Breast cancer survival and health iniquities

Sobrevida por câncer de mama e iniquidade em saúde

La supervivencia del cáncer de mama y la inequidad en salud

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Abstract

Breast cancer is the most frequent neoplasm in women, and some studies have shown social inequalities in incidence and survival, which are poorly investigated in Brazil. To assess iniquity in prognosis, a hospital-based cohort study was carried out. Follow-up was made by active search in medical records and in the Mortality Information System, phone calls, and consultation on Individual Tax-Collection Record status. Survival functions were estimated by the Kaplan-Meier method, and the Cox proportional hazards model was employed for prognostic assessment. Disease-specific survival was estimated at 76.3% (95%CI: 71.9-81.0) in 5 years. Women seen at public facilities had worse prognosis (HR = 1.79; 95%CI: 1.09-2.94), which was particularly due to the disease being diagnosed at a more advanced stage. These findings point to inequalities of access to screening actions, as women of lower social conditions with later diagnostic and therefore with worse prognostic.

Breast Neoplasms; Prognosis; Survival Analysis; Equity

Resumo

O câncer de mama é a neoplasia mais frequente em mulheres e alguns estudos mostram desigualdades sociais na sua incidência e sobrevida, o que é pouco estudado no Brasil. Para avaliar a iniquidade no seu prognóstico, foi feito estudo de coorte hospitalar. O seguimento foi realizado por busca ativa nos registros médicos e Sistema de Informação sobre Mortalidade, contato telefônico e consulta de situação cadastral no Cadastro de Pessoas Físicas. As funções de sobrevida foram estimadas pelo método de Kaplan-Meier e o modelo de riscos proporcionais de Cox foi utilizado para avaliação prognóstica. Foi estimada uma sobrevida específica pela doença de 76,3% (IC95%: 71,9-81,0) em 5 anos. As mulheres atendidas no serviço público tiveram pior prognóstico (HR = 1,79; IC95%: 1,09-2,94), e tal efeito foi mediado, sobretudo, pelo estadiamento da doença mais avançado no momento do diagnóstico. Tais achados apontam para a existência de desigualdades de acesso a ações de rastreamento, com as mulheres de menor posição socioeconômica tendo diagnóstico mais tardio e consequentemente pior prognóstico.

Neoplasias da Mama; Prognóstico; Análise de Sobrevida; Equidade

Introduction

Breast cancer is the most frequently diagnosed neoplasm, and the main cause of cancer deaths among women, in both developed and developing countries, and is the second most common type of cancer worldwide [1].

In Brazil, it is also the most common malignant neoplasm among women [2], and the main cause of cancer death in the female population in 2012 (Departamento de Informática do SUS. Informações de saúde: estatísticas vitais. http://tabnet.datasus.gov.br/cgi/tabcgi.exe?sim/cnv/obt10uf.def, accessed on 29/Jun/2015). Despite the trend for stabilization of breast cancer mortality in Brazil since 1994, there are considerable differences in mortality rates from this disease when the analysis is made for each of the country's regions or states, with a decrease or stabilization of the rates in regions with higher socioeconomic level, and significant increase in regions with a low socioeconomic level [3].

A number of factors have been associated with the prognosis for breast cancer patients, making possible the establishment of specific criteria for the therapeutic approach. These factors include staging [4,5], size of the tumor, and the status of the axillary lymph nodes [6,7,8], in addition to individual characteristics, such as age at diagnosis [9] and race [5]. Even though advancements and modifications in the therapeutic approach are associated with improved survival [10,11], delays in beginning treatment may compromise it [12,13]. Other survival-related factors include the characteristics of the health services [14], having a private health plan/insurance [14,15], and the socioeconomic status of the patients. The socioeconomic status of the patients is a variable still little used in Brazil, but it has shown to be an important determinant of breast cancer survival in studies carried out in other countries, and may be identified with the use of individual measures, such as income and school education, contextual measures of the area of residence, or by proxy variables, such as having a private health plan/insurance and using the public or the private health care system [16].

Differences in survival with the disease were observed in regions with similar health care practices in terms of clinical protocols in oncology, with the worse survival being related to low diagnostic investigation markers (assessment of tumor proliferation and hormonal receptor status, and number of isolated lymph nodes), which may signify late diagnosis or improper classification of the tumor, leading to delayed, improper or lack of treatment [17].

The aim of this study was to assess socioeconomic iniquities in the survival of women with invasive breast cancer seen in public and private health care services of oncology care centers, and who lived within a regional health catchment area in the state of Minas Gerais, Brazil.

Materials and methods

Study population

A hospital-based cohort with 437 women with invasive breast cancer diagnosed between 1998 and 2000 that underwent surgery. All the subjects of this study received care (surgery and/or adjuvant therapy: chemotherapy, or radiation therapy, or hormone therapy) in the city of Juiz de Fora, Minas Gerais, and lived within the Juiz de Fora regional health catchment area. The patients were followed-up until five years after the date of diagnosis of the last patient included in the study. Detailed follow-up and information collection methodology are published in Guerra et al. [8].

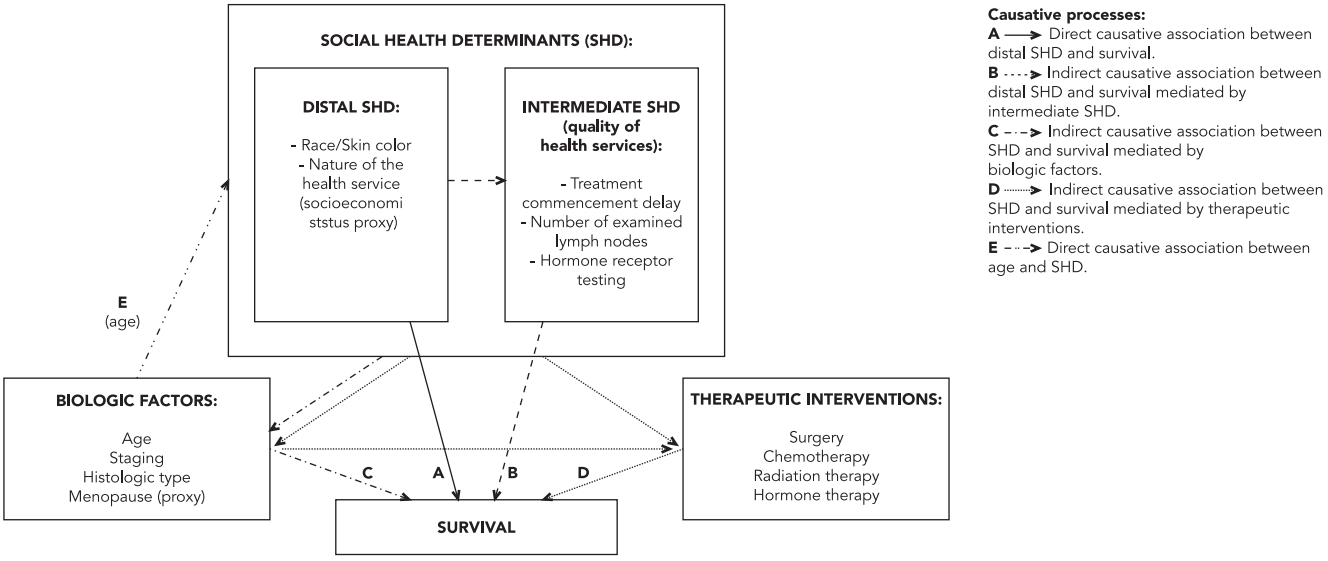
We have identified 868 cases of diagnosed female breast cancer in the area under investigation, in the period established for the study. Cases of carcinoma *in situ* (n = 13), cases submitted to surgical intervention for diagnostic purposes (biopsies and nodulectomies with no axillary dissection – n = 91) and to hygienic mastectomy (n = 11), cases in which the type of surgical approach could not be identified (n = 8), and cases of non-residents in the regional health catchment area of the city of Juiz de Fora (n = 308) were excluded from the analysis. Therefore, the study population included 437 patients. To assess the multiple prognostic factors with Cox models, 23 patients with incomplete data for two of the variables investigated (skin color: n = 14; staging: n = 9) were also excluded from the sample, so that the models could be compared. Thus, 414 women were included in the models.

Conceptual model and collected variables

For the survival analysis, a hierarchical conceptual model was used (Figure 1), with the exposure variables divided as follows: (a) distal social determinants – race/skin color and nature of the health care service, which are considered a proxy of the socioeconomic status; (b) intermediate social determinants (health care service quality indicators) – delay of more than 60 days for the beginning of treatment, number of lymph nodes examined, hormonal receptor dosage; (c) biological factors – age, tumor stag-

Figura 1

Conceptual chart of the social determinants for survival for women with breast neoplasms.



ing, histologic type of the tumor, menopausal status; (d) therapeutic interventions – type of surgery, chemotherapy, radiation therapy, hormone therapy.

To investigate health iniquity, the independent (exposure) variables used were the nature of the health care service (public or private), and race/skin color (white or non-white). In the hierarchical conceptual model adopted by this article, these are the distal social determinants of prognosis. Their effects may or may not be influenced by intermediate determinants related to the quality of the health care services the patients had access to, biological factors and therapeutic interventions.

For the characterization of some variables, the following criteria were adopted: number of lymph nodes examined, which is considered a quality marker of the diagnostic investigation at the time the diagnosis was made, and categorized into < 10 and ≥ 10 [18]; menopausal status, indicated by age ≤ 50 or > 50 years, the cutoff point validated as the marker of this condition [9].

Data analysis

For the survival analysis, the date of diagnosis (date of the histologic pathology report) was considered the beginning of the survival time. Deaths (date of death) that occurred until the end of the study follow-up, due to breast cancer or as a consequence of treatment, were considered as failures. Women who remained alive until the final follow-up date were censored at this date, and the cases confirmed as lost to follow-up were censored at the date of the last follow-up recorded. Patients who died due to causes unrelated to breast cancer or its treatment were censored at the date of death. For each patient, the maximum time of follow-up considered in the study was five years.

The differences observed in the distribution of variables related to the nature of the health care service were calculated with the chi-square test (or Fisher's exact test when indicated), and those with a p-value ≤ 0.05 were considered statistically significant.

Cox proportional hazard regression model was adjusted to evaluate prognostic factors, with the calculation of the hazard ratios (HR) and their corresponding 95% confidence interval (95%CI). The modeling used time as counting process formulation [19]. The variables included in the intermediate social determinants, biological factors and therapeutic interventions were used only to estimate adjusted association measures for the social variables, allowing their direct and indirect effects to be distinguished. The effect of the distal social determinants affected by the other groups of variables was estimated by calculating

the percentage reduction of the distal social determinants measure of association [20].

Initially, simple models for each exposure variables were made, estimating crude association measures. In the case of therapeutic interventions, in addition to simple models, age- and staging-adjusted models were also made, because these variables are considered for the selection of individual therapies. Next, three multiple models were assessed, with the addition of the variables of the groups of determinants. All distal social determinants were included in multiple model 1. In multiple model 2, in addition to the significant distal social variables of model 1 ($p < 0.05$ in the Wald test), biological factors that reached $p < 0.20$ in the simple models were included. Finally, in multiple model 3, social determinants and biological factors that were significant in the previous model ($p < 0.05$) were included, with the addition of therapeutic interventions with $p < 0.20$ in the simple models or in the age- and staging-adjusted models. Even though the variable age was not significant in the simple model ($p > 0.20$), it was included in all multiple models for the calculation of age-adjusted effect measures.

The Cox model assumptions were initially assessed with the use of Kaplan-Meier charts, stratified by the variables and by analysis of the Schoenfeld residuals, deviance, and Martingale score [19].

Data was entered in the Epi Info 2002 software (Centers for Disease Control and Prevention, Atlanta, USA), and descriptive and survival analysis in software R version 3.0.1 (The R Foundation for Statistical Computing, Vienna, Austria; http://www.r-project.org), with the use of the *survival* library.

The present study was approved by the Ethics Research Committee (CEP) of the Social Medicine Institute, Rio de Janeiro State University (IMS/UERJ) on July 24, 2003, and later by the CEP of the Federal University of Juiz de Fora (UFJF; submission registration n. 1436.127.2008).

Results

Preliminary analyses

Table 1 presents the distribution of individuals for each study variable, stratified according to the nature of the health service (public *vs.* private), which is the main variable of interest as it serves as a proxy of socioeconomic status .

Among the 437 women investigated, most of them lived in the city of Juiz de Fora (86% seen in private health services, and 79% in public health services), and were Caucasian (85% in private health services and 73% in public health services). Sixty-five percent (65%) of the women were seen in public health services, with no statistically significant differences regarding the city of residence, and with a higher proportion of non-white/non-Caucasian women seen at public health services (26% *vs.* 15%; $p = 0.007$).

For quality-related variables of health care services, only 6% of the women had the commencement of their treatment delayed more than 60 days, and almost all of them were seen in public health services (8% *vs.* 2%; $p = 0.007$). Most of the women had more than 10 lymph nodes examined, with no significant differences between public and private health services (84% *vs.* 82%; $p = 0.610$); however, less than half of the women were tested for hormone receptor, with the worse scenario in public health services (39% *vs.* 65%; $p < 0.001$). Notwithstanding, hormone therapy was given to 65% of women in public health services, and 70% in private health services ($p = 0.346$). Chemotherapy was indicated for 65% of the women in public health services, and 69% in private health services, also with no significant differences ($p = 0.419$). On the other hand, a higher proportion of women in public health services underwent radical surgery (70% *vs.* 59%; $p = 0.022$) and radiation therapy (83% *vs.* 73%; $p = 0.009$).

In terms of biological characteristics, 72% of women seen at public health sector and 61% of women seen in private health sector were in the age group 40 to 69 years ($p = 0.057$). A higher proportion of women diagnosed with the disease in stage III or IV were seen in public health services (37% vs. 26%; $p < 0.001$). Sixty-two percent (62%) of women seen in public health services and 68% of those seen at private health sector were post-menopausal ($p = 0.212$), and the most common histologic type was the ductal carcinoma, with no differences between public and private health services (82% *vs.* 86%; $p = 0.255$).

Death due to breast cancer was more frequent in women who went to public health sector (23% *vs.* 14%; $p = 0.028$), but there was no difference between public and private services in terms of recurrence (12% *vs.* 9%; p = 0,375), even though this analysis was performed with no consideration to censoring.

Cox models

Table 2 presents the results of simple Cox models, and Table 3 shows the results of multiple Cox models, with the measures of association (HR) and the 95%CI.

Table 1

Distribution of variables according to the nature of the health care service (proxy of socioeconomic status) for the 437 women included in the breast cancer hospital-based cohort, Juiz de Fora Regional Health Catchment Area, Minas Gerais State, Brazil, diagnosed between 1998 and 2000.

Variables	Private (n = 153)		Public (n = 284)		p-value *
	n	%	n	%	
Distal social determinants					
Race/Skin color **					0.007
White	126	85	200	73	
Non-white	23	15	74	27	
City of residence					0.069
Juiz de Fora	132	86	225	79	
Other	21	14	59	21	
Intermediate social determinants					
Treatment delay > 60 days					0.007
No	150	98	260	92	
Yes	3	2	24	8	
Number of examined lymph nodes					0.610
≥ 10	129	84	234	82	
< 10	24	16	50	18	
Hormone receptor testing					< 0.001
Yes	100	65	112	39	
No	53	35	172	61	
Biologic factors					
Age group (years)					0.057
40-69	93	61	204	72	
< 40	25	16	36	13	
≥ 70	35	23	44	15	
Tumor stage ***					< 0.001
I	43	29	31	11	
II	67	45	146	52	
III	34	23	90	32	
IV	5	3	12	5	
Histologic type					0.255
Ductal	132	86	233	82	
Other	21	14	51	18	
Menopause (proxy)					0.212
Post	104	68	176	62	
Pre	49	32	108	38	
Therapeutic interventions					
Type of surgery					0.022
Conservative	63	41	86	30	
Radical	90	59	198	70	
Chemotherapy					0.419
Yes	105	69	184	65	
No	48	31	100	35	
Radiation therapy					0.009
Yes	111	73	236	83	
No	42	27	48	17	
Hormone therapy					0.346
Yes	107	70	186	65	
No	46	30	98	35	
Outcome					
Deaths due to breast neoplasms					0.028
Yes	22	14	66	23	
No	131	86	218	77	
Recurrence of breast neoplasm **					0.375
Yes	14	9	33	12	
No	136	89	238	84	

* Chi-square test (or Fisher's exact test when indicated); significant if $p < 0.05$;

** The sum is lower due to lack of data on race/skin color: 4 in private health care services and 10 in public health care services;

*** The sum is lower due to lack of data on disease stage: 4 in private health care services and 4 in public health care services.

Table 2

Crude measures of association and coefficients of the simple Cox model variables for the 414 women included in the breast cancer hospital-based cohort, Juiz de Fora Regional Health Catchment Area, Minas Gerais State, Brazil, diagnosed between 1998 and 2000.

Variables	Crude HR (95%CI)	Coefficient	p-value *
Distal social determinants			
Race/Skin color			
White	1.00		
Non-white	1.52 (0,96-2.40)	0.415	0.077
Nature of the health service			
Private	1.00		
Public	1.86 (1.14-3.04)	0.621	0.013
Intermediate social determinants			
Treatment delay > 60 days			
No	1.00		
Yes	1.57 (0.76-3.26)	0.453	0.222
Number of examines lymph nodes			
≥ 10	1.00		
< 10	1.27 (0.74-2.19)	0.242	0.383
Hormone receptor testing			
Yes	1.00		
No	1.26 (0.82-1.93)	0.232	0.286
Biologic factors			
Age group (years)			
40-69	1.00		
< 40	1.49 (0.86-2.56)	0.396	0.155
≥ 70	1.19 (0.68-2.08)	0.172	0.544
Tumor stage			
I	1.00		
II	5.73 (1.37-23.92)	1.746	0.017
III	18.02 (4.37-74.31)	2.892	< 0.001
IV	23.81 (4.94-114.70)	3.170	< 0.001
Histologic type			
Ductal	1.00		
Other	1.49 (0.88-2.50)	0.397	0.134
Menopause (proxy)			
Post	1.00		
Pre	1.00 (0.65-1.55)	0.001	0.995
Therapeutic interventions			
Type of surgery			
Conservative	1.00		
Radical	2.35 (1.38-4.00)	0.855	0.001
Chemotherapy			
Yes	1.00		
No	0.52 (0.31-0.87)	-0.657	0.013
Radiation therapy			
Yes	1.00		
No	0.71 (0.39-1.28)	-0.343	0.255
Hormone therapy			
Yes	1.00		
No	1.26 (0.82-1.94)	0.229	0.301

95%CI: 95% confidence interval; HR: hazard ratios.

* Wald test, statistically significant if $p < 0.05$.

Table 3

Adjusted association measures of the multiple Cox model distal social variables for the 414 women included in the breast cancer hospital-based cohort, Juiz de Fora Regional Health Catchment Area, Minas Gerais State, Brazil, diagnosed between 1998 and 2000.

Variables	Model 1 HR (95%CI)	Model 2 HR (95%CI)	Model 3 HR (95%CI)
Distal social determinants			
Nature of the health service			
Private	1.00	1.00	1.00
Public	1.80 * (1.10-2.94)	1.44 (0.87-2.37)	1.48 (0.89-2.45)
Race/Skin color			
White	1.00	-	-
Non-white	1.42 (0.89-2.26)	-	-

95%CI: 95% confidence interval; HR: hazard ratios.

* Wald test, statistically significant if $p < 0.05$.

Model 1: adjusted for age; corrected R2 = 2.3%; Likelihood ratio test (LR test) = 8.87; $p = 0.031$; Model 2: adjusted for age, stage and histologic type; corrected R2 = 14.1%; LR test = 56.84; $p < 0.001$; Model 3: adjusted for age, stage, type of surgery, chemotherapy and hormone therapy; corrected R2 = 15.4%; LR test = 62.58; $p < 0.001$.

Among the social variables, only race/skin color, and nature of the health care service were selected for the multiple models. In model 1, with only the distal social determinants, the nature of the service was only significantly associated with survival (HR = 1.80; 95%CI: 1.10-2.94). The addition of the biological variables in model 2 caused a 45% decrease in its HR, due, mainly, to the variable staging of the disease, as it was the only variable significantly associated with survival in this model. In model 3, the inclusion of the variable therapeutic interventions practically did not change the HR of the variable nature of the health service.

In the survival curves stratified by the covariables, the risk seems to be proportional throughout the time of follow-up. In the analysis of Schoenfeld residuals, the global linear correlation tests and the correlation tests of each variable of the multiple models were not significant, indicating that the risks were proportional. The charts of these residuals over time also did not show violation of the proportional hazard assumption. Few outlier values were observed in the analysis of the final model residuals, as some women had less survival time than expected by the model, but none influenced the model's estimation.

Discussion

In this study, breast-cancer specific survival in five years was 76.3% (95%CI: 71.9-81.0), and prognosis was worse for women seen in public health services compared to those who received care in private services (HR = 1.80; 95%CI: 1.10-2.94). The main determinant of this relation was the staging of the disease, whereas therapeutic interventions did not have an intervening role. After adjustment for staging, there was no significant association between the nature of the health service and survival; therefore, there was no significant direct effect. Women seen at the public health care services were more often non-whites, and had their disease diagnosed at more advanced stages.

Care provided by private health care services was considered a proxy of individual socioeconomic status, as, in Brazil, the use of private care services and private health plans/insurance are associated with the number of one's assets, school education and having a formal job [21]. Studies in the United States have shown shorter survival time of women who use Medicaid (public health system for people under the poverty line), compared to those who have private health insurance [15,22]. Studies conducted in Brazil and other Latin American countries found a positive association between socioeconomic status of the patient and breast cancer survival [6,23,24]. In the USA, this association was also evidenced in both cohort studies [25,26] and clinical trials [27]. Major studies conducted in European countries, some with national registries of the entire population, have also shown better prognosis for breast cancer in women with higher socioeconomic status [28,29,30]. Finally, such association is also found in

countries with lower development levels [31,32,33]. In some of these studies, the association between socioeconomic status and survival disappeared after staging adjustment, while in other it remained significant, with some reduction in the measure of association, which shows that the staging of the disease is the main variable in this relation. In addition to staging, a number of studies identified, as influencing factors of the relation between socioeconomic status and survival, the access to health services for screening, diagnosis and treatment, and, in a smaller proportion, the histologic type and grade, biomarkers such as hormone receptors, and the overall health status of the patient in relation to the presence of morbid conditions [16]. The social status of the area of residence is also identified, with its effect mediated mainly by the patient having or not having private health insurance [22]. In most studies carried out in the United States, socioeconomic status and race/skin color had independent effects in breast cancer survival [34].

Characteristics related to health services, like the number of patients treated with chemotherapy over a given period of time, the type of facility (High-Complexity Center for Oncology – CACON vs. standalone clinics), and the nature of the facility (public, private or non-for-profit) can also influence breast cancer survival. Among the health care facilities accredited by the Brazilian Unified National Health System (SUS) in Rio de Janeiro to provide cancer treatment, between the years of 1999 and 2002 a lower risk of death due to the disease was observed in women seen in reference centers that provided a higher volume of care, and in women whose health services were covered by a private health plan [14].

It has been determined that women with breast cancer who do not have a private health plan are diagnosed at a later stage of the disease and die earlier, compared to women with the disease who have such plans [14,15]. Therefore, one sees that the potential reasons for such discrepancies include factors that relate to late diagnosis and quality of treatment.

In the past, the number of dissected lymph nodes was also associated with breast cancer survival and is a good marker of the diagnostic investigation, as it is more likely to identify micrometastatic disease leading to an indication for adjuvant therapy [35].

The identification of social determinants in the prognosis of chronic diseases tend to be hampered in the studies by improper setting of regression models due to the lack of a previous conceptual model, and by not respecting the factors hierarchy or causative pathways [36]. Therefore, all exposure variables are simultaneously addressed in the analysis, and biological or therapeutic variables are used for the control of confounders whereas, in fact, they could mediate the relation between the more distal determinants and prognosis. Over the past few years, more and more studies start off from the previous conceptual model and develop hierarchical analysis models in their investigation about this and other health problems, thus taking into account not only the possibility of confounding, but also of mediation [26].

The race/skin color variable was not significantly associated with survival, partially because it is difficult to accurately characterize this variable, due to the significant racial diversity of Brazil, and from the subjective and visual characterization of this variable by more than one examiner in different health facilities, which might have led to misclassification. Even though race/skin color is not a valid category as a biologic concept for humans, it is still an important social concept due to the existence of health iniquities related to this variable to date [37]. Survival studies conducted in Brazil have had inconsistent results about the race/skin color and breast cancer survival relation. This association was not found in a hospital-based cohort in São Paulo with 430 women diagnosed in 1999/2000 [38]; on the other hand, a study made with 30,293 women with breast cancer diagnosed between 2003 and 2008, and identified in a population-based cancer registry in the city of São Paulo showed significant association between black race/ethnicity and shorter survival [39]; another historic cohort study conducted in Florianópolis with 1,002 women diagnosed between 2000 and 2002 showed an association between Caucasian race/white skin color and longer survival which remained after school-education adjustment, but not after staging adjustment [23]. Many studies conducted in the USA also showed an association between race/skin color and better prognosis, a number of them even after being adjusted for socioeconomic status and staging [34,40,41,42]. In Europe, studies that consider socioeconomic status are more frequent than those that investigate race/skin color as determinants of diseases, but Jack et al. [43] found shorter survival in black women, even after adjustment for other medical and social variables.

The number of examined lymph nodes, with more than 80% presenting the expected values, and with no differences between public and private services, shows similar quality in the care delivered in both sectors at the time, which was good. This variable was not associated with prognosis in this study population. Its importance lies in the fact that an incomplete diagnostic inves-

tigation makes early diagnosis and the proper characterization of the seriousness of the disease more difficult, which may hamper the indication of adjuvant therapy and therefore affecting survival with the disease [17,35]. Mention should be made that the use of the number of dissected nodes as a marker of diagnostic investigation was adequate for the study population, as the sentinel lymph node technique had not been adopted in that region in the period the cases were recruited, which can be ascertained from the medical records.

Even though in the public sector the proportion of women who were not tested for hormone receptors was significantly higher, this did not affect the prognosis of these patients, probably because the indication of hormone therapy was high in both groups, without being related to the hormone receptor test result. A study published in 2005 found better prognosis for women who underwent hormone therapy [10].

Despite the fact that women seen at public services have more often been submitted to radical surgery and radiation therapy, this might be due to the fact that their proportion of being diagnosed at a more advanced stage was higher. In our study, radiation therapy was not significantly associated with prognosis, and was indicated for almost 80% of the patients. Studies, however, have shown that lack of radiation therapy is associated with shortened survival with the disease [11].

In the public services, the proportion of delays in commencing treatment was higher, but this was not associated with worse prognosis because the number of cases was relatively small (3 patients in private services and 24 in public services). Studies have shown that delays in the commencement of treatment may lead to shorter survival with the disease [12,13].

Conclusion

In this study, the socioeconomic status of the patient, which is related to the nature of the services used, whether public or private, was significantly associated with breast cancer survival, and the main variable that influenced this relation was the staging of the disease. The worse prognosis for women seen in public services is related to diagnosis being made at a more advanced stage of the disease, probably with more cases being identified clinically than by screening. These findings point to the existence of social inequalities and discrepancies in the primary and secondary breast cancer prevention in the area under investigation, with higher probability of patients who use the public health service, the higher proportion of the population, to be worse off. These results are similar throughout Brazil regarding breast cancer prevention and management [44].

The results presented here reinforce the importance of working with information provided by health care services, which, despite limitations typical of secondary data, expand the knowledge about disease management practices by identifying the main problems to be tackled. Of note is the innovative methodological approach this investigation used. As far as we know, the social determinants of breast cancer survival have not yet been the main focus of survival analysis in Brazilian cohorts.

Finally, it should be mentioned that the services network of the SUS, which is in charge of care provision to a high proportion of the population, needs to be more resolutive, and overcome the hurdles that bar a number of women with breast cancer from benefitting of the therapeutic advances currently available. The challenges are tremendous, and demand a great effort of health officials, practitioners of the different levels of care, and the organized society in the development and management of a cancer control policy that ensures equity of access to information, screening, diagnosis and treatment.

Resumen

Algunos estudios muestran desigualdades sociales en la incidencia y la supervivencia del cáncer de mama, lo que se ha estudiado poco en Brasil. Para evaluar la inequidad en el pronóstico del cáncer de mama, se realizó un estudio de cohorte de base hospitalaria. El seguimiento de los pacientes se llevó a cabo por medio de una búsqueda activa en los registros médicos y en el Sistema Nacional de Mortalidad brasileño; llamadas de teléfono y búsqueda de números de identificación nacionales. Las funciones de supervivencia fueron estimadas por el método de Kaplan-Meier y el modelo de riesgos proporcionales de Cox se utilizó para la evaluación pronóstica. La supervivencia específica del cáncer de mama en cinco años fue de un 76,3% (IC95%: 71,9-81,0). Las mujeres que recibieron asistencia en los servicios públicos tenían peor pronóstico (HR = 1,79; IC95%: 1,09-2,94), y este efecto fue medido principalmente por el estadio de la enfermedad más avanzada en el momento del diagnóstico. Estos resultados apuntan a la existencia de desigualdades en el acceso a las acciones de detección del cáncer de mama.

Neoplasias de la Mama; Pronóstico; Análisis de Supervivencia; Equidad

Contributors

M. R. Guerra and M. C. Nogueira participated with the idea, data analysis and interpretation, writing of the article, and approval of the final version. G. Azevedo e Silva collaborated with the idea, data analysis and interpretation, critical and relevant review of the intellectual content, and approval of the final version. I. C. G. Leite and J. R. D. Cintra contributed with the idea, writing of the article, and approval of the final version. R. V. C. Oliveira and M. T. Bustamente-Teixeira participated with the idea, data interpretation, writing of the article, approval of the final version.

References

1. Ferlay J, Shin HR, Bray F, Forman D, Mathers C, Parkin DM. Estimates of worldwide burden of cancer in 2008: GLOBOCAN 2008. Int J Cancer 2010; 127:2893-917.
2. Instituto Nacional de Câncer. Câncer no Brasil: dados dos registros de base populacional. v. 4. Rio de Janeiro: Instituto Nacional de Câncer; 2010.
3. Freitas-Junior R, Gonzaga CMR, Freitas NMA, Martins E, Dardes RCM. Disparities in female breast cancer mortality rates in Brazil between 1980 and 2009. Clinics 2012; 67:731-7.
4. Sant M, Allemani C, Capocaccia R, Hakulinen T, Aareleid T, Coebergh JW, et al. Stage at diagnosis is a key explanation of differences in breast cancer survival across Europe. Int J Cancer 2003; 106:416-22.
5. Siegel R, Naishadham D, Jemal A. Cancer statistics, 2012. CA Cancer J Clin 2012; 62:10-29.

6. Mendonça GAS, Silva AM, Caula WM. Características tumorais e sobrevida de cinco anos em pacientes com câncer de mama admitidas no Instituto Nacional de Câncer, Rio de Janeiro, Brasil. Cad Saúde Pública 2004; 20:1232-9.
7. Kim KJ, Huh SJ, Yang JH, Park W, Nam SJ, Kim JH, et al. Treatment results and prognostic factors of early breast cancer treated with a breast conserving operation and radiotherapy. J Clin Oncol 2005; 35:126-33.
8. Guerra MR, Mendonça GAS, Bustamante-Teixeira MT, Cintra JRD, Carvalho LM, Magalhães LMPV. Sobrevida de cinco anos e fatores prognósticos em coorte de pacientes com câncer de mama assistidas em Juiz de Fora, Minas Gerais, Brasil. Cad Saúde Pública 2009; 25:2455-66.
9 Anderson WF, Jatoi I, Devesa SS. Distinct breast cancer incidence and prognostic patterns in the NCI's SEER program: suggesting a possible link between etiology and outcome. Breast Cancer Res Treat 2005; 90:127-37.
10. Panades M, Olivotto IA, Speers CH, Shenkier T, Olivotto TA, Weir L, et al. Evolving treatment strategies for inflammatory breast cancer: a population-based survival analysis. J Clin Oncol 2005; 23:1941-50.
11. Hooning MJ, Aleman BM, van Rosmalen AJ, Kuenen MA, Klijn JG, van Leeuwen FE. Cause-specific mortality in long-term survivors of breast cancer: a 25-year follow-up study. Int J Radiat Oncol Biol Phys 2006; 64:1081-91.
12. Hebert-Croteau N, Freeman CR, Latreille J, Rivard M, Brisson J. A population-based study of the impact of delaying radiotherapy after conservative surgery for breast cancer. Breast Cancer Res Treat 2004; 88:187-96.
13. Lohrisch C, Paltiel C, Gelmon K, Speers C, Taylor S, Barnett J, et al. Impact on survival of time from definitive surgery to initiation of adjuvant chemotherapy for early-stage breast cancer. J Clin Oncol 2006; 24:4888-94.
14. Brito C, Portela MC, Vasconcellos MTL. Sobrevida de mulheres tratadas por câncer de mama no estado do Rio de Janeiro. Rev Saúde Pública 2009; 43:481-9.
15. Ward E, Halpern M, Schrag N, Cokkinides V, De Santis C, Bandi P, et al. Association of insurance with cancer care utilization and outcomes. CA Cancer J Clin 2008; 58:9-31.
16. Woods LM, Rachet B, Coleman MP. Origins of socio-economic inequalities in cancer survival: a review. Ann Oncol 2006; 17: 5-19.
17. Eaker S, Dickman PW, Hellstrom V, Zack MM, Ahlgren J, Holmberg L. Regional differences in breast cancer survival despite common guidelines. Cancer Epidemiol Biomarkers Prev 2005; 14:2914-8.
18. Fisch T, Pury P, Probst N, Bordoni A, Bouchardy C, Frick H, et al. Variation in survival after diagnosis of breast cancer in Switzerland. Ann Oncol 2005; 16:1882-8.
19. Carvalho MS, Andreozzi VL, Codeço CT, Campos DP, Barbosa MTS, Shimakura SE. Análise de sobrevivência: teoria e aplicações em saúde. 2ª Ed. Rio de Janeiro: Editora Fiocruz; 2011.
20. Szklo M, Javier Nieto F. Identifying noncausal associations: confounding. In: Szklo M, Javier Nieto F, editors. Epidemiology: beyond the basics. 3rd Ed. Burlington: Jones and Bartlett Learning; 2014. p. 153-84.
21. Viacava F, Souza-Júnior PRB, Szwarcwald CL. Coverage of the Brazilian population 18 years and older by private health plans: an analysis of data from the World Health Survey. Cad Saúde Pública 2005; 21 Suppl 1:S119-28.
22. Gorey KM, Luginaah IN, Holowaty E, Zou G, Hamm C. Mediation of the effects of living in extremely poor neighborhoods by health insurance: breast cancer care and survival in California, 1996 to 2001. Int J Equity Health 2013; 12:6.
23. Schneider IJC, d'Orsi E. Sobrevida em cinco anos e fatores prognósticos em mulheres com câncer de mama em Santa Catarina, Brasil. Cad Saúde Pública 2009; 25:1285-96.
24. Piñeros M, Sánchez R, Perry F, García OA, Ocampo R, Cendales R. Delay for diagnosis and treatment of breast cancer in Bogotá, Colombia. Salud Pública Méx 2011; 53:478-85.
25. Bradley CJ, Given CW, Roberts C. Race, socioeconomic status, and breast cancer treatment and survival. J Natl Cancer Inst 2002; 94:490-6.
26. Pudrovska T, Anikputa B. The role of early-life socioeconomic status in breast cancer incidence and mortality: unraveling life course mechanisms. J Aging Health 2012; 24:323-44.
27. Herndon 2nd JE, Kornblith AB, Holland JC, Paskett ED. Effect of socioeconomic status as measured by education level on survival in breast cancer clinical trials. Psychooncology 2013; 22:315-23.
28. Eaker S, Halmin M, Bellocco R, Bergkvist L, Ahlgren J, Holmberg L, et al. Social differences in breast cancer survival in relation to patient management within a National Health Care System (Sweden). Int J Cancer 2009; 124:180-7.
29. Beiki O, Hall P, Ekbom A, Moradi T. Breast cancer incidence and case fatality among 4.7 million women in relation to social and ethnic background: a population-based cohort study. Breast Cancer Res 2012; 14:R5.
30. McKenzie F, Ives A, Jeffreys M. Socio-economic inequalities in survival from screen-detected breast cancer in South West England: population-based cohort study. Eur J Public Health 2012; 22:418-22.
31. Ali R, Mathew A, Rajan B. Effects of socio-economic and demographic factors in delayed reporting and late-stage presentation among patients with breast cancer in a major cancer hospital in South India. Asian Pac J Cancer Prev 2008; 9:703-7.
32. Rezaianzadeh A, Peacock J, Reidpath D, Talei A, Hosseini SV, Mehrabani D. Survival analysis of 1148 women diagnosed with breast cancer in Southern Iran. BMC Cancer 2009; 9:168.
33. Lan NH, Laohasiriwong W, Stewart JF. Survival probability and prognostic factors for breast cancer patients in Vietnam. Glob Health Action 2013; 6:1-9.

34. Newman LA, Griffith KA, Jatoi I, Simon MS, Crowe JP, Colditz GA. Meta-analysis of survival in African American and white American patients with breast cancer: ethnicity compared with socioeconomic status. J Clin Oncol 2006; 24:1342-9.
35. Moraes AB, Zanini RR, Turchiello MS, Riboldi J, Medeiros LR. Estudo da sobrevida de pacientes com câncer de mama atendidas no hospital da Universidade Federal de Santa Maria, Rio Grande do Sul, Brasil. Cad Saúde Pública 2006; 22:2219-28.
36. Victora CG, Huttly S, Fuchs SC, Olinto MT. The role of conceptual frameworks in epidemiological analysis: a hierarchical approach. Int J Epidemiol 1997; 26:224-7.
37. Travassos C, Williams DR. The concept and measurement of race and their relationship to public health: a review focused on Brazil and the United States. Cad Saúde Pública 2004; 20:660-78.
38. Queiroz EA. Impacto prognóstico e criação de um escore específico para avaliação de comorbidades em mulheres com câncer de mama [Tese de Doutorado]. São Paulo: Fundação Antônio Prudente; 2008.
39. Silveira DP. Perfil da incidência e da sobrevida de câncer de mama: análise a partir dos registros de câncer de base populacional e cobertura de planos privados de saúde no município de São Paulo [Tese de Doutorado]. Rio de Janeiro: Escola Nacional de Saúde Pública Sergio Arouca, Fundação Oswaldo Cruz; 2011.
40. Albain KS, Unger JM, Crowley JJ, Coltman Jr. CA, Hershman DL. Racial disparities in cancer survival among randomized clinical trials patients of the Southwest Oncology Group. J Natl Cancer Inst 2009; 101:984-92.
41. Markossian TW, Hines RB. Disparities in late stage diagnosis, treatment, and breast cancer-related death by race, age, and rural residence among women in Georgia. Women Health 2012; 52:317-35.
42. Silber JH, Rosenbaum PR, Clark AS, Giantonio BJ, Ross RN, Teng Y, et al. Characteristics associated with differences in survival among black and white women with breast cancer. JAMA 2013; 310:389-97.
43. Jack RH, Davies EA, Møller H. Breast cancer incidence, stage, treatment and survival in ethnic groups in South East England. Br J Cancer 2009; 100:545-50.
44. Lee BL, Liedke PE, Barrios CH, Simon SD, Finkelstein DM, Goss PE. Breast cancer in Brazil: present status and future goals. Lancet Oncol 2012; 13:e95-102.

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