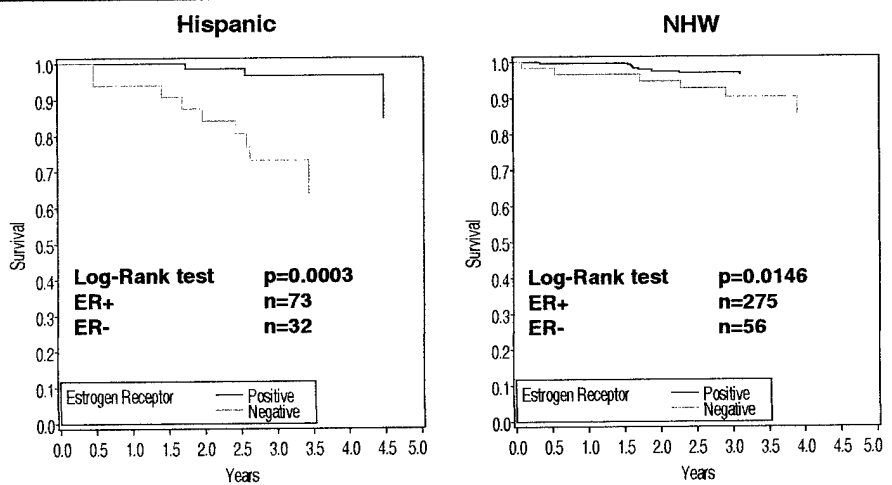
*recurrence or new primary self-reported at 24-month follow-up interview and then verified by medical abstraction



Short-term Breast Cancer Survival by Stage and Ethnicity



Short-term Breast Cancer Survival by ER status and Ethnicity



Cox Proportional Hazards Regression Model of Death from Breast Cancer (also adjusted for BMI, ethnicity, ER status, and stage)			
	Hazard Ratio	95% Hazard Ratio CI	Chi-square p-value
Age at Diagnosis			
30 – 49	2.87	(0.58 – 14.28)	0.1940
50 – 59	1.69	(0.41 – 6.99)	0.4713
60 – 69	1.00	–	–
70 – 79	3.41	(0.80 – 14.58)	0.0985
80 – 89	7.90	(1.83 – 33.98)	0.0055
	p*=0.0483		
Menopausal Status			
Pre	1.00	–	–
Post	1.79	(0.57 – 5.67)	0.3202
	p*=0.3202		
Tamoxifen at Baseline			
No	1.00	–	–
Yes	0.46	(0.17 – 1.26)	0.1303
	p*=0.1303		
*p-value for overall chi-square test			



Cox Proportional Hazards Regression Model of Death from Breast Cancer (also adjusted for BMI, age, menopause status and tamoxifen use)			
	Hazard Ratio	95% Hazard Ratio CI	Chi-square p-value
TNM Stage			
I	1.00	--	--
IIA	1.21	(0.50 – 2.96)	0.6707
IIB	3.81	(1.34 – 10.83)	0.0120
IIIA	6.22	(0.70 – 55.44)	0.1014
	p*=0.0779		
Estrogen Receptor			
Positive	1.00	--	--
Negative	3.12	(1.32 – 7.38)	0.0097
Unknown	1.61	(0.36 – 3.75)	0.8023
	p*=0.0250		
Ethnicity			
NHW	1.00	--	--
Hispanic	1.98	(0.93 – 4.20)	0.0771
	p*=0.0771		
*p-value for overall chi-square test			



Patient and Prognostic Factors

Non-significant results from Cox Proportional Hazards Models

Factor	Chi-Square p-value
Income	0.8108
Prior screening interval	0.6656
Treatment	0.8675
BMI	0.6614
WHR	0.0959



Results Summary

A larger proportion of Hispanic women died from breast cancer during the 3-yr follow-up period (11%H vs. 4%NHW), and were more likely to be <50 years old (50%H vs. 29% NHW).

Hispanic women were significantly younger at diagnosis, reported lower incomes, higher body mass indices, and were more likely to have chemotherapy prescribed; however these factors were not significantly associated with breast cancer survival.

There were no ethnic differences in breast cancer survival among women diagnosed with local stage I breast cancer, however Hispanic women with stage II A or beyond had significantly reduced survival compared to NHW with similar stages.

Hispanic women were more likely to be diagnosed with estrogen receptor negative (ER-) tumors (26%H vs. 15%NHW), which in turn was associated with significantly reduced breast cancer survival.



Future Research

- Establish factors associated with developing estrogen receptor negative (ER-) vs. positive (ER+) breast cancer
 - The HEAL study will be able to investigate whether ethnic differences in body composition, weight history, hormone levels, physical activity, diet, reproductive history, use of exogenous hormones or family history of breast cancer are associated with developing ER- vs. ER+ breast cancer using baseline HEAL data.
- Identify factors associated with poorer stage-specific survival among Hispanic women
 - The 5-year HEAL follow-up will attempt to determine whether there are ethnic differences in stage-specific treatment received by asking participants about what treatment was prescribed, whether it was completed, and if not, what factor contributed to treatment cessation.
 - The HEAL study will be able to investigate tumor tissue characteristics including immunohistochemistry measures of tumor suppression and cell proliferation (p53 and Ki-67) in relation to stage at diagnosis and survival.
- Identify factors associated with the diagnosis of early (*in situ* and stage 1) vs. later stage breast cancer
 - The HEAL study can examine the intervals between the date of the abnormal mammogram, diagnosis and treatment by ethnicity.



TITLE: Ethnic Differences in Breast Cancer Prognosis and Short-term Survival among New Mexico Women

RUNNING HEAD: Ethnicity and Breast Cancer Survival

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KEY WORDS: breast cancer survival, Hispanic, prognosis, estrogen receptor

Abstract

Background: Over the past 30 years, breast cancer incident rates among Hispanic women in New Mexico have doubled and mortality rates have increased over 50%. The factors responsible for these trends are not currently understood.

Methods : To investigate the role of ethnicity on breast cancer survival, subjects were selected from a population-based cohort of 650 participants enrolled in the New Mexico "Health, Eating, Activity and Lifestyle " (HEAL) Study, a multi-site, cohort study funded by the National Cancer Institute. Subjects included 373 non-Hispanic white (NHW) and 124 Hispanic (H) invasive breast cancer cases (TNM stages I-III A) diagnosed between September 1996 and March 1999. We investigated the effects of prognostic factors and patient characteristics on short-term breast cancer survival (mean follow-up is 3.3 years after diagnosis).

Results: Over-all survival (estimated from 1325 person-years of follow-up) was significantly reduced among Hispanic women compared to NHW (85% H vs. 91.5% NHW), and the percentage of deaths due to breast cancer were higher (11% H vs. 4.5% NHW; $p < 0.007$). Hispanic women were significantly younger, had a higher prevalence of overweight, BMI 25-29.9, had a larger proportion of estrogen receptor negative tumors, and were more likely to receive chemotherapy. In the multivariate Cox proportional hazards survival model, significant factors included estrogen receptor status (hazard ratio ER- vs. ER+, 3.1; 95% CI 1.3, 7.4) and stage at diagnosis (hazard ratio for TNM Stage IIB vs. TNM Stage I, 3.8; 95% CI 1.3, 10.8). Treatment, income, BMI and prior screening interval were not significantly associated with breast cancer death. After adjusting for age, stage, menopausal status, ER status, tamoxifen use, and ethnicity, Hispanic women's risk of breast cancer death was twice that of NHW women (2.0; 95% CI 0.9, 4.2). Future research with this cohort is warranted in order to identify additional factors that contribute to the ethnic disparity in breast cancer survival.

INTRODUCTION

The unequal burden from the increased severity of cancer at diagnosis, and the reduced survival often experienced by ethnic minorities in the United States, currently represents an important public health challenge (1,2). As a result, one of the goals of the U.S. Department of Health and Human Services' *Healthy People 2010* program is to actively address the current racial and ethnic disparities in health care and disease outcomes (3). Additionally, the American Cancer Society's goals for 2015 to reduce age-adjusted cancer mortality rates by 50% include the acknowledgement that in order to achieve this goal, it will be important to address the excess burden in minority populations (McDonald 2001; insert ref after 3).

Regarding breast cancer, a relatively large effort has been devoted to investigating the often-observed reduction in breast cancer survival experienced by African American women compared to Caucasian women (4,5,6,7). Hypothesized factors frequently proposed to account for this pattern include: 1) differences in access to, or attitudes toward, seeking health care that can contribute to a delay in diagnosis; 2) differences in treatment received; and 3) differences in tumor biology, which may be affected by ethnic differences in environmental exposures, genetic susceptibility, health-related behaviors, and obesity (8).

Currently, relatively less is known regarding breast cancer survival among Hispanic women in the US. In two recent studies from northern and southern California that used population-based registry data, it was found that breast cancer mortality was significantly higher among Hispanics compared to non-Hispanic white (NHW) women, even after adjusting for differences in stage at diagnosis (9,10). In New Mexico, over the past 30 years, breast cancer incidence rates among Hispanic women have doubled, and mortality rates have increased over 50%. The factors responsible for these trends are currently not well understood. Also of concern are the results of a study examining ethnic differences in breast cancer

survival among equally insured members of a large HMO in New Mexico, which included Hispanic, Native American and non-Hispanic white breast cancer patients. They found that Hispanic 5-year relative survival was comparable to that of NHW women in 1973-1982, but it was significantly worse during 1983-1992 (11).

Studies examining survival differences between African American and Caucasian breast cancer patients have often found that the disparity in survival is greatly reduced or disappears after adjusting for cancer stage at diagnosis (4,7). Therefore, determining the factors associated with the more advanced stage of cancer often seen among Black women remains important to understanding survival differences. Two recent studies have found that the higher prevalence of obesity in African American breast cancer patients explained approximately 30% of the racial difference in stage at diagnosis (Moorman et al. 2001; Cui et al. 2002 insert after ref 7). Other important factors that have been shown to reduce breast cancer survival include younger age at diagnosis, and negative estrogen receptor status (features that often co-occur, especially among Black women (6). In order to investigate whether these factors are responsible for the poorer breast cancer survival reported for New Mexico Hispanic women (11) we examined breast cancer survival in a group of Hispanic and Non-Hispanic white women participating in an on-going cohort study to:

- 1) investigate the relationships between body composition, hormone receptor status and breast cancer survival;
- 2) to determine whether ethnic differences in obesity, central fat patterning, and the prevalence of positive and negative estrogen receptor status contributes to differences in survival.

METHODS

Study population

Subjects are participants in the "Health, Eating, Activity, and Lifestyle Study (HEAL)," a collaborative, multi-center prospective cohort study of breast cancer cases identified through the National Cancer Institute's Surveillance, Epidemiology and End Results (SEER) population-based cancer registries in New Mexico, Los Angeles County (CA), and Western Washington. The HEAL study is designed to investigate the effects of physical activity, diet, body composition, hormones, and tumor characteristics on stage of breast cancer at diagnosis, recurrence and survival. The study, funded by the National Cancer Institute, began in New Mexico in 1996, and has collected information from participants at baseline (within nine months of diagnosis), at 24 months after the baseline interview, and is currently completing the 5 year follow-up. Data presented for this analysis will include Hispanic and non-Hispanic white HEAL participants from New Mexico.

Recruitment and Eligibility

Breast cancer patients were identified through rapid case ascertainment by the New Mexico Tumor Registry (a NCI SEER population-based registry) and were eligible for this study if they resided in the following New Mexico counties (Bernalillo, Sante Fe, Sandoval, Valencia, and Taos). Eligible cases had been diagnosed with TNM stages 0, I, IIA, IIB, or IIIA breast cancer between September 1996 and March 1999, and had not been diagnosed previously with breast cancer. Eligibility required subject participation in an in-person interview within 9 months from the time of diagnosis. All participants signed an informed consent approved by the University's IRB. A total of 654 subjects completed the baseline portion of the study, and were eligible for follow-up.

Data Collection and Variable definitions

Survival analyses included the 498 invasive breast cancer cases (*in situ* cases were excluded from this analysis due to incomplete information regarding tumor size and estrogen receptor status), that included 374 NHW and 124 Hispanic women. Vital status, including cause of death (as of July 2002) was established from monthly updates from the New Mexico Bureau of Vital Statistics and Social Security Administration, and through annual contact with patients' physicians and annual study newsletter mailings.

Baseline information was collected during an in-person interview that included questions regarding weight history, reproductive and menstrual history, age at menopause, type of menopause, hysterectomy status, history of oral contraceptive and hormone replacement therapy use, tamoxifen use, family history of breast and other specific cancers, diabetes mellitus, history of tobacco and alcohol use, dietary patterns, physical activity, mammography screening utilization, weight gain/loss during treatment, and selected demographic data including income, education, marital status, occupation, and self-reported ethnicity.

Body composition measures included in this analysis include body mass index $BMI = wt(kg)/ht(m^2)$ and waist-to-hip ratio (measured to nearest cm) that were obtained by trained study staff at the time of interview. Interviewers were trained in anthropometric techniques by qualified instructors who monitored their measurements every three months to minimize measurement drift.

Prognostic factors including American Joint Committee on Cancer (AJCC) stage groupings TNM stage I, IIA, IIB, and IIIA, maximum tumor diameter, estrogen and progesterone receptor status, and first course of treatment were obtained through medical abstraction by New Mexico Tumor Registry staff.

Statistical Analysis

Subject characteristics were categorized as follows: BMI by WHO criteria for overweight (BMI 25-29.9), obesity (BMI \geq 30); waist-to-hip ratio (WHR) by tertiles, and reported prior mammography screening interval (verified by radiology facility records) categorized as 4-15 months, 16-27 months, >28 months and no screening prior to diagnostic series. Prognostic characteristics included tumor size \leq 10 mm or >10mm, treatment grouped as surgery only, surgery and radiation, surgery and chemotherapy, and estrogen receptor positive and negative status.

Chi-square tests were performed to determine ethnic differences in demographic and prognostic characteristics. Kaplan-Meier survival curves were constructed to assess the role of patient characteristics on short-term (3-5 year) breast cancer survival. Cox proportional hazards models were used to evaluate the multivariate effects of patient and prognostic factors on breast cancer survival.

RESULTS

Hispanic women were significantly younger at diagnosis, were more likely to report total household incomes that were \$20,000 or less, and were more likely to be overweight according to World Health Organization standards (BMI 25-29.9) (Table 1). Hispanic women were diagnosed with larger tumors ($p < 0.038$), were more likely to be prescribed chemotherapy ($p, 0.023$), and to have estrogen receptor negative breast cancer ($p < 0.006$) (Table 2). There were no significant ethnic differences in TNM stage at diagnosis, in previous mammography screening interval, or the use of tamoxifen (Tables 1 and 2).

With respect to breast cancer mortality, 11% of Hispanic women died of breast cancer during the 5-year follow-up period, compared to 4.5% of NHW women ($p < 0.007$). Hispanic women were also more likely to be diagnosed with recurrence or new primary breast cancer within the 2.5 years after initial diagnosis (Hispanics 7%

vs. 2% NHW, $p < 0.021$). There were no ethnic differences in percent of deaths due to other causes in this cohort (Table 3).

There was no ethnic difference in breast cancer mortality among women with early, Stage I breast cancer, but among the 195 women diagnosed with Stage IIA, IIB or IIIA, Hispanics had significantly reduced breast cancer survival ($p < 0.007$, Table 4, Figures A and B). Comparing survival curves for estrogen receptor (ER) status shown in Figures C and D, (Table 4) it can be seen that ER negative breast cancer was associated with decreased survival among both NHW and Hispanic women ($p < 0.02$ and 0.0003 respectively), however the magnitude of difference is clearly much larger for Hispanic women in this cohort. Therefore, Hispanic women in the HEAL cohort were more likely to have ER negative tumors, and also displayed a larger increase in mortality associated with this tumor type.

The following sociodemographic factors were not significantly associated with breast cancer mortality and were thus excluded from the multivariate Cox proportional hazards model: income, prior mammography screening interval, treatment, and BMI. Waist-to-hip ratio (WHR), a measure of centralized obesity, was not significant overall, but the highest tertile approached significance with a relative risk of breast cancer death of 3.36 (95% CI 0.96-11.75, $p < 0.06$) compared to women in the lowest tertile of WHR. This result is of interest for two reasons: 1) women with large WHR often have higher levels of insulin which is associated with increased proliferation of both normal and malignant breast tissue; and 2) New Mexico Hispanic women are more likely to have higher WHR than NHW (H 42% vs. NHW 31% in the highest tertile in the HEAL cohort).

In the multivariate model, the relative risk of breast cancer death was significantly increased for women diagnosed with TNM stage IIB (OR 3.81; 95% CI 1.34-10.83) compared to women with localized Stage I disease, and among those with ER negative tumors (OR 3.12; 95% CI 1.32-7.38). And finally, after adjusting for age,

menopausal status, tamoxifen, stage, and ER status, Hispanic women's risk of death from breast cancer was nearly twice that of NHW (OR 1.98; 95% CI 0.93-4.20).

Continued research with this cohort is warranted in order to identify additional factors that contribute to the ethnic disparity observed in breast cancer survival.

DISCUSSION

There is mounting evidence to support the recent claim that a substantial portion of the racial difference often observed in breast cancer survival between African American and Caucasian women, can be explained by differences in the prevalence of obesity, and the associated effect on stage at diagnosis (Moorman et al. 2001; Cui et al. 2002 add to refs). There is also increasing evidence to support a relationship between premenopausal breast cancer, high body mass index, the development of estrogen negative tumors, and reduced survival (Daling et al. 2001). Although less is known about factors influencing breast cancer survival in Hispanic women, the results reported here from the New Mexico HEAL study cohort indicate that Hispanic women were more likely to be diagnosed with estrogen receptor negative tumors, and also experienced a larger reduction in survival associated with them, compared to NHW women. There was also an indication that body composition, particularly measures of centralized obesity, including high waist-to-hip ratio was associated with increased risk of death from breast cancer, and was more prevalent among Hispanic women in the cohort.

There is a large body of research examining the relationship between body weight and breast cancer risk, and there is increasing evidence to also support a relationship between obesity and reduced breast cancer survival (Goodwin and Boyd 1990 add to refs). It is likely that the mechanisms often proposed to explain the increase in breast cancer risk associated with obesity, such as increased levels of bio-available estrogens and increased insulin levels, may also contribute to reduced survival through the tumor-promoting effects of estrogen and insulin (Moorman et

al 2001 add to refs). Despite the high prevalence of obesity reported for U.S. Hispanic women, very few studies have examined the relationship between obesity and breast cancer in Hispanic women.

Results recently reported for the New Mexico Womens' Health Study (NMWHS), a statewide, population-based case-control study conducted in New Mexico in 1992-1994 address the role of ethnicity, body size, timing of weight gain, and breast cancer risk (Wentzen et al 2002 add to refs). The sample size for that analysis included 694 Hispanic women and 813 NHW women who had complete data for self-reported physical activity, weight/height at 18, and usual weight/height. Body mass index was categorized in the analysis according the World Health Organization's criteria: BMI <22, BMI 22-<25, overweight (BMI 25-25.9) and obese (BMI \geq 30). Adult weight gain was calculated by subtracting weight at 18 from usual weight, and these were categorized according to quartiles calculated from the controls.

Risk of breast cancer among Hispanic women was significantly associated with weight gain since age 18 in the combined sample containing *both* pre-and postmenopausal women. Odds of developing breast cancer among Hispanic women in the highest quartile of weight gain (> 30 lbs.) was 2.41; (95% CI 1.45-4.01) compared to the lowest quartile of weight gain (<9 lbs.). In contrast, among non-Hispanic white women, a significantly increased risk associated with the highest quartile of weight gain was only observed among postmenopausal women (OR 2.27; 95% CI 1.09-4.73).

The majority of studies examining the role of weight gain and breast cancer risk have found that obesity is associated with postmenopausal breast cancer risk, and that high BMI as a premenopausal women is associated with a *reduction* in risk of breast cancer (14). The mechanisms commonly proposed to account for these patterns include the following: 1) weight gain as a postmenopausal woman is often

centralized around the abdominal region, and this is associated with increases in insulin levels (a mitogen for breast cells) and decreases in sex-hormone-binding-globulin (which results in an increase in unbound, bio-available estrogens that are produced in fat tissue); 2) weight gain in premenopausal women is less likely to be centralized (contributing less to insulin increase) and has been associated with reductions in estrogen and progesterone levels, which in turn may slow breast cell proliferation.

It is important to note that the majority of the studies on weight gain, body composition, menopausal status and breast cancer risk have been conducted in populations of non-Hispanic white women, and therefore the results may not apply to Hispanic women. In New Mexico, Hispanic women are more likely to develop centralized obesity than NHW in general, and this is particularly apparent among premenopausal women. Therefore, the pattern observed in the New Mexico Womens' Health Study showing that weight gain was associated with increased breast cancer risk among *both* pre-and postmenopausal Hispanic women, but *only* postmenopausal NHW women may be explained due to ethnic differences in the *timing* of central, abdominal fat deposition, and the associated hormonal consequences. This has the potential to have important implications for the health of Hispanic women for the following reasons:

- 1) they represent the ethnic group with the largest increase in prevalence of obesity in the United States between 1991-1998; an 80% increase for Hispanic women, and a 47% increase for NHW (15);
- 2) three recent studies with younger breast cancer patients observed a significant relationship between overweight (BMI > 25) premenopausal women and the development of ER negative breast cancer tumors (16);
- 3) Hispanic women in the New Mexico HEAL cohort were more likely to develop ER negative tumors, and also exhibited poorer survival associated with them,

compared to NHW; 4) weight gain in New Mexico Hispanic women is more likely to be centralized and thus may be associated with larger increases in insulin, which may increase breast cancer risk, and breast cancer mortality, via the proliferative action of insulin on tumor growth.

In summary, obesity in New Mexico Hispanic women appears to increase the risk of developing breast cancer in general, and among younger women, may also increase the risk of developing estrogen receptor negative tumors, which is associated with reduced survival. Future research with the New Mexico HEAL cohort will continue to investigate relationships between body composition, lifestyle factors such as diet and exercise, hormone levels, and the development of estrogen receptor negative vs. estrogen receptor positive breast cancer, with the goal of increasing the understanding of factors that contribute to the ethnic disparity in breast cancer survival which continues to be observed.

(insert strengths and weakness paragraph to discussion section)

Acknowledgements

This study was supported through the Dept. of Defense Breast Cancer Research Program postdoctoral training grant DAMD 17-98-1-8218 and through NCI contract N01-PC-67007.

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**Table 1: Selected demographic characteristics by ethnicity
New Mexico HEAL Study (n=498)**

	NHW (n = 374)		Hispanic (n = 124)		Chi-Square p-value
	N	%	N	%	
Age at Diagnosis					0.0028
<40	18	5 %	12	10 %	
40-49	60	16 %	37	30 %	
50-59	106	28 %	31	25 %	
60-69	95	25 %	24	19 %	
70-79	67	18 %	15	12 %	
80+	28	8 %	5	4 %	
Income					0.0001
<\$10,000	31	8 %	22	18 %	
\$10,000-\$20,000	48	13 %	25	20 %	
\$20,000-\$50,000	146	39 %	50	40 %	
>\$50,000	125	33 %	16	13 %	
Unknown or refused	24	7 %	11	9 %	
Months since prior screen*					0.3284
4 – 15 months	190	51 %	52	43 %	
16 – 27 months	85	23 %	30	25 %	
> 28 months	54	15 %	19	16 %	
No prior	42	11 %	20	16 %	
BMI at baseline					0.0339
< 25	192	51 %	47	38 %	
25 – 30	109	29 %	47	38 %	
30 +	73	20 %	30	24 %	
WHR at baseline**					0.0724
< 0.80	108	31 %	28	24 %	
0.80 – 0.86	132	38 %	40	34 %	
0.87 +	106	31 %	49	42 %	

* months since prior screen unknown for n=6 (2%)

** WHR not measured for n=35 (7%)

**Table 2: Selected prognostic factors by ethnicity
New Mexico HEAL Study (n=498)**

	NHW (n = 374)		Hispanic (n = 124)		Chi-Square p-value
	N	%	N	%	
TNM Stage*					0.4374
I	219	62 %	64	55 %	
IIA	100	28 %	35	30 %	
IIB	32	9 %	15	13 %	
IIIA	3	1 %	2	2 %	
Estrogen receptor					0.0063
Positive	275	74 %	73	59 %	
Negative	56	15 %	32	26 %	
Unknown/Not done	43	11 %	19	15 %	
Progesterone receptor					0.0071
Positive	229	61 %	56	45 %	
Negative	89	24 %	43	35 %	
Unknown/Not done	56	15 %	25	20 %	
Tumor Size*					0.0382
≤ 10 mm	152	43 %	38	33 %	
> 10 mm	202	57 %	78	67 %	
Treatment					0.0233
Surgery alone	116	32 %	41	34 %	
Surgery & Radiation	162	44 %	37	30 %	
Surgery & Chemo	88	24 %	44	36 %	
Using tamoxifen at baseline **					0.1877
No	207	55 %	76	61 %	
Yes	166	45 %	46	37 %	

* invasive cases with unknown tumor size n=28 (6%)

** use of tamoxifen unknown n=3 (2%)

Table 3: Vital Status of New Mexico HEAL Study cohort at 3-5 years since diagnosis (invasive cases n=498)

	NHW (n = 374)		Hispanic (n = 124)		Chi-Square p-value
	N	%	N	%	
Vital Status					
Alive	339	91 %	105	85 %	0.0642
Dead	35	9 %	19	15 %	
Death : Breast Cancer	17	4.5 %	14	11 %	0.0071
Death : Other Causes	18	4.5 %	5	4 %	0.3958
Recurrence at 24 months*	9	2 %	9	7 %	0.0121
Age at DX: Death Breast Cancer					
< 40	2	12 %	2	14 %	
40-49	3	17.5 %	5	36 %	
50-64	3	17.5 %	4	29 %	
65 +	9	53 %	3	21 %	

* recurrence or new primary reported at 24 month follow-up interview and verified by medical abstraction

Table 4: Kaplan-Meier Survival Curves for Stage* and Estrogen Receptor Status**

Figure A. BC Survival by Ethnicity (TNM Stage I)

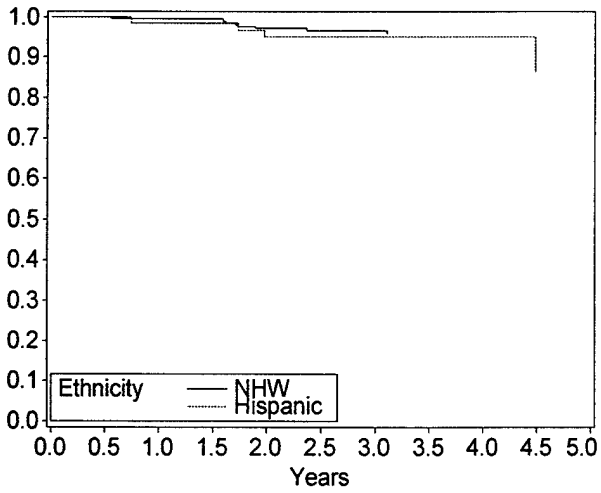


Figure B. BC Survival by Ethnicity (TNM Stage IIA-III)

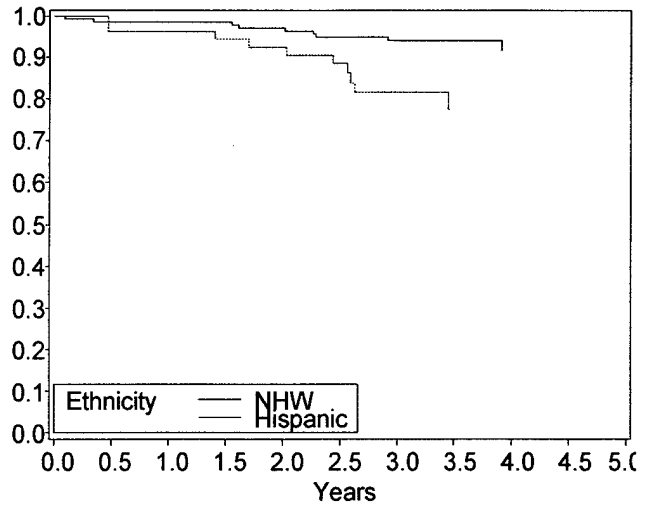


Figure C. NHW BC Survival By Estrogen Receptor Status

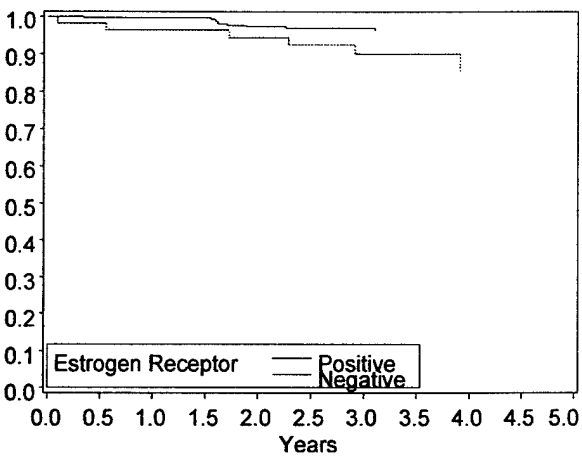
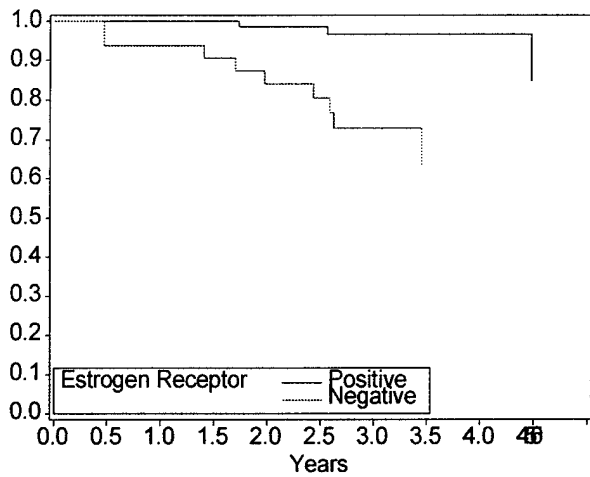


Figure D. Hispanic BC Survival By Estrogen Receptor Status



* Hispanics are shown in lower curve for Figures A and B; **ER negative cases are shown in lower curve Figures C and D

**Table 5: Multivariate Cox Proportional Hazards Model of Breast Cancer Mortality
New Mexico HEAL Study, 3-5 Years Follow-up
(also adjusted for age, menopause status, and tamoxifen)**

	Hazard Ratio	95% Hazard Ratio CI	Chi-square p-value
TNM Stage			
I	1.00	--	--
IIA	1.21	(0.50 - 2.96)	0.6707
IIB	3.81	(1.34 - 10.83)	0.0120
IIIA	6.22	(0.70 - 55.44)	0.1014
	p*=0.0779		
Estrogen Receptor			
Positive	1.00	--	--
Negative	3.12	(1.32 - 7.38)	0.0097
Unknown	1.61	(0.36 - 3.75)	0.8023
	p*=0.0250		
Waist/Hip Ratio (WHR)			
< .80	1.00	-	-
.80 - .86	1.17	(0.37 - 3.64)	0.7889
≥ .87	3.36	(0.96 - 11.75)	0.0582
	P*=0.0959		
Ethnicity			
NHW	1.00	-	-
Hispanic	1.98	(0.93 - 4.20)	0.0771
	P*=0.0771		
* overall chi-square test			