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Risk Factors Associated with Mortality of Breast Cancer Patients After Surgery: The Case of Zambia

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ABSTRACT

Breast Cancer (BC) has become a public health problem worldwide due to its high mortality rate among women in both developed and developing countries. The association between BC mortality and patient care and personal factors has been widely studied in developed countries. However, scarce data regarding BC mortality and its prognostic factors is available in Zambia. This research aimed to identify the factors affecting survival rates and to estimate a 5-year mortality of BC patients after surgery.

Retrospective data was collected from medical records of patients from the Cancer Diseases Hospital (CDH) in Lusaka, Zambia. The records encompassed 233 women who had undergone BC surgery between 2013 and 2018 and were followed up until the end of 2019. Prognostic factors of BC mortality after surgery using a Logistic regression model were determined. The most commonly used statistic of comparison was the Odds Ratio (OR). Further, 5-year mortality rates for various age groups were estimated using the fitted model.

Age at surgery, marital status, HIV status, BMI, BC stage, histologic grade, and PR status were significantly associated with the mortality of BC patients after surgery. The odds of death increased with the degree of severity across the levels of factors such as tumour size, lymph node status, BC stage and histologic grade. Also, the odds ratio for mortality increased with the age of patients. Additionally, the odds of death were higher for HIV-positive and unmarried patients compared to the HIV-negative and married ones. Further, the odds of death for obese or overweight patients were more than twice that of those classified as not obese. Furthermore, the 5-year mortality of different age groups using multiple logistic regression stood at 75.4 per cent for the younger group (≤ 35 years) and 99 per cent for the older group (50 <= Age).

Keywords: *Breast cancer, mortality, logistic regression, prognostic, retrospective study.*

INTRODUCTION

Breast Cancer has become a source of concern worldwide due to its high mortality rate among women in both developed and developing countries [1, 2]. It was estimated that 2.1 million new cases of Breast cancer were identified and 0.6 million cases of deaths due to breast cancer occurred worldwide in 2018 [1]. Breast cancer is one of the most prevalent public health problems in Zambia and, unfortunately, diagnosis is often delayed, compounding the problem further since management of the cancer is difficult and expensive. It is the second most common cancer and cause of cancer-related deaths in Zambia among women [3], resulting in less than 50 per cent two-year survival rate [4].

The distribution of breast cancer mortality rate varies significantly among different regions of the world, possibly due to different geographical, economic, social and cultural factors that affect the spread of breast cancer. In developed countries breast cancer, often diagnosed at an early stage, allows for early treatment and reduction of mortality due to this disease [5]. However, in countries with limited resources locally advanced breast cancer is still common and has a poor prognosis resulting in a higher mortality rate [6]. The survival of breast cancer patients depends on factors such as tumour size, age at diagnosis, stage of the disease, obesity, socioeconomic status, histologic grade and hormone receptor status [2,7-9]. In addition, HIV has always been associated with certain unusual cancers, especially cervical cancer [10]. However, due to the success of Anti-Retroviral Treatment (ART), HIV is changing from being the major cause of death to a chronic condition with which the patients may survive into middle age and beyond. The change raises a question of what impact, if any, HIV may have on breast cancer patients after surgery with respect to survival. Identifying prognostic factors of breast cancer plays an important role in the treatment and care of patients as it may improve the delivery of health care to groups at risk. However, the effects of factors such as age at diagnosis, stage of cancer, marital status, and family history are unclear and still challenging topics [11], thus the need for further investigation. Furthermore, the statistical significance of these factors in models varies due to a variety of issues; some of the issues may include environment and culture.

Data regarding breast cancer epidemiology are rare, and surveys conducted by the American Cancer Society and other studies have not included Zambia [5, 6]. In Zambia studies regarding information based on the mortality rate for breast cancer patients, after surgery and its possible associated factors related to both patient care and personal attributes, are scanty. This motivated the need for this study to examine factors which may play a role in predicting mortality for breast cancer patients, after surgery, and to assess their impact on survival five years after surgery or longer. The objectives of this study were twofold: first, to identify prognostic factors associated with the mortality of breast cancer patients after surgery, and second, to estimate the mortality rate of breast cancer patients after surgery over a 5-year period.

MATERIALS AND METHODS

Study Design and Population

This was a retrospective study on 233 patients, who had surgery as the primary treatment for breast cancer and confirmed by a surgeon or specialists, between 2013 and 2018 and followed up to 31st December 2019 from the date of surgery from the Cancer Diseases Hospital (CDH) in Lusaka District, Zambia. In addition, women meeting the following criteria were included in the study: patients who were older than 18 years of Age, underwent surgery, and whose end-point result was either death or survival. Data for any subject lost to follow-up or dying from other causes during this period was treated as having been censored.

SAMPLE SIZE

In this study, the primary variable of interest was HIV status and study subjects were placed into two groups: positive for HIV and negative for HIV. The response variable was categorical: survival or death from breast cancer after surgery. The researchers set the probability of death given HIV negative at 40 per cent, the power of the test at 80, and type I error at 5 per cent. Using Hsieh's [12] formula for logistic regression, The researshers obtained a sample size of 466 as the maximum sample size; this was reduced to 233 when the exclusion criteria was applied.

DATA COLLECTION

For each patient, data was collected from the date of cancer surgery until 31st December 2019, the end of the follow-up period, and whose end-point result was either death or survival. Sociodemographic data collected included family history, contraceptive use, and alcohol consumption, which were classified as either yes or no, age, marital status (married or unmarried), date last seen or outcome of the end-point result. Unmarried women included those who had never been married before, those who were divorced, and the widowed.

In addition, clinic-pathological data such as laterality (left or right), histologic grade (grades I/II or III), type of surgery (mastectomy or lumpectomy), breast cancer stage (I/II or III/IV), tumour size (< 5 cm or ≥ 5cm) was collected. In addition, lymph node, HIV status, ER status, PR status and human epidermal growth factor receptor 2 (HER2) expression, which were classified as either positive or negative, were also collected from patients' medical records. Body weight in kilogrammes and height in metres were used to calculate Body Mass Index (BMI). Which was used to determine obesity. All data was collected from CDH.

Statistics Analysis

A multivariable logistic regression analysis was used to assess the significance of several risk factors simultaneously and to predict the mortality of breast cancer patients after surgery over five years. Three models were fitted: first, a model which involved factors found to be significant in literature; this was done for validation using the researchers data; second, a model using factors found insignificant in literature, including those which were not considered in the literature. The second model was fitted to assess factors that needed to be considered independently in the literature and to rule out the influence of factors in the first model. Finally, a model consisting of all the significant factors from the two models was fitted. Various tests, using the odds ratio as a test statistic, were performed, and a prediction of a five-year survival was done for various groups of study subjects using the model.

Ethical clearance was obtained from the relevant institutions, including a patient consent waiver since no direct contact with patients was planned. De-identified data was used for analysis and reporting.

RESULTS

Univariate analysis

In this section, the researchers compared the survival of subjects in different categories of each variable based on the summary of some sociodemographic and clinical characteristics given in Table 4.1. The median Age at surgery was 47.6 years, and the range was 59 years (from 18 to 77). Most of the patients were married (59.2%). The probabilities of death due to breast cancer after surgery, over the study period, were estimated to be 13.8 per cent for the married and 36.8 per cent for the singles. Regarding surgery treatment, 85.0 per cent of patients underwent a mastectomy, and 15.0 per cent had a lumpectomy or breast conservation surgery. The distribution of subjects according to histologic grade was 52.8 per cent for those with grades I or II and 47.2 per cent for those with grades III. The majority of the women who underwent surgery did so in the late stages (III and IV) of breast cancer, accounting for 60.1 per cent of the entire study population. In general, factors with two response categories (positive or negative) had higher mortality rates for subjects who were found to be positive on that factor than subjects who were negative, as may be seen in column 6 of Table 4.1 based on the odds ratios reported therein. For other factors, such as tumour size and lymph node status, the mortality rate increased with the degree of severity across the levels of the factor. Chi-square tests of association between individual factors and survival status were performed, and P-values are reported in the last column of Table 4.1. The results showed that breast cancer stage, histologic grade, PR status, tumour size, lymph node, and BMI were significantly associated with the mortality of breast cancer patients after surgery, agreeing with that reported in the literature.

Further, from the factors reported to be insignificant in the literature, only marital status and alcohol consumption were significantly associated with breast cancer mortality after surgery in our study. Among the additional factors, HIV status was the only one that was significantly associated with the mortality of breast cancer patients after surgery. Relative comparison using the odds ratio showed that the odds of death for single patients were about 3.65 times higher than for married ones.

Table 4.1 Social-demographic and clinic characteristics of patients and summary of tests of association of factors versus survival

Variable	Levels	Deceased (%)	Survived (%)	No. of cases (n)	Univariate Analysis	
					OR	P Value
Marital status	Married Single	13.8 36.8	86.2 63.2	138 95	Ref 3.654	< 0.001*
BMI	Not obese Obese	15.7 31.2	84.3 68.8	121 112	Ref 2.44	0.005*
Alcohol consumption	No Yes Unknown	18.6 31.9 15.0	81.4 68.1 75.0	140 69 24	Ref 2.052	0.031*
BC stage	0, I & II III & IV	10.8 31.4	89.2 68.6	93 140	Ref 3.804	< 0.001*
PR status	Negative Positive Unknown	14.3 32.7 13.3	85.7 67.3 86.7	105 113 15	Ref 2.921	0.001*
HIV status	Negative Positive Unknown	15.4 43.1 19.2	84.6 56.9 80.8	123 58 52	Ref 4.147	< 0.001*
Histologic grade	I & II III	15.4 31.8	84.6 68.2	123 110	Ref 2.554	0.003*
Tumor size	Tis, 1 & 2 T3 & T4 Unknown	16.9 31.4 4.3	83.1 68.6 95.7	89 121 23	Ref 2.259	0.016*
Lymph node status	N0 & 1 N2 & N3 Unknown	13.3 36.1 5.0	86.7 63.9 95.0	105 108 20	Ref 3.674	< 0.001*
HER2	Negative Positive Unknown	20.6 31.2 12.0	79.4 68.6 88.0	131 77 25	Ref 1.744	0.089
Family history	No Yes	21.7 34.6	78.3 65.4	207 26	Ref 1.906	0.148
Contraceptive use	No Yes Unknown	26.3 22.4 22.0	73.7 77.6 78.0	57 76 100	Ref 0.774	0.531
Surgery type	Lumpectomy Mastectomy	17.1 24.2	82.9 75.8	35 198	Ref 1.547	0.362
Laterality	Right Left	27.9 18.9	72.1 81.1	111 122	Ref 0.600	0.103
ER status	Negative Positive Unknown	17.6 28.3 13.3	82.4 71.7 86.7	91 127 15	Ref 1.854	0.068

Note: * indicates a significant association between a factor and survival at a 5 per cent level of significance

The odds of death for breast cancer patients classified as obese or overweight were 2.44 times higher than those classified as not obese or overweight. In addition, the odds of death for those who were HIV positive were 4.15 times higher than the odds of dying HIV negative. Odds greater than one also were observed for factors such as consumption of alcohol (2.052) and PR (2.921). On the other hand, factors such as type of surgery, family history, tumour laterality, HER2, ER and contraceptive use showed insignificant associations with survival, as the tests reviewed in Table 4.1.

Multivariate Analysis

The researchers performed multivariate analysis by using multiple logistic regression; first examining a model of factors proven in literature to be associated with survival. The model containing literature-proven factors (model 1) showed that Age at surgery, BMI, PR status, breast cancer stage and histologic grade were significantly associated with breast cancer mortality, while the rest of the variables were insignificant. Another model (model 2) containing other additional factors, including those which were insignificant in the literature, revealed that marital status and HIV status were significantly associated with mortality while the rest were insignificant.

The third model consisted of all significant factors from the two models, and the factors were Age at surgery (x_1), BC stage (III or IV = x_2), BMI (obese or overweight = x_3), PR status (positive PR = x_4), histologic grade (grade III = x_5), HIV status (positive = x_6) and marital status (single = x_7) with the dependent variable being survival status (dead or alive). For variables having two categorical levels, the level assumed disadvantageous to the subject assumed the value of 1 and the other the value of 0. The model fitted was as follows:

$$\ln\left(\frac{\pi(\underline{x})}{1-\pi(\underline{x})}\right) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 + \beta_7 x_7 \quad (4.1)$$

Where $\underline{x}$ = (x_1,x_2,...,x_7)', is a vector of factors, $\pi(\underline{x})$ is the probability of a subject dying after surgery given the presence of the factors in vector $\underline{x}$ and β_1,β_2,...,β_7 are coefficients associated with the factors, and β_0 is a constant. The results of the fitted model are tabulated in Table 4.2.

Table 4.2 The estimated coefficients, P-values and 95 per cent CI for the preliminary model.

Factors			**β^**	**P-value (p)**	**95% CI**
Age at surgery		x_1	0.068	0.001	(1.028, 1.114)
BC stage	III or IV	x_2	2.361	< 0.001	(3.173, 35.429)
BMI	Obese/overweight	x_3	1.090	0.028	(1.123, 7.869)
PR status	Positive	x_4	1.965	< 0.001	(2.418, 21.040)
Histologic grade	III	x_5	1.521	0.003	(1.702, 12.305)
HIV status	Positive	x_6	1.171	0.014	(1.262, 8.243)
Marital status	Single	x_7	1.410	0.005	(1.548, 10.838)
Constant			-9.803	< 0.001	

Using the estimated coefficients from Table 4.2, the fitted model was:

$$\ln\left(\frac{\pi(\underline{x})}{1-\pi(\underline{x})}\right) = -9.803 + 0.068x_1 + 2.361x_2 + 1.090x_3 + 1.965x_4 + 1.521x_5 + 1.410x_7 \quad (4.2)$$

In the final model, some interaction terms were examined.

Final Logistic Model

Several interaction terms were examined, but only the interaction between BMI and HIV remained significant in the model. The results from the extended logistic regression, excluding insignificant interaction terms, revealed that five characteristics had prognostic value for breast cancer mortality, including age at surgery ($p = 0.001$), breast cancer stage ($p < 0.001$), PR status ($p < 0.001$), histologic grade ($p = 0.002$) and marital status ($p = 0.001$). Even though BMI and HIV are insignificant, their joint significance is captured in the interaction. The results of the final model are tabulated in Table 4.3.

Table 4.3 Final logistic regression model, factors, parameter estimates and P-value

Variables in the model	**β ^**	**P-value (p)**
Age in years	.075	0.001*
Breast cancer stage	2.360	< 0.001*
BMI	-.048	0.945
PR status	2.031	< 0.001*
Histologic grade	1.573	0.002*
HIV	-.313	0.698
Marriage	1.839	0.001*
BMIxHIV	2.535	0.023*
Constant	-9.856	0.000

Note: * indicates significant factors at a 5% level of significance

To estimate five-year mortality, the time of the study (in years) as a variable was also included, yielding the following model:

$$\ln\left(\frac{\pi(\underline{x})}{1-\pi(\underline{x})}\right) = -9.259 + 0.079x_1 + 2.381x_2 - 0.027x_3 + 2.091x_4 + 1.585x_5 - 0.172x_6 + 1.665x_7 + 2.600x_8 - 0.373x_9 \quad (4.3)$$

Where x_8 is the interaction term between BMI and HIV and x_9 = time on study.

Cancer-related factors were classified as level I, while social and lifestyle-related factors were classified as level II. In addition, age was used for stratification, and "time on study" (Time) was used as a time-dependent variable. Further, the combinations of the presence and absence of the factors in the two levels were used to divide subjects into nine groups, as displayed in Table 4.4.

Table 4.4 Five-year mortality by age group using a logistic regression model

	Pattern of variables									
	Age	**26**	**40**	**70**	**26**	**40**	**70**	**26**	**40**	**70**
Variables	**Parameter estimates**	**Cancer + social and lifestyle variables**			**Cancer-related variables**			**Social and lifestyle variables**		
Stage PR Grade	2.381 2.091 1.585	1 1 1	1 1 1	1 1 1	1 1 1	1 1 1	1 1 1	0 0 0	0 0 0	0 0 0
Marriage BMIxHIV HIV BMI	1.665 2.600 -0.172 -0.027	1 1 1 1	1 1 1 1	1 1 1 1	0 0 0 0	0 0 0 0	0 0 0 0	1 1 1 1	1 1 1 1	1 1 1 1
Age Time Constant	0.079 -0.373 -9.259	5 1	5 1	5 1	5 1	5 1	5 1	5 1	5 1	5 1
Mortality probability		0.741	0.897	0.989	0.047	0.130	0.614	0.0067	0.0199	0.178

Five-year mortality rates of patients aged 26, 40, and 70 years, both of which had classes of variables, were 74.1 per cent, 89.7 per cent, and 98.9 per cent, respectively. Mortality was rather high for patients with the two classes of variables present, pattern 1. On the other hand, breast cancer mortality was low for patients with either one of the two classes present, patterns 2 and 3. The Table also shows that the five-year mortality rate of breast cancer patients after surgery increases with Age, as may be observed within each pattern of the age groups. Further, the results also show that cancer-related variables have a far greater impact on mortality.

DISCUSSIONS

Breast cancer is one of the most common causes of cancer deaths among women worldwide [1, 5]. Analysis of mortality rate data and related outcomes is essential to evaluate cancer treatment programmes and to monitor the progress of regional and national cancer control programmes. The present study was based on the data obtained from the cancer registry at the Comprehensive Cancer Center at CDH in Lusaka District. The hospital collects information about cancer incidence, type, location, stage, and the kinds of treatment patients receive across the country. In the researchers logistic model, there were both demographic as well as clinical variables such as breast cancer stage, PR status, marital status, age, and HIV status, among others.

The clinical stage is important in prognosis and determining the appropriate cancer treatment [2, 7, 13]. In a multiple logistic regression model fitted, patients who underwent surgery at advanced stages (stage III and IV) demonstrated a poor prognosis for survival time. It was found that patients who underwent surgery at advanced stages (stages III and IV) had a worse prognosis after surgery than those in early stages (stages 0, I and II). This result is consistent with many previous findings worldwide [3, 13]. According to Balabram, Tuira and Gobbi [14], patients who were diagnosed with advanced stage cancer had shorter survivors after surgery when compared with those with early stages of the disease. Alvarez *et al*. [7] reported a decrease in survival rate for patients with advanced clinical stages III and IV after diagnosis. The late stage of the disease at diagnosis, in developing countries like Zambia, could be due to numerous factors such as poverty, lack of screening programmes, low availability of diagnostic facilities, and cultural beliefs creating a barrier to early presentation of the disease [9, 15].

In this study, higher histological grades and an increase in BMI were highly correlated with mortality for patients with breast cancer after surgery, as observed in other studies [9, 14, 16]. This study revealed that histologic grade III increased the odds of death from breast cancer after surgery compared to histologic grades I and II. The researchers also found that the risk of death due to breast cancer was higher in obese or overweight patients than in those who were not. The findings of the present study show that obesity is an important condition to take into account in the fight to reduce breast cancer mortality after surgery in developing countries like Zambia. This could be achieved by promoting regular physical exercise and healthy eating, which have positively affected obesity prevention among women [9]. On the contrary, Alverez *et al*. [7] found no association between histologic grade and breast cancer mortality.

In addition, this study established that HIV-positive patients were at higher risk of death due to breast cancer after surgery compared to patients who were HIV-negative. However, data regarding the effect of HIV status on breast cancer mortality is scarce. Coghill *et al*. [17] revealed that HIV-infected cancer patients experienced a more than two-fold increased risk of death during the year following cancer diagnosis compared to HIV-uninfected cancer patients. In this study, the interaction between BMI and HIV status was significant. However, the introduction of the interaction term reduced the individual effect of BMI and HIV on the risk of death from breast cancer after surgery. The effect HIV has on body weight seen in several infected individuals in this study may explain the strong interaction between the two factors. Marital status was another factor that was significantly associated with breast cancer mortality after surgery. Single women had an increased risk of mortality from breast cancer after surgery, as reported in other studies [18]. In some studies, they observed that the benefits of emotional support, a good lifestyle, and stable economics were likely to be protective factors on survival for married women with cancer [18]. In Zambia, single women, especially those having many children, generally encounter harsh economic conditions. The financial drain of the treatment course of breast cancer could be an obstacle for seeking care and appropriate treatment compliance, especially when patients are required to pay for health care services. This could have contributed to the higher mortality of breast cancer patients after surgery among single patients in this study.

In this study, variables like lymph nodes, tumour size and alcohol consumption, which were statistically significant in univariate analysis, lost their significance in the multiple logistic regression analysis. One of the possible reasons for this could be that the presence of the more significant factors overshadowed theirs. In contrast, other studies noted a significant association between mortality and factors such as lymph node status and tumour size [19, 20]. However, in this study, tumour size was not significant in a multiple logistic regression analysis despite being significant in the univariate analysis, as observed in other studies [16]. Although family history and alcohol consumption are well-established risk factors for breast cancer [5-8], their association with mortality remains vague. In the present study, family history and alcohol consumption were not significantly associated with mortality of breast cancer after surgery, as noted in numerous studies [16, 19]. Some studies observed a reduction in survival for patients with a positive family history of breast cancer [7].

In this study, age was significantly associated with mortality of breast cancer patients after surgery. In a retrospective study by Momenyan *et al*. [16], age was significantly associated with mortality of breast cancer patients after surgery as well. In addition, Bouzguenda [21] identified an age of more than 70 years as a depreciatory factor influencing significantly the survival of breast cancer patients using both univariate and multivariate analyses. Further, Chang and Kuo [19] revealed that mortality of breast cancer after surgery was higher in patients aged less than 35 years. Alvarez *et al*. [7] showed that patients younger than 40 years had a lower survival rate when compared with patients older than 40.

On the contrary, some studies revealed no significant difference in survival between the different age groups [2, 7, 8, 13]. The final prognostic factor of mortality after surgery that was significant in this study was the presence of PR. This factor increased the risk of death among breast cancer patients in the study population. In a multivariate analysis, Kawaguchi *et al*. [22] showed that PR negativity was significantly correlated with prolonged overall survival. On the other hand, other studies revealed that patients with negative PR were at higher risk of death than positive ones [16, 19]. Baozguenda *et al*. [21] revealed that PR-positive breast cancer patients presented better survival rates as compared to PR-negative patients. A study by Alvarez *et al*. [7] reported no significant relationship between PR status and improved survival. Conflicting results may be due to several factors such as the age range of the study groups used in those studies and the stage of the disease that could also have varied, among others.

The five-year mortality rates for patients aged 26, 40, and 70 years, which had variables, were 74.1 per cent, 89.7 per cent and 98.9 per cent, respectively. Previous studies in other African countries showed that the five-year overall mortality varied from 40 per cent to 88 per cent except for the older group [9, 13, 21, 23]. One reason for this disparity could be due to a significant number of patients in this category who were not married and were HIV positive. Since the cancer hospital is only in Lusaka District, patients above 50 years may be far from the hospital and may find it difficult to conduct after-surgery reviews due to distance. Aside from Age, this could have contributed to a higher mortality rate for the older patients in our study. In addition, the five-year overall observed mortality of the study subjects after surgery using actuarial life tables was 50 per cent and this was higher compared to other studies that reported varied proportions from 26 per cent to 44 per cent [2, 5, 6, 24].

On the other hand, the overall five-year mortality rate observed in this study was lower compared to 88.1 per cent in Gambia, 75.9 per cent in Nigeria and 88 per cent in Tunisia [6, 21, 23]. Ngowa *et al*. [13] showed a five-year overall breast cancer mortality of 70 per cent in Cameron. However, logistic regression was the preferred method for reporting the five-year mortality rate because life tables are ideal for follow-up studies with specific periods and require large samples to obtain good estimates of mortality or survival. Further, actuarial estimates in our case did not make a distinction in terms of age, as does the logistic model.

Despite the importance of this study to Zambia and its prospective effect on the quality of care for patients with breast cancer, especially after surgery, it may have some limitations. First, loss to follow-up, such as patients relocating to other parts of the country, thereby making it difficult for them to continue with their routine treatment or may have died, but such information was not available. Consequently, the sample size was reduced considerably due to the exclusion of patients from the study whose final status could not be ascertained. Further, information regarding factors such as lymph node, alcohol consumption, and tumour size was missing for several patients. As such, their influence on the model was affected. Nevertheless, the results of the current study provide some knowledge of the risk factors of breast cancer mortality in Zambia. Further, since the study population was reasonably representative of the whole country, the study's results present a credible outlook on breast cancer mortality.

CONCLUSION

The current study has shown that age, marital status, PR status, breast cancer stage, histologic grade, and obesity were prognostic factors of mortality for breast cancer patients after surgery. The study also established that HIV-positive women with breast cancer appear to have decreased survival compared with HIV-negative women. ER, status, Her2 status, family history, tumour laterality, and surgery type were not statistically associated with breast cancer mortality after surgery. Although significant in univariate analysis, lymph node status, tumour size and alcohol consumption were not significantly associated with breast cancer mortality in the multiple logistic models. In addition, this study showed that patients older than 70 years had shorter survival times, followed by the middle age group compared to younger patients [35 years less]. Since some variables had missing data in some patients' medical files, this study recommends that CDH improves the collection of information in such a manner that they to reduce missing data in these variables to enable researchers to assess the effect of the same on breast cancer mortality. Further, since survival is better for women who had early stages of the disease, the study recommends that early detection of breast cancer along with the availability and accessibility of appropriate treatment should be made available to improve life expectancy for women with the disease in Zambia.

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