


Disparities in Breast Cancer Survivors in Rural West Texas

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Abstract

Objectives: Breast cancer is the second highest female mortality rate in Texas for all races and ethnicities, except for Hispanics. Interestingly, Hale County is a rural underserved county in West Texas which experiences a lower rate of cancer, has higher age-adjusted mortality rates (26.2/100 000), on average, compared to all of Texas (23.1/100 000). The purpose of this study was to determine the relationship between sociodemographic variables and breast cancer outcomes in underserved Hale County which contributed to the highest mortality rate in Texas.

Methods: Hale County breast cancer data (1995–2014) were obtained from the Texas Cancer Registry. Statistical methods independent samples t-test, Kaplan–Meier curve, and Cox proportional hazard were used to describe the significant relationship between survival time, sociodemographic, and prognostic variables.

Results: Women with breast cancer in Hale County were more likely to be White non-Hispanics ($n = 266$, 65.5%) and had the highest longevity (2753.6 ± 2073.5 days). White Hispanics experienced the worst survival (2369.6 ± 2060.2 days) and were more likely to develop a serious grade of cancer. Significant relationships were found between the stage of cancer and insurance status with survival time for both White non-Hispanics and White Hispanics ($P < .001$). Patients in grades II and III were found to be significantly ($P < .01$) associated with breast cancer death, and grades II and III which had around five-fold and eleven-fold increased risk of death, respectively, compared with the referent group, grade I.

Conclusion: Determining the impact of sociodemographic variables on breast cancer outcome is essential to addressing issues of geographic disparities and integrating such variables may guide relevant policy interventions to reduce breast cancer's incidence in rural underserved communities in West Texans.

Keywords

rural West Texas, Hale County, breast cancer, sociodemographic variables

Introduction

In 2017, breast cancer was the most common cancer among women, affecting 123.9 per 100 000, and it was the second most common cause of cancer death among women in the United States, killing approximately 40 610 people.¹ Risk factors for breast cancer include genetic factors, environmental factors, socioeconomic status, and race/ethnicity, among others.² Although overall breast cancer incidence rates have lowered nationally, rates have heightened for Blacks, remained constant for Whites, and have decreased for Hispanics.³ Specifically, disparities exist between the

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development and progression of breast cancer and vary by age and race/ethnic categories.⁴ When compared to Black non-Hispanics (BNH) women, WNH women have a lower incidence rate before the age of 40, but a higher incidence rate between the ages of 65 and 84.¹ Moreover, the median age of diagnosis for Black women is lower than the national average age for all races, 59 years and 62 years, respectively.¹ Furthermore, Black and Hispanic women are more likely to be diagnosed with late-stage breast cancer.⁵ At every age, BNH have the highest breast cancer mortality rate, which is likely related to the fact that Black women are twice as likely to develop more aggressive forms of cancer or triple-negative breast cancer.¹ Likewise, the most recognizable signs and symptoms of breast cancer often appear in the later stages of the disease, making it imperative to detect, diagnose, and treat breast cancer early.⁶ However, women who have a history of breast cancer in their families regardless of race or ethnicity could benefit from early screening regularly before age 40 since about 7% of the breast cancer cases occur in patients under 40.⁷

Trends in Texas mirror that of national data, wherein breast cancer is the second most common cause of cancer death.⁸ The incidence rate of breast cancer is also higher for women of all races and ages in Texas compared to other forms of cancer.⁹ In Texas alone, the incidence rate of women breast cancer was 112.6 per 100 000.⁹ Furthermore, breast cancer accounts for the second-largest cancer mortality rate in Texas for women of all races and ethnicities, except for Hispanics where breast cancer has a greater age-adjusted rate.⁹ Age-adjusted rates for Blacks in Texas are higher compared to other races.¹⁰ Specifically, Black women are 1.48 times more likely than White women to die from breast cancer within the United States.¹ Among Medicaid recipient Texans, Black women are significantly less likely to have a mammogram compared to White women, which might contribute to their higher mortality rates.¹¹ Investigating breast cancer, specifically in Texas, could provide researchers and physicians a better understanding of the underlying causes of the disease within this region.

Although West Texas is a mostly rural area, many of its cities are fast-growing metropolitan areas that may still experience geographic health-related disparities. Breast cancer incidence is 9% higher in urban areas compared with rural areas.¹² Urban residents experience higher rates of mortality compared to their rural counterparts, partly due to race, lower income, cigarette smoking, and exposure to environmental hazards.¹³ In a rural West Texas area, Lubbock and the surrounding Hale Counties have seen an accelerated rate in population growth and are becoming more urban.¹⁴ Hale County, Texas consists of primarily White Hispanics (51.1%), White non-Hispanic (34.6%), and BNH (4.41%). Each of the remaining racial/ethnic groups accounted for less than 5% of the racial/ethnic makeup. For example, 2.8% were multiracial Hispanic, 3.8% Other Hispanic, 1.84% Multiracial non-Hispanic, .24% Asian non-Hispanic among others.¹⁵

Therefore, the smaller categories of racial/ethnic groups were combined for analyses. Age-adjusted incidence rates of breast cancer decreased in Hale County between 1995 and 2014; however, rates are on the rise since their lowest point (93.2 per 100,000) in 2012.¹⁶ The age-adjusted mortality rate is higher in Hale County (26.2 per 100 000) compared to all of Texas (23.1 per 100 000) for the same period.¹⁶ A predictive measurement would be necessary to understand how breast cancer is affected by the fast growing population of Hale County. Furthermore, only a few research works have addressed health disparities in rural, West Texas. Previous research, such as Project FRONTIER, has investigated the natural course of chronic diseases within rural West Texas, including Parmer, Bailey, Cochran, and Hockley Counties.¹⁷ However, this research has not evaluated the development of breast cancer among the population of these counties. Further research is necessary to understand this issue among these residents.

This study aimed to compare race/ethnic-specific groups and their survival times among women with breast cancer using data from the Texas Cancer Registry (TCR). The findings of this study will assist to identify racial/ethnic disparities among women with breast cancer through (1) descriptive analysis of socioeconomic and prognostic variables, (2) significance testing procedures to identify disparities, and (3) further analysis to determine differences in survivorship based on a variety of factors, such as type of insurance or zip codes for each race/ethnicity group. It was hypothesized that significant race/ethnic-specific disparities in disease progression and development exist among women with breast cancer in Hale County that contribute to decreased survival time. The study includes a broad range of socio-demographic variables and assessed the intersection of race/ethnicity and age in breast cancer survival among women in a small rural community.

Methods

This study was cross-sectional. The study protocol was approved by TDSHS, TCR IRB (Texas Department of State Health Services, Texas Cancer Registry, Institutional Review Board) NUMBER: 17-038; IRB APPROVAL DATE: 09/18/2020. TTUHSC (Texas Tech University Health Sciences Center) strictly follows high ethical standards in the Department of Public Health and its other schools.

The sample size was calculated using G*Power software, version 3.1.¹⁸ It was determined that a total of 128 participants, 64 in each independent group was sufficient to compare mean differences of continuous measurements with alpha (α) = .05, median effect size = .50, and power = 80% when running the independent sample t-test.

Hale County breast cancer patient data were obtained from the TCR, between 1995 and 2014. Of the 406 total women, 266 were White non-Hispanics (WNH) and 115 were White Hispanics (WH). There were 18 Black women and 7 Asian

women that made up a sample size of $n = 25$. Black and Asian women's small sample sizes individually were small for statistical analysis and therefore they were combined as Other races for inclusion in the statistical analysis. Sociodemographic variables under investigation were race/ethnicity, insurance status, patient's zip code, age at diagnosis, as well as grade and stage of cancer. Stage variable was classified by the Surveillance, Epidemiology, and End Results (SEER) staging system. The survival time was defined by the difference between the date of primary cancer was diagnosed clinically or microscopically, confirmed by a recognized medical practitioner, and the date of the last contact with the patient, or date of death if the patient has died.

Independent samples t-test was used to determine a significant relationship between gender-specific variables and survival time. Kaplan–Meier survival curves were created to illustrate the probability of survival for sociodemographic variables. Cox proportional hazard regression was used to compare survival between various causes of death. Hazard ratios and 95% confidence intervals (CI) to determine an association between risk factors and the occurrence of breast cancer death and other cause of death were reported. Pie graphs of the frequencies of variables by death cause for women were displayed.

Results

This study investigated racial/ethnic disparities associated with breast cancer survival among rural women living in Hale County, West Texas. Table 1 contains results of the independent samples t-tests for mean survival times by race/ethnicity for various sociodemographic variables. Breast cancer death plateaued between 1995 and 2008 and decreased between 2009 and 2014. Interestingly, death due to other causes also decreased. Table 2 contains the hazard ratios for each variable by cause of death. Significant hazards were found within the grade, stage, and age variables only. Figure 1 illustrates Kaplan–Meier survival probabilities for each variable by cause of death. Finally, Figure 2 depicts a visual representation of the frequency and percentage of each variable by cause of death.

Race/Ethnicity

WNH ($n = 266$, 65.5%) made up the largest proportion of patients in Hale County, followed by WH ($n = 115$, 28.3%) and last Other races ($n = 25$, 6.2%). The mean survival time in days between race/ethnicity groups and various categories in Hale County were as follows: WNH, 2753.6 ± 2073 ; WH, 2369.6 ± 2060.2 ; Other, 2628.3 ± 2116.9 .

Age at Diagnosis

The majority of WNH ($n = 75$, 28.2%) and Other ($n = 7$, 28.0%) races were between the age of 65 and 74 years. WH

were diagnosed earlier, between 45 and 55 years old ($n = 34$, 29.6%). The WNH group had the lowest number of women below the age of 45 ($n = 13$, 4.9%), there were no patients over the age of 85 for both WH and Other races.

For WNH women, survival time decreased as age increased. The highest survival was found for women under age 45 (3764.8 ± 2504.6 days) and the lowest survival for women over age 85 (1872.9 ± 1556.7 days). This trend was mirrored among WH women, except for those below age 45 who experienced the second lowest survival time for this race/ethnicity category. The mean survival time for WH women was highest between the age of 45 and 54 (2727.6 ± 2404.9 days) and was lowest between the age of 75 and 84 (1870.0 ± 3362.6 days). Other races did not follow a specific trend with a high survival time between the age of 55 and 64 (3205.8 ± 2322.6 days) and a low between the age of 65 and 74 (2216.7 ± 2212.5 days).

Significant differences in breast cancer survival were only witnessed for WNH women across age groups. When diagnosed below 45 years, women were shown to live significantly longer than those diagnosed above the age of 75 ($P = .023$). Those diagnosed between ages 45 and 55 lived significantly longer than those diagnosed between 65 and 75 years ($P = .018$) and those older than 75 ($P = .001$). Finally, WNH women between the ages 55 and 64 were found to have significantly higher survival compared to those between 64 and 74 ($P = .048$) and 75 years or older ($P = .002$). While these results show the significance of age at diagnosis on survival time for WNH, no significant differences were found for WH or Other races/ethnicities. Age also played a role in one's risk of dying from breast cancer. Women over age 75 had a 2.349 ($P = .008$) times greater risk of dying from all-cause death compared to those under age 45.

Insurance Status

Within Hale County, women with breast cancer were least likely to have private insurance (WNH, $n = 29$, 10.9%) and most likely to be uninsured or not specify their insurance status (WNH, $n = 190$, 71.7%; WH, $n = 71$, 61.7%; Other, $n = 22$, 88.0%) for every race/ethnicity category.

Women who were unaware of their type of insurance had the longest rate of survival for all race/ethnicity groups (WNH, 3236.8 ± 2224.6 days; WH, 3114.7 ± 2257.2 days; Other, 2795.9 ± 2149.7 days). Shortest survival times were found among WNH and Other races with public insurance (WNH, 1506.7 ± 843.4 days; Other, 1036.0 ± 915.0 days), and WH with private insurance (1121.3 ± 917.7 days).

Rural women who were unaware of their insurance status lived significantly longer compared to their counterparts. Specifically, this population had higher survival compared to those with private insurance (WNH, $P = .003$; WH, $P = .001$), public insurance (WNH, $P = .0001$; WH, $P = .001$), and no insurance (WH, $P = .029$). No significant differences were found for Other races/ethnicities between insurance status.

Table 1. Differences Between Survival Times for Race/Ethnicity Groups (in Days) of Women Breast Cancer Patients in Hale County (1995–2014).

Year at diagnosis	White non-Hispanic mean difference (P-value)	White Hispanic T-test value (P-value)	Other T-test value (P-value)
<45 vs 45–55	181.54 (.85)	–733.90 (.29)	–387.25 (.87)
<45 vs 55–64	509.71 (.54)	–498.95 (.42)	–835.50 (.64)
<45 vs 65–74	1247.91 (.08)	–229.19 (.71)	153.54 (.92)
<45 vs 75+	1727.65 (.02*)	123.67 (.92)	–594.25 (.73)
45–55 vs 55–64	328.17 (.52)	234.95 (.73)	–448.25 (.85)
45–55 vs 65–74	1066.36 (.02*)	504.71 (.50)	540.79 (.78)
45–55 vs 75+	1546.10 (.01*)	857.57 (.54)	–207.00 (.92)
55–64 vs 64–74	738.20 (.05*)	269.76 (.67)	989.04 (.50)
55–64 vs 75+	1217.94 (.01*)	622.62 (.61)	241.25 (.88)
65–75 vs 75+	479.74 (.16)	352.86 (.77)	–747.786 (.60)
Insurance			
Private insurance vs public insurance	240.04 (.34)	–232.05 (.51)	—
Private insurance vs no insurance	–828.29 (.45)	.72 (.49)	—
Private insurance vs NOS, unknown	–1494.62 (.01*)	–2205.53 (.01*)	—
Public insurance vs No insurance	–1068.33 (.22)	1.09 (.29)	—
Public insurance vs NOS, unknown	–1734.66 (.01*)	–1973.49 (.01*)	–1759.90 (.27)
No insurance vs NOS, unknown	–666.34 (.77)	–2.25 (.03*)	—
Grade			
Grade I vs grade II	425.84 (.36)	123.52 (.89)	–2613.20 (.18)
Grade I vs grade III	784.95 (.12)	.62 (.54)	–1.13 (.29)
Grade I vs grade IV	2412.00 (.25)	—	—
Grade I vs unknown	370.15 (.53)	–.05 (.96)	–2.02 (.11)
Grade II vs grade III	359.11 (.29)	.50 (.62)	—
Grade II vs grade IV	1986.16 (.31)	—	—
Grade II vs unknown	–55.69 (.89)	–.21 (.83)	–.42 (.69)
Grade III vs grade IV	1627.05 (.44)	—	—
Grade III vs unknown	–414.80 (.35)	–.82 (.42)	–1.20 (.26)
Grade IV vs unknown	–2041.85 (.40)	—	—
Stage			
In situ vs localized	–179.50 (.78)	–530.69 (.49)	416.67 (.84)
In situ vs regional by direct extension	–2211.87 (.31)	1308.21 (.27)	—
In situ vs regional-to- regional lymph	–439.71 (.56)	749.43 (.47)	–798.80 (.71)
In situ vs regional	652.63 (.50)	3080.46 (.01*)	—
In situ vs distant metastasis	3237.13 (.01*)	4630.21 (.01*)	2586.50 (.40)
In situ vs unstaged	1861.91 (.01*)	3350.71 (.01*)	1069.33 (.57)
Localized vs regional by direct extension	–2032.37 (.37)	1838.90 (.14)	—
Localized vs regional- to-regional lymph	–260.22 (.63)	1280.11 (.18)	–1215.50 (.37)
Localized vs regional	832.13 (.38)	3611.15 (.01*)	—
Localized vs distant metastasis	3416.63 (.01*)	5160.90 (.01*)	2169.83 (.22)
Localized vs unstaged	2041.41 (.01*)	3881.40 (.01*)	652.67 (.58)
Regional by direct extension vs regional- to-regional lymph	1772.15 (.50)	–558.79 (.74)	—
Regional by direct extension vs regional	2864.50 (.19)	1772.25 (.10)	—
Regional by direct extension vs distant metastasis	5449.00 (.01*)	3322.00 (.01*)	—
Regional by direct extension vs unstaged	4073.78 (.01*)	2042.50 (.02*)	—
Regional to regional lymph vs regional	1092.35 (.32)	2331.04 (.08)	—
Regional to regional lymph vs distant metastasis	3676.85 (.01*)	3880.79 (.05*)	3385.30 (.09)
Regional to regional lymph vs unstaged	2301.62 (.01*)	2601.29 (.01*)	1868.13 (.16)
Regional vs distant metastasis	2584.50 (.02*)	1549.75 (.13)	—
Regional vs unstaged	1209.28 (.02*)	270.25 (.66)	—
Distant metastasis vs unstaged	–1375.22 (.03*)	–1279.50 (.14)	–1517.17 (.31)

(continued)

Table 1. (continued)

Year at diagnosis	White non-Hispanic mean difference (P-value)	White Hispanic T-test value (P-value)	Other T-test value (P-value)
Zip code			
79 311 vs 79 041	.13 (.90)	.71 (.49)	-.73 (.54)
79 311 vs 79 072	.31 (.75)	-.01 (.99)	-1.20 (.25)
79 311 vs other	2.34 (.03*)	1.02 (.34)	—
79 041 vs 79 072	.16 (.88)	-.85 (.40)	-.51 (.61)
79 041 vs other	1.93 (.07)	.34 (.75)	—
79 072 vs other	2.05 (.04*)	.96 (.34)	—

Note. NOS, not otherwise specified; —, not applicable due to low frequency, * $P < .05$.

Grade of Tumor

The majority of WNH women were diagnosed with grade II breast cancer ($n = 103$, 38.7%), while WH ($n = 45$, 39.1%) and Other races ($n = 10$, 40%) were more likely to be diagnosed with grade III. As expected, a diagnosis of higher-grade breast cancer led to lower longevity, except for grade I breast cancer for Other race women who had the lowest survival rate for all race/ethnicities and grades (562.0 ± 244.7 days). WNH women had the longest survival time when diagnosed with grade I breast cancer (3242.0 ± 2005.3 days) and the shortest survival time when diagnosed with grade IV breast cancer (830.0 ± 1.6 days). The highest mean survival times for WH (2615.9 ± 2298.3 days) and Other races (3791.8 ± 2123.5 days) were for those whose breast cancer grade was unknown.

Further, there was no significant difference in survival time between cancer grade at diagnosis and race/ethnicity. Using grade I as a reference group, grade II, III, and unknown had a high likelihood of breast cancer death ($P = .011$; $P = .009$; $P = .024$), respectively, and grade III patients had a high likelihood of death compared with grade II. It was found that there was an increased risk for Other-cause death for grade II, III, IV, and unknown ($P = .003$; $P = .002$; $P = .001$; $P = .017$), respectively. Furthermore, those diagnosed with grade IV had around 8 times greater risk of dying from other causes ($P = .001$).

SEER Stage of Cancer

Most women with breast cancer in Hale County were diagnosed with localized cancer (WNH, $n = 76$, 28.6%; WH, $n = 15$, 13.0%; Other, $n = 7$, 28.0%), while the lowest number of patients had regional breast cancer by direct extension (WNH, $n = 1$, .4%).

Stage did not follow a specific trend concerning survival time. WNH diagnosed with regional-to-regional lymph breast cancer (4045.8 ± 2472.0 days), WH women diagnosed with localized breast cancer (5212.4 ± 1546.3 days), and Other race women diagnosed with regional-to-regional lymph breast cancer (3907.8 ± 2147.7 days) had higher longevity among race/ethnicity categories.

Although there were no differences in survival between grades of tumor, there were significant differences in survival between stages of tumor. Women diagnosed with a distant metastasis had significantly lower survival compared to in situ (WNH, $P = .006$; WH, $P = .004$), localized (WNH, $P = .003$; WH, $P = .001$), regional by direct extension (WNH, $P = .0001$; WH, $P = .007$), regional to regional lymph node (WNH, $P = .007$; WH, $P = .049$), regional (WNH, $P = .021$) and unstaged (WNH, $P = .025$) cancer. Furthermore, those with unstaged cancer had shorter longevity compared to those diagnosed with in situ (WNH, $P = .0001$; WH, $P = .0001$), localized (WNH, $P = .0001$; WH, $P = .0001$), regional by direct extension (WNH, $P = .001$; WH, $P = .020$), regional to regional lymph (WNH, $P = .0001$; WH, $P = .0001$), and regional (WNH, $P = .022$) cancer.

Zip Code of Residence

Of the 7 zip codes within Hale County, only the top three were examined due to lack of sample size within smaller regions. Given that zip code 79 072 has the highest population throughout the entire county, it is not surprising that it contains the highest amount of breast cancer patients (WNH, $n = 207$, 77.8%; WH, $n = 95$, 82.6%; Other 20, 80.0%). Only 15 individuals were diagnosed outside of Hale County, and they were also included in the analysis.

In general, lower mean survival times occurred for those diagnosed outside the three major zip codes of Hale County (WNH, 1265.6 ± 837.2 days; WH, 1024.5 ± 696.5 days). Zip code 79 311 had the longest mean survival time for WNH (2962.5 ± 1949.8 days) and the shortest mean survival time for Other races ($231.0 \pm .9$ days). The longest survival time for both WH and Other races occurred in zip code 79 072 (2459.0 ± 2098.7 days and 2850.9 ± 2117.6 days, respectively). Significant difference in survival time by zip code was only identified for WNH who resided outside of Hale County to those living within the zip codes 79 311 and 79 072. Finally, WNH living outside Hale County had significantly shorter survival compared to those living in zip codes 79 311 ($P = .029$) and 79 072 ($P = .042$).

In the case of breast cancer death (Figure 1), WNH mean survival time was higher than WH and Other. The highest

Table 2. Hazard ratios, 95% confidence intervals, and significance for women breast cancer patients in Hale County (1995–2014).

	All-cause death		Breast cancer death		Other cause death	
	HR (CI)	Significance (P-value)	HR (CI)	Significance (P-value)	HR (CI)	Significance (P-value)
Race/ethnicity						
White non-Hispanic	1.155 (.585–2.281)	.677	.579 (.244–1.374)	.215	2.306 (.726–7.321)	.156
White Hispanic	1.175 (.568–2.431)	.664	.879 (.351–2.203)	.784	1.767 (.523–5.975)	.36
Other	1.000 (ref)	—	1.000 (ref)	—	1.000 (ref)	—
Insurance						
Private insurance	.561 (.245–1.286)	.172	1.406 (.587–3.367)	.445	N/A	—
Public insurance	.884 (.516–1.514)	.652	1.344 (.658–2.745)	.418	.569 (.243–1.333)	.194
No insurance	1.588 (.389–6.485)	.519	3.749 (.892–15.750)	.071	N/A	—
NOS, unknown	1.000 (ref)	—	1.000 (ref)	—	1.000 (ref)	—
Grade						
Grade I	1.000 (ref)	—	1.000 (ref)	—	1.000 (ref)	—
Grade II	1.087 (.945–1.251)	.260	4.889 (1.228–18.538)	.011*	.873 (.791–.962)	.003**
Grade III	1.142 (.993–1.316)	.070	10.788 (2.428–45.54)	.009**	.573 (.541–.607)	.002**
Grade IV	5.089 (1.226–21.162)	.010*	N/A	—	7.863 (2.032–30.419)	.001**
Unknown	.943 (.529–1.684)	.844	10.101 (1.259–76.923)	.024*	.421 (.207–.855)	.017*
Stage						
In situ	.462 (.237–.901)	.024*	N/A	—	1.103 (.521–2.338)	.797
Localized	.609 (.396–.936)	.024*	.207 (.091–.473)	.0001***	1.182 (.668–2.090)	.565
Regional by direct extension	.923 (.286–2.982)	.894	N/A	—	2.229 (.657–7.564)	.198
Regional-to-regional lymph	.512 (.302–.870)	.013*	.336 (.140–.802)	.014	.791 (.392–1.597)	.513
Regional	1.810 (.920–3.559)	.086	2.082 (.913–4.749)	.081	1.372 (.409–4.596)	.608
Distant metastasis	10.421 (4.764–22.795)	.0001***	7.829 (2.646–23.162)	.0001***	14.287 (4.587–44.495)	.0001***
No staging	1.000 (ref)	—	1.000 (ref)	—	1.000 (ref)	—
Age						
<45	1.000 (Ref)	—	1.000 (ref)	—	1.000 (ref)	—
45-54	.510 (.238–1.091)	.083	.507 (.195–1.316)	.162	.577 (.163–2.050)	.395
55-64	1.026 (.533–1.975)	.938	.647 (.274–1.528)	.321	1.791 (.614–5.226)	.286
65-74	1.484 (.785–2.808)	.225	.803 (.348–1.850)	.606	2.870 (1.004–8.204)	.049*
75+	2.349 (1.252–4.405)	.008**	.794 (.324–1.944)	.613	5.513 (1.970–15.431)	.001*
Zip code						
79 311	.679 (.22–2.081)	.499	.371 (.062–2.236)	.279	.868 (.190–3.973)	.855
79 041	.532 (.172–1.650)	.275	.455 (.083–2.505)	.365	.566 (.120–2.670)	.472
79 073	.605 (.221–1.654)	.328	.669 (.161–2.772)	.579	.559 (.135–2.317)	.423
Other	1.000 (ref)	—	1.000 (ref)	—	1.000 (ref)	—

Note. CI, confidence interval, —, not applicable due to low frequency; Ref, referent group, P * < .05; ** < .01; *** < .001.

survival time was obtained for the age group <45 years, and the lowest was >85 years. A higher survival time was found among those with private insurance compared to those with public and no insurance. Those with grade I breast cancer had the longest survival time compared to those with grades II & III. The zip code 79 311 had the longest survival time than zip codes 79 041 and 79 072.

Figure 2 exhibits, breast cancer death in WNH (58%) was higher than WH (33%) and Other (9%). The Private insurance (69%) was higher in health coverage than public insurance (17%). The grade I breast cancer was the higher percentage (45%) compared with grade II (31%), III (22%), & IV (2%). The likelihood of breast cancer death was higher for the 65–74 age group compared with the age group 55–64 years.

Discussion

Hale County was targeted by Komen¹⁹ at high risk in breast cancer incidence and death rates. It has only two digital mammography facilities, which are located in the most densely populated city. The diagnostic and treatment services are very limited or non-existent for the patients. Furthermore, survivorship services within Hale County are limited, and those affected would have to travel to Lubbock County to access those services. As per the community profile 2015 report by the Komen,¹⁹ Hale County's age-adjusted rates per 100 000 women for the number of new cases is 83.4, the death rate is 25.5, and the late-stage incidence rate is 34. In line with the recent trend of urban-rural disparities regarding cancer mortality, Hale County has experienced

higher breast cancer mortality rates compared to the rest of Texas.²⁰ Making it imperative to assess the associated underlying factors affecting disparities. This discrepancy may be linked to a variety of sociodemographic and prognostic variables, including race/ethnicity, age at diagnosis, insurance status, zip code, grade of tumor, stage of cancer, and cause of death.

Although there were no significant differences in survival time or hazard probabilities, breast cancer mortality differed based on race/ethnicity-specific sociodemographic variables. The findings illustrate how cancer incidence is not distributed proportionally across races/ethnicities. In Hale County, 37.6% of women are WH; whereas, 65.5% of breast cancer patients constituted WNH, almost double the number of this ethnicity distribution across the county.²¹ Despite the higher incidence

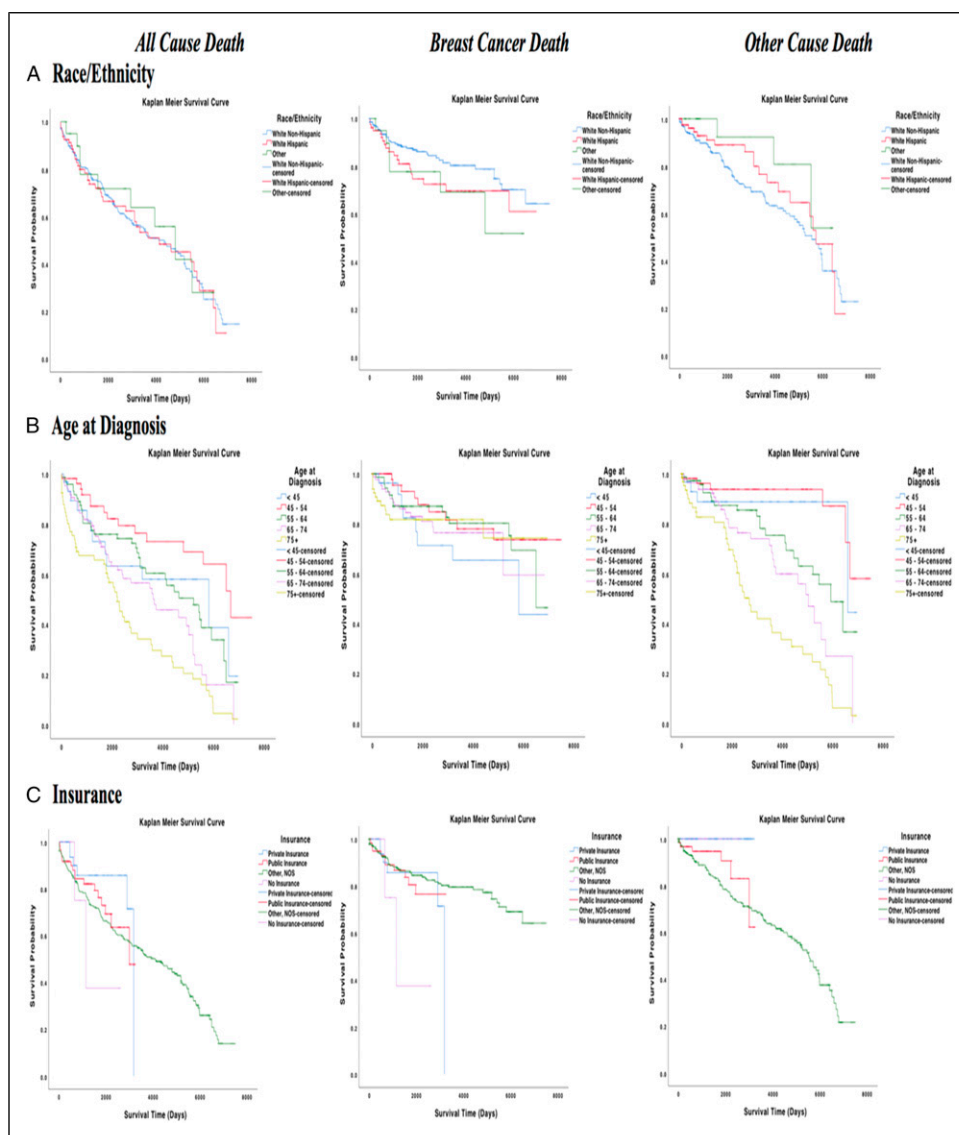


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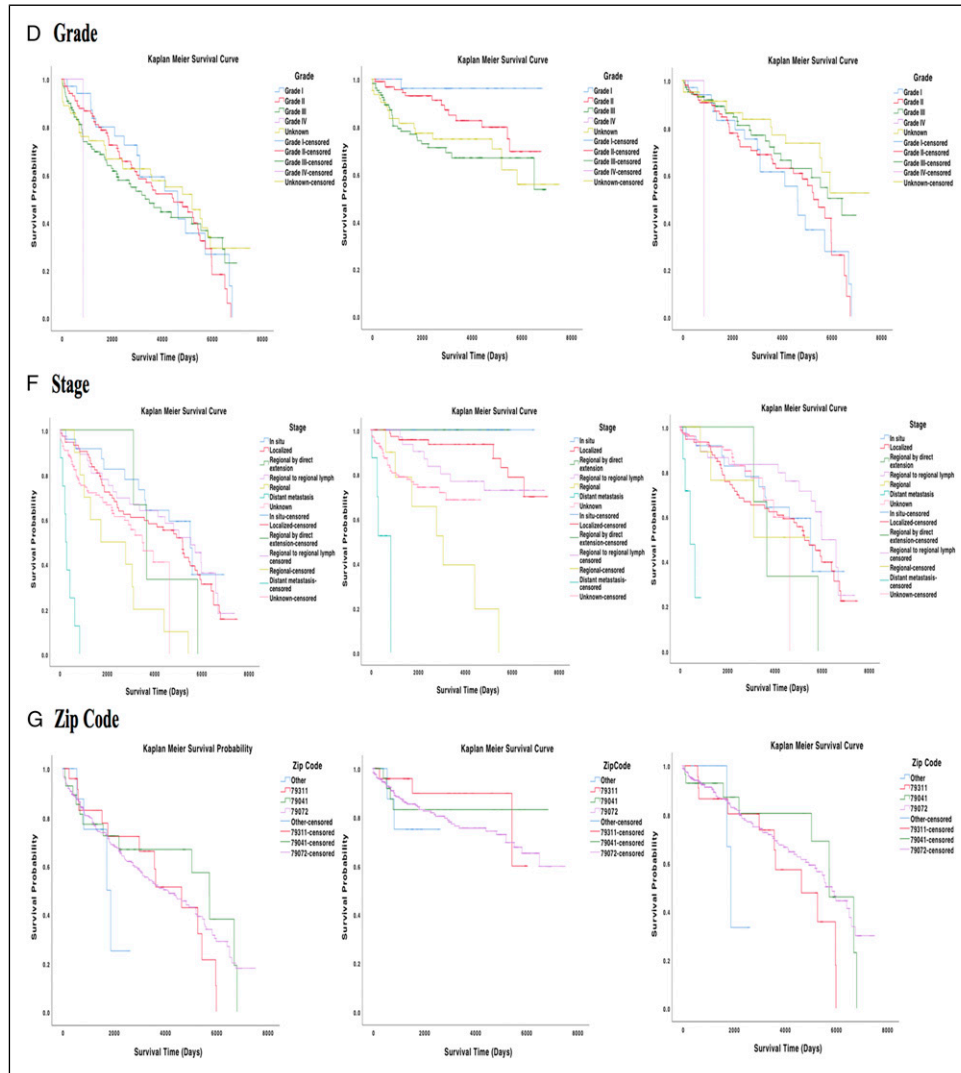


Figure 1. Kaplan–Meier curves of survival probability for women in Hale County (1995–2014).

rates, WNH women continue to experience better 5-year survival rates and overall better prognosis than WH or women from other racial groups. This results from WNH women undergoing adequate screening procedures and presenting with less aggressive cancer stages.²¹ In fact, previous research has found that Black and Hispanic women are 30–60% more likely to be diagnosed with breast cancer greater than stage II compared to WNH and are more likely to receive inappropriate treatments.⁵ In addition, both WH and Black women are more likely to be diagnosed with more advanced and aggressive forms of cancer at similar rates.²² This was further illustrated by grade distributions by race/ethnicity, which directly results in higher mortality rates among WH and women of Other non-White races.²³ This discrepancy in breast cancer prognosis may play a large role in explaining lower survivorship among WH and Other race women. Although the degree to which biological factors and inequity in access to screening affect breast cancer mortality remains

somewhat unclear, reducing rates of breast cancer-related deaths would occur from more equitable access to prevention and early detection as well as access to high quality and appropriate treatments.²² Inequities in health care access are common indicators of larger systemic issues including racism and discrimination within the health care system and unequal distribution of quality resources to working-class communities and racial/ethnic minority communities. For example, immigration status, neighborhood disadvantage, and SES status have all been associated with breast cancer disparities.²⁴

Age at diagnosis may be another factor impacting survivorship. Within each age category, WH and Other races had lower survival compared to WNH. Moreover, there have been other studies that suggest postmenopausal women, who are long-term oral contraceptive users, have a greater probability of developing breast cancer.²²

Furthermore, WH women are more likely to be diagnosed at a younger age compared to WNH and Other races.²³ While

some research has found that being diagnosed at a younger age has shown to have a shorter prognosis due to both physical and psychosocial function loss, this is not the typical scenario.²⁵ This may be the case for WH women diagnosed at an earlier age. It may be useful for this population to have support (tangible and intangible) that can best help them to navigate the treatment and adjustment process. Further younger women may struggle with balancing their role within a family context (ie, mother, spouse) and managing their illness, which could lead to a poorer prognosis.

The rural–urban differences are apparent for a variety of different health conditions, such as cardiovascular disease, which may be due to the availability of primary care physicians, environmental factors, and lifestyle choices in urban settings.²⁶ A systematic review and meta-analysis comparing

the stage of breast cancer diagnosis between women living in rural and urban areas, found that women in rural areas are more likely to develop worse stages of breast cancer compared to urban women due to lack of proper screening techniques.²⁷ Furthermore, once diagnosed, rural residents are less likely to receive a consistent chemotherapy regimen or radiotherapy due to the distance to the physician’s office and the limited availability of cancer treatment and specialist physicians, such as radiologists and medical oncologists.²⁸ To overcome the issue of travel distance to care facilities and to narrow the rural-urban disparities gap, several promising interventions have been developed including outreach clinics, tele-oncology, virtual tumor boards, and provider and patient education programs, among others.²⁸ Broad-scale institutional and financial support for outreach clinics,

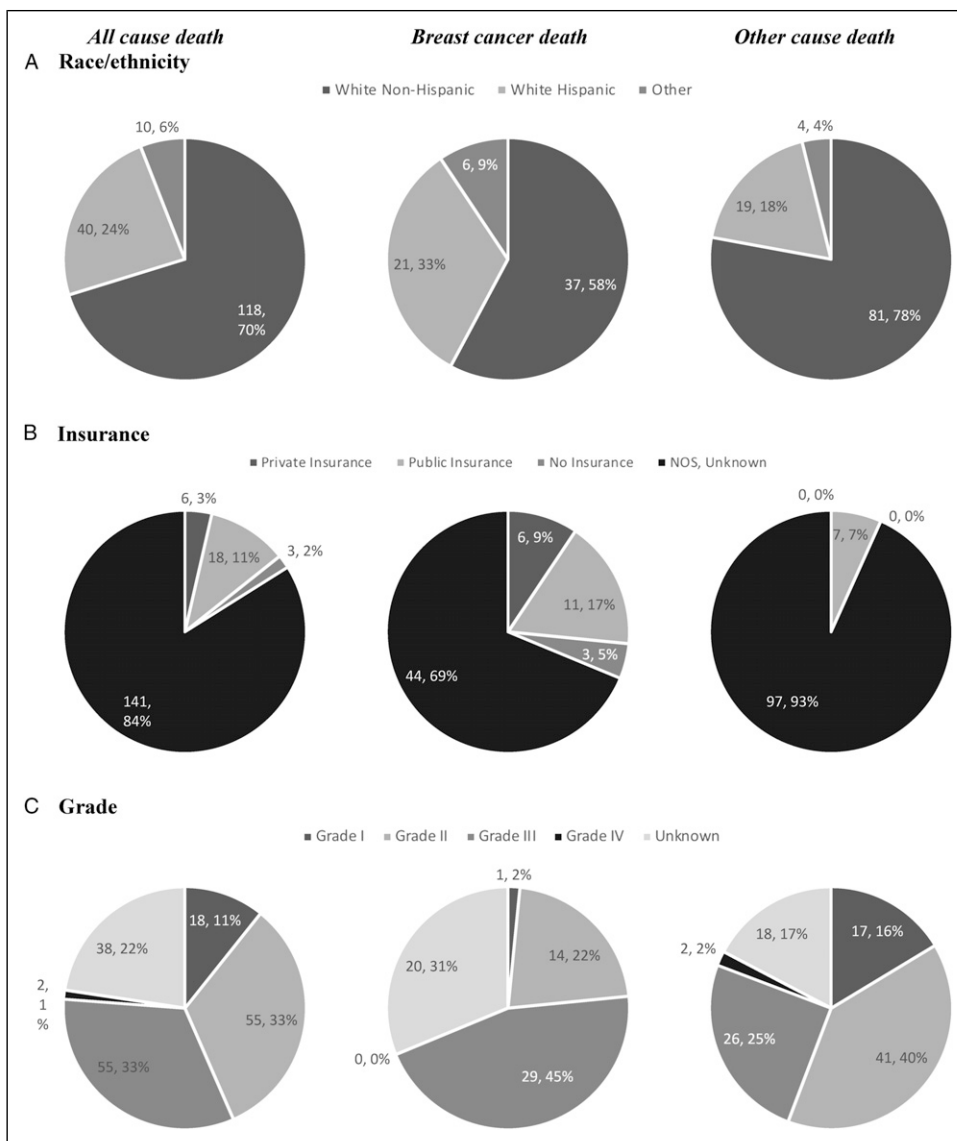


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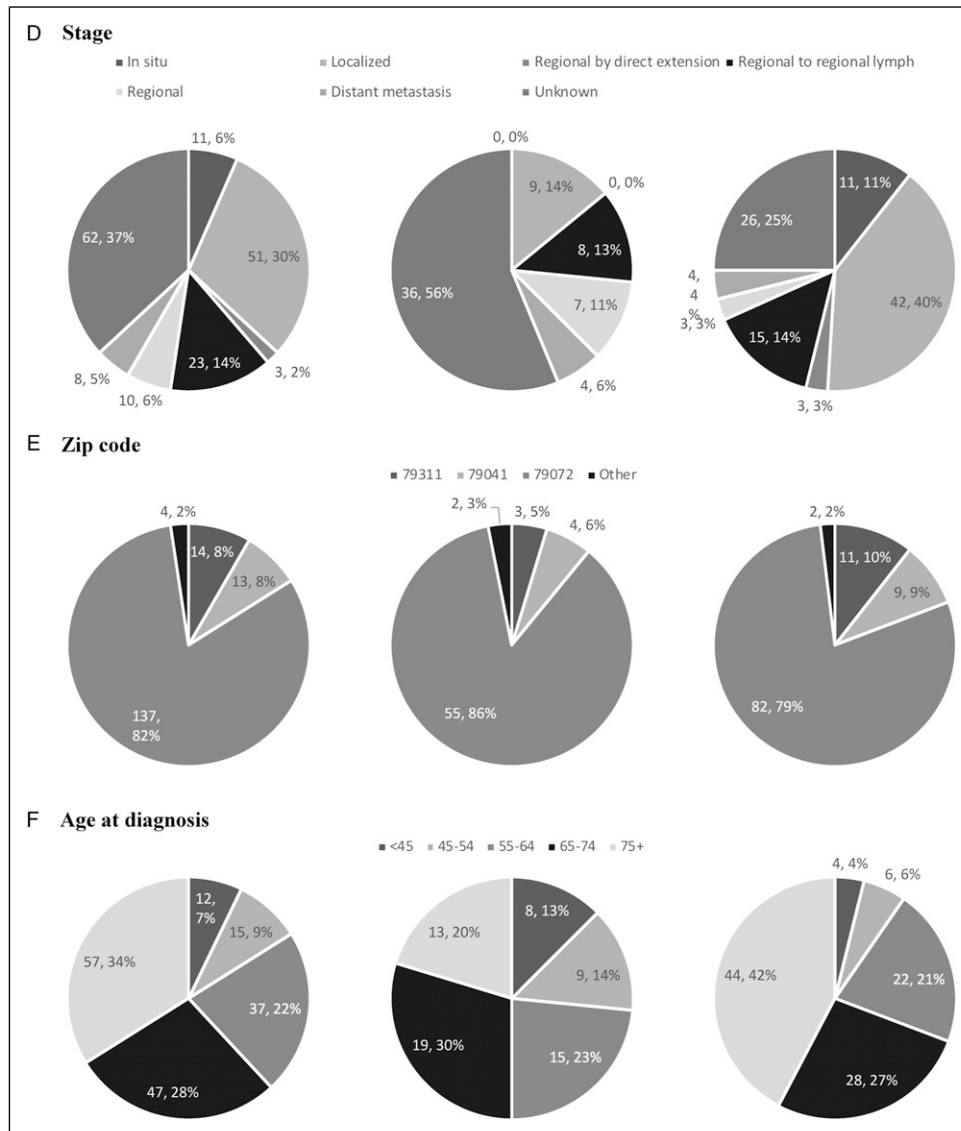


Figure 2. Frequencies of variables by death cause for women in Hale County (1995–2014).

tele-oncology, and support resources may be useful in narrowing the geographic disparities in and beyond Hale County.

Financial restraints, as well as insurance status inhibit the use of preventative services, further contributing to socioeconomic factors that influence health. Given that women constitute a large portion of those in poverty within Hale County their poorer status makes them more susceptible to various forms of cancers.²⁹ While considering the race/ethnicity, Hispanics/Latinos constituted the largest group not meeting the standard of living in zip code 79 072 (Plainview), the highest populated area, which may explain why mortality rates were higher among this group. Furthermore, there is a greater percentage of residents living in poverty within Hale County (20.7%), compared to the rest of

Texas (15.6%).²⁹ In this study, patients' insurance status was associated with survival times. Studies have suggested that disenrollment from insurance plans like Medicare or having no insurance at all heavily burden the cancer outcome (late detection of cancers, treatment delay), especially in the case of breast cancer in rural counties.³⁰ Therefore, systemic changes such as the implementation of the Affordable Care and Patient Protection Act (ACA) that aimed to narrow the insurance gap and associated disparities may have the ability to improve breast cancer-related prognosis. More specifically, ACA has implications for payment and delivery of prevention, diagnostic, and treatment services for those living with or at risk for cancer.³¹ Education level and health literacy affect perceptions of cancer screening and subsequent treatment options when diagnosed.³²

A limitation of this study was the incomplete data set, giving unknown or others group high variability, and thus distorting analysis to favor statistical significance. Second, the inability to compare multiple races/ethnicities; for example, the Other race group contained African Americans and Asians which are known to have different outcomes. Black and Asian women were a small sample size for statistical analysis, they were combined as Other races. Those 15 people were diagnosed outside of Hale County and the dataset analyzed does not include any information on why they were diagnosed outside, even though they were the resident of Hale County. A possible reason could be due to participant's personal choice, proximity to service location, or availability of health services that were convenient for patients. The authors included these patients in the analysis because neighboring counties surrounding Hale County have similar patient demographics and hoped that including them in the analysis would produce information that would be helpful for interested researchers.

The authors of this study support a national public health effort to improve the availability of breast cancer screening among vulnerable and underserved groups. Optional screening for breast cancer is recommended at age 40–45 by the American Cancer Society, high-risk populations such as WH women may benefit from this screening and should be encouraged to do so by medical professionals. Specifically, early screening may increase prognosis and decrease overall mortality rates within Hale County. Recent attention has focused on the role of implicit or unconscious bias among physicians as a potential contributor to racial disparities in clinical decision-making for treatment.³³ Future research should examine how Hale County compares to surrounding counties, such as Lubbock, whose population is quickly growing. This could aid in the identification of specific variables that amplify rural, Hale County's mortality rate.

Conclusions

The present study examined the role of race/ethnic socio-demographic and prognostic variables in survivorship of women with breast cancer within rural Hale County, TX. Given the findings, WH women like other vulnerable groups should be encouraged to engage in currently optional screening efforts more frequently between ages 40 and 45 to combat the late-stage cancer development and be given improved clinical management of their disease. Furthermore, factors that characterize the severity of cancer, including grading system and SEER stage classification, played a significant role in one's hazard for each death caused. The rural setting of this study may have further contributed to the poor outcome evidenced by the data for certain ethnic groups. Further studies should be conducted addressing other variables like the level of education and financial status of the patients, adequacy of facilities, or the availability of specialized physicians within the rural settings. Comparison studies with the urban population suffering from similar magnitudes of the disease should also be undertaken to

identify other factors that may have significance to cancer survivorship. Last, the findings from this study warrant a need to develop a multipronged approach to address the racial/ethnic disparities in breast cancer survivorship within a rural setting.

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Declaration of Conflicting Interests

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Human Subjects

This study proposal was approved by the Institutional Review Board (#17-038, dated: 09/18/2020), Texas Department of State Health Services (DSHS). No personal identifiable information was obtained. Texas Tech University Health Sciences Center (TTUHSC) strictly follows high ethical standards in the Department of Public Health and its other schools.

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