Prevalence, trends and risk factors of Breast Cancer Mortality in Namibia: 2000-2015

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Abstract

The objectives of the study were to establish prevalence, trends and risk factors for breast cancer survival in Namibia. Secondary data was available from the Namibia Cancer Association Registry for breast, cervical and prostate cancer from the year 2000 to 2015. Patient survival was measured by age at death and the event variable was whether the patient was still alive or dead. Covariates included sex, ethnicity, and region. Descriptive summary statistics in form of tables, charts and graphs were used to profile the background characteristics of the patients. Kaplan-Meier curves were constructed and the Cox proportional hazards model was used to establish the determinants of survival among cancer patients. Results showed that breast cancer survival was influenced by age, region and ethnicity. Policy efforts should focus on the whites, basters and Herero speaking groups. Khomas region had the highest percentage of cancer cases and this calls for further research on the causes.

Keywords: cancer, Namibia, survival analysis, Cox regression

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1 Introduction

Cancer is the leading cause of death in economically developed countries and the second leading cause of death in developing countries. The burden of cancer is increasing in eco-

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nomically developing countries as a result of the population aging and growth as well as, increasingly an adoption of cancer associated lifestyle choice including smoking, and physical inactivity (Ferlay, 2001; Zietsman et al., 2011). All over the world, cancer represents a tremendous burden on the patient's families and societies. In Namibia, the most frequent cancer among men was Kaposi sarcoma, followed by prostate cancer. The predominant cancer in women was breast cancer, followed by cancers of the cervix. It is difficult to precisely estimate the burden of cancer mortality in developing countries, due to lack of and/or poor quality of available data. However, it is estimated that 10% of deaths in developing countries are due to cancer, and that given the aging of these populations, cancer incidence is increasing (WHO, 2011). Signs and symptoms of cancers are lumps, coughing, breathlessness and change in bowel habit (Zietsman et al., 2011).

Risk factors for female breast cancer include early menarche, late age at first childbirth, a high-fat diet and certain genetic mutations. Other possible risk factors include high alcohol consumption and the use of certain post-menopausal hormone replacement therapies. A variant of breast cancer found in men tends to be more aggressive than the female type while presenting with same symptoms and signs. Eighty to ninety percentage of cancer are related to three major groups of risk factors such as nutrition (high fat, high cholesterol, low fiber, high sugar diet), lifestyle (alcohol, smoking, stress, sedentary lifestyle) and environment (industrial toxic, electromagnetic radiation, chemical carcinogens, air and water pollution among others (Chan-Yeung et al., 2003). A substantial proportion of the worldwide burden of cancer could be prevented through the application of existing cancer control knowledge by implementing for tobacco control, vaccination for liver and cervical cancer and early detection and treatment, as well as public health campaigns promoting physical activity and a healthier dietary intake. Nagata et al. (2014) concluded that soy intake possibly decreases the risk of breast cancer among Japanese women. Clinicians, public health professionals and policy makers can play an active role in accelerating the application of such interventions globally. This study examined the prevalence, trends and risk factors for Breast cancer mortality in Namibia using survival analysis. Survival methods have been applied to model risk factors for event history data such as cancer mortality (Herndon et al., 2013; Wu et al., 2013). Survival analysis is a collection of statistical procedures for data analysis for which the outcome variable of interest is time until an event occurs.

2 Data and Methods

2.1 Data

Secondary data was available from the Namibia Cancer Association Registry for breast, cervical and prostate cancer from the year 2000 to 2015. Patient survival was measured by age at death and the event variable was whether the patient was still alive (coded 1) or dead (coded 0). Covariates included demographic characteristics such as age, sex, ethnicity, and region. Other possible predictors were not available in the data such as educational level, knowledge about cancer, marital status to enhance the study. Descriptive summary statistics in form of tables, charts and graphs were used to profile the background characteristics of the patients.

2.2 Statistical Analysis

Survival analysis is a collection of statistical procedures for data analysis for which the outcome variable of interest is time until an event occurs (M. Gail, et al. 2005). Survival analysis focuses on hazard function. The hazard rate is the instantaneous probability of the given event occurring at any point in time. It can be plotted against time, forming a graph of the hazard rate over time. Kaplan-Meier method is a nonparametric technique for estimating the survival rates with the presence of censored cases. The basic idea is to first compute the conditional probabilities at each time point when an event occurs and then, compute the product limit of those probabilities to estimate the survival rate at each point in time. This technique is often used for comparing the effects of treatments on the survival time. The Cox model provides an estimate of the treatment effect on survival after adjustment for other explanatory variables. In addition, it allows us to estimate the hazard (or risk) of death for an individual, given their prognostic variables (Walters, 2001). The Cox Proportional Hazards formula is

$$h(t,\mathbf{X}) = h_0(t)\exp\left(\sum_{i=1}^{p}\beta_i X_i\right),$$

where $\mathbf{X} =$ (Age, Sex, Region, Ethnicity) are explanatory variables.

We define T as a positive random variable denoting survival times. We therefore assume that T is absolutely continuous. The actual survival time of a unit is a realization or value of T, which can be denoted as t. T is characterized by a probability density function, $f(t)$ and a cumulative distribution function, $F(t)$. The distribution function of a random variable T

is given by:

$$F(t) = \int_0^t f(u)d(u) = \Pr(T \leq t).$$

And we define a density function $f(t)$: $f(t) = \frac{dF(t)}{d(t)}F'(t)$.

Implying that $f(t) = \lim_{\Delta t \to 0} \frac{F(t+\Delta t) - F(t)}{\Delta t}$.

The event history has a survival function that is expressed mathematically as:

$$S(t) = 1 - F(t) = \Pr(T \geq t).$$

The survival function denotes the probability a survival time T is equal to or greater than some time t. $S(t)$ is a strictly decreasing function. Now that relationship between failure times and the survival function is captured through the hazard rate sometimes called an instantaneous failure rate, the force of mortality, or the age-specific failure rate.

$$h(t) = \frac{f(t)}{S(t)}.$$

The hazard rate gives the rate at which unit's fails (or durations end) by t given that the unit had survived until t. So, the hazard function is a conditional failure rate expressed as:

$$h(t) = \lim_{\Delta t \to 0} \frac{\Pr(t \leq T \leq t + \Delta t \,|T \geq t)}{\Delta t}.$$

The Cox proportional hazards model was used to establish the determinants of survival among breast cancer patients. The study used MS Excel for data cleaning and SPSS Version 22 for data analysis.

3 Results

The frequency distribution profiling the sample characteristics, together with tests of association cancer survival are given in Tables 1 and 2. Most of the patients were alive (91.8%) at time of the investigation. The majority of patients were female (74.5%).The majority of cancer patients were aged between 30 and 80 years of age (90.4%) and most of them were from the Khomas region (40.1%). Table 2 shows that the highest percentage of cancers had been detected in 2009 (11.8%).

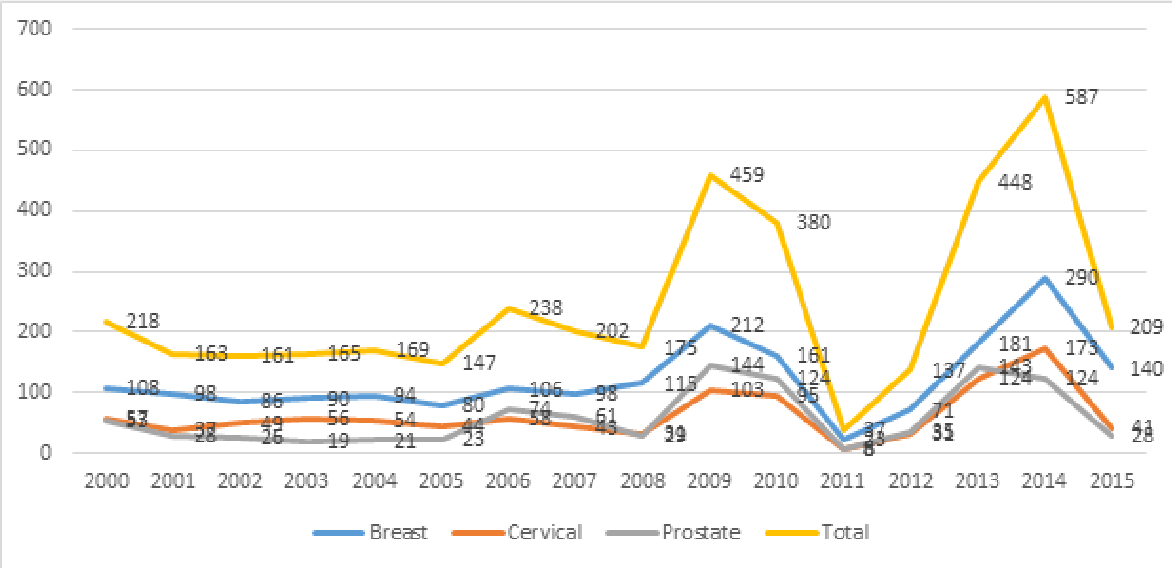

Figure 1: Trends in reported cancer cases 2000-2015 by type.

Table 1: Frequency distribution of sample characteristics and tests of association with the cancer survival ($*p < 0.05$, $**p < 0.01$, $***p < 0.001$)

Variables	**Frequency**	**Percentage**	**Chi-Square Statistic**	$p-$**value**
Genter			**0.558**	**0.757**
Male	995	25.5		
Female	2900	74.5		
Age-Group			**22.76****	**0.002**
1-10	1	0.03		
11-20	3	0.08		
21-30	120	3.1		
31-40	504	12.9		
41-50	802	20.6		
51-60	853	21.9		
61-70	768	19.7		
71-80	593	15.2		
81 +	251	6.4		
Region			**89.467*****	**p < 0.001**
Zambezi	88	2.3		
Erongo	336	8.6		
Hardap	253	6.5		
Karas	186	4.8		
Khomas	1562	40.1		
Kunene	111	2.8		
Ohangwena	80	2.1		
Kavango	161	4.1		
Omaheke	108	2.8		
Oshana	552	14.2		
Oshikoto	104	2.7		
Otjozondjupa	354	9.1		

Table 2: Frequency distribution of sample characteristics and tests of association with the cancer survival ($*p < 0.05$, $**p < 0.01$, $***p < 0.001$)

Variables	**Frequency**	**Percentage**	**Chi-Square Statistic**	$p-$**value**
Ethnicity			**74.75*** **	**p < 0.001**
White	774	19.9		
Baster	311	8.0		
San/ Bushman	21	.5		
Caprivian	88	2.3		
Damara	407	10.5		
Herero	409	10.5		
Kavango	159	4.1		
Coloured	292	7.5		
Nama	219	5.6		
Tswana	31	.8		
Ovambo	1174	30.2		
Year of Detection			**1821.382*** **	**p < 0.001**
2000	218	5.6		
2001	163	4.2		
2002	161	4.1		
2003	165	4.2		
2004	169	4.3		
2005	147	3.8		
2006	238	6.1		
2007	202	5.2		
2008	175	5.2		
2009	459	11.8		
2010	380	9.8		
2011	37	.9		
2012	137	3.5		
2013	448	11.5		
2014	587	15.1		
2015	209	5.4		

Chi-square tests revealed that patient survival was significantly associated with region (Chi-square = 89.47, $p < 0.001$); ethnicity (Chi-square = 74.75, $p < 0.001$); and year since detection (Chi-square = 1821.382, $p < 0.001$). However, gender ($p = 0.757$) and the type of cancer ($p = 0.405$) did not seem to be associated with cancer survival. Figure 1 shows trends in detected cancer cases from 2000 to 2015 by type of cancer. Trend in the detected cases were not very clear (possibly due to under-reporting) even though an upward trend could be seen.

Results of the Cox regression model to establish the risk factors for breast cancer survival are presented in Table 3. There were no significant gender differentials in breast cancer survival. With regard to region patients from Ohangwena ($HR = 0.524$, 95% CI : $(0.338 - 0.813)$, $p = 0.004$) were less likely to survive breast cancer while those from Ka-

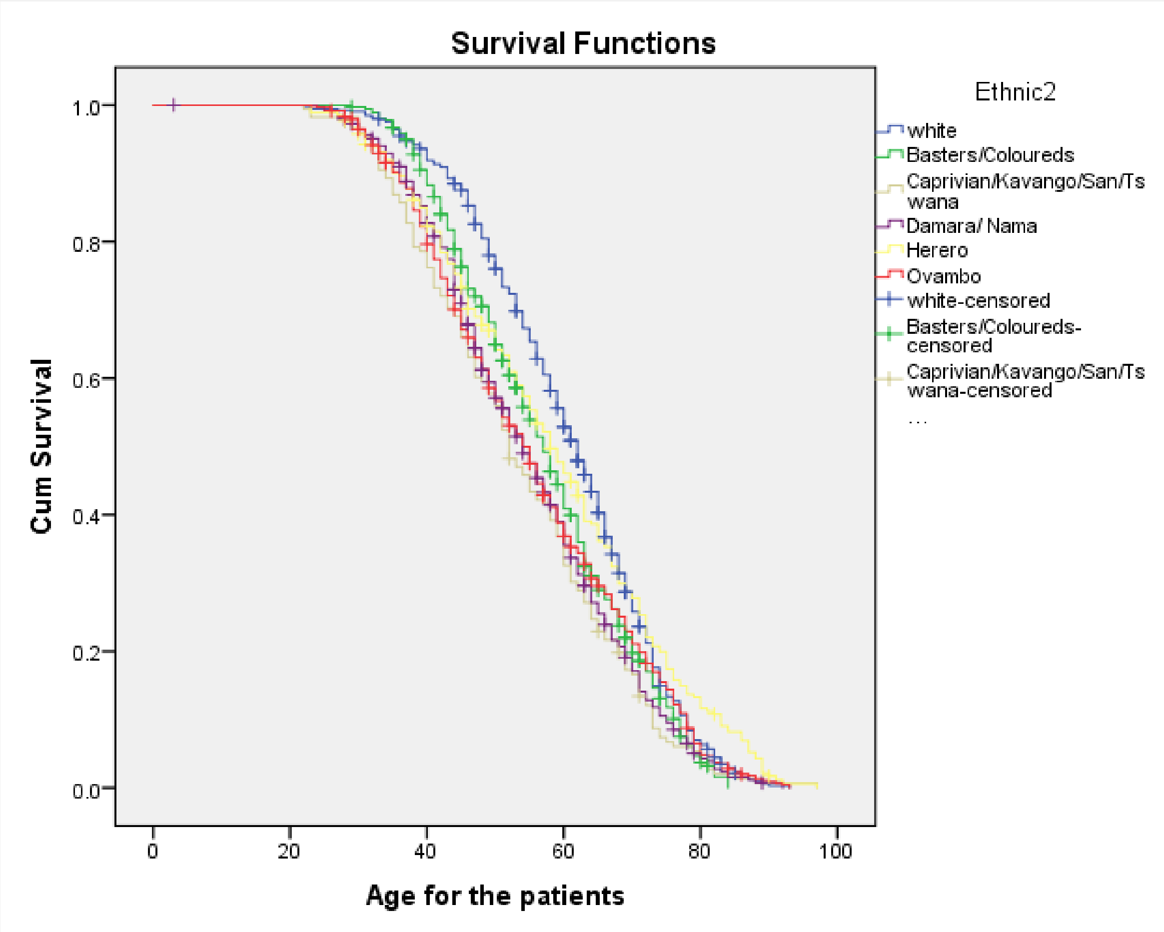

Figure 2: Kaplan-Meier survival curve by selected ethnicity.

vango region ($HR = 1.724$, 95% CI : $(1.012 - 2.933)$, $p = 0.041$) were more likely to survive breast cancer compared to those from the Otjozonjupa region. Results also indicated that Whites ($HR = 0.562$, 95% CI : $(0.0.453 - 0.697)$, $p < 0.001$); Basters ($HR = 0.704$, 95% CI : $(0,512 - 0.969$, $p = 0.031)$; Herero ($HR = 0.696$, 95% CI : $(0.531 - 0.913)$, $p = 0.009$), and Kavango ($HR = 0.511$, 95% CI : $(0.298 - 0.876)$, $p = 0.015$) were less likely to survive breast cancer compared to the Ovambo. Table 3 further shows that patients whose cancer was detected in the 2006 ($HR = 0.488$, $p = 0.032$, 95% CI : $(0.253 - 0.940)$ were less likely to survive compared those detected in 2015.

Table 3: Cox regression model for breast cancer survival

Breast Cancer			**95% CI for Hazard ratio**	
Variable	**p-value**	**Hazard ratio**	**Lower**	**Upper**
Sex				
Male	0.245	1.217	0.868	1.705
Female		1.00		
Regions				
Zambezi	0.07	2.531	0.926	6.92
Erongo	0.749	0.958	0.738	1.245
Hardap	0.871	0.971	0.685	1.379
Karas	0.367	0.859	0.618	1.195
Khomas	0.44	1.088	0.879	1.346
Kunene	0.05	0.677	0.458	1.001
Ohangwena	0.004	0.524**	0.338	0.813
Kavango	0.041	1.724*	1.012	2.936
Omaheke	0.61	0.897	0.591	1.361
Omusati	0.145	0.785	0.568	1.087
Oshana	0.727	0.932	0.629	1.381
Otjikoto		1.000		
Otjozondjupa		1.000		
Ethnicity				
White	0.000	0.561***	0.453	0.697
Baster	0.031	0.704*	0.512	0.969
San/ Bushman	0.467	0.724	0.303	1.731
Caprivian	0.962	1.024	0.388	2.704
Damara	0.184	0.840	0.649	1.086
Herero	0.009	0.696**	0.531	0.913
Kavango	0.015	0.511*	0.298	0.876
Coloured	0.147	0.820	0.628	1.072
Nama	0.284	0.835	0.601	1.161
Tswana	0.332	0.659	0.284	1.530
Ovambo		1.00		
Year Detected				
2000	0.326	0.870	0.659	1.149
2001	0.205	0.824	0.612	1.111
2002	0.142	0.800	0.594	1.078
2003	0.055	0.855	0.566	1.006
2004	0.432	0.893	0.675	1.183
2005	0.147	0.730	0.476	1.118
2006	0.032	0.488*	0.253	0.940
2007	0.501	1.100	0.833	1.454
2008	0.444	0.902	0.692	1.175
2009	0.764	1.036	0.824	1.301
2010	0.339	0.877	0.669	1.148
2011	0.818	0.936	0.532	1.645
2012	0.306	1.613	0.646	4.030
2014	0.836	0.862	0.210	3.543
2015	0.782	0.949	0.656	1.374

4 Discussion

Results showed that breast cancer survival was influenced by age, region and ethnicity. Significant factors associated with poor survival in other studies also included ethnicity, marital status, menopausal stage (for women) and education. Having less than a high school education was a risk factor for death among patients with early stage breast cancer (Herndon et al., 2013). Breast cancer cases were highest in the Khomas region. Mowa (2016) noted that even though the majority of women in Windhoek have a sound knowledge of breast cancer, there are still some negative attitudes towards the screenings and practices. It was not possible to establish differentials in rural/urban, and other potential determinants cited in literature as these variables were not captured in the dataset. Wu et al. (2013) found significant ethnic differentials among non-Latino Whites, African Americans, Latino and Asian Americans in breast cancer survival. Zheng et al. (2013) provided evidence for associations of breast cancer risk in the East Asian population with nearly half of the genetic risk variants initially reported in GWASs conducted in European descendants. Taken together, these common genetic risk variants explain 10% of excess familial risk of breast cancer in Asian populations. Regional differentials in breast cancer survival could be attributed to disparities in access to care (Akinyemiju, 2012), early detection of disease (Eaker et al., 2005), and possibly dietary diversity. There is need to capture more variables like place of residence, educational level, marital status, socio-economic status, diet, and exercise habits etc. for a more comprehensive analysis.

5 Conclusions and Recommendations

A section on Cancer could be incorporated into the Namibia Demographic and Health Survey (DHS). Policy efforts should focus on early breast cancer screening and awareness campaigns for both men and women and should focus on the whites, basters and Herero speaking groups. Khomas region had the highest percentage of cancer cases and this calls for further research on the causes.

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