Impact of Sociodemographic Factors on the Time to Initiate Breast Cancer Treatment at a High-Complexity Hospital in Porto Alegre, Brazil

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Abstract

Introduction Time between cancer diagnosis and the start of treatment is crucial for patient prognosis. In the Brazilian public health system, this interval varies significantly. Access to timely care is shaped by multiple interconnected factors, including service organization, diagnostic processes, and follow-up care. Social aspects, such as ethnicity, level of schooling, and knowledge of disease symptoms, also influence these outcomes.

Objective To identify the association between the level of schooling and delays in the initiation of oncological treatment.

Materials and Methods A cross-sectional study was conducted evaluating all female patients with breast tumor registered in the Cancer Registry of Hospital de Clínicas de Porto Alegre, between January 2022 and December 2023. Data collection of the sample was made through electronic medical record review and telephone questionnaires. Descriptive, univariable, and multivariable analyses were performed to assess factors associated with the prevalence of delayed treatment initiation.

Results A total of 307 participants had their data collected between June 1st, 2023, and February 1st, 2024. In the multivariable analysis, initiation of treatment $>$ 60 days after diagnosis was significantly associated with lower level of schooling, with an estimated relative risk of 1.48 (95%CI = 1.064–2.062). *Pardo* ethnicity, which refers to mixed-race individuals, was correlated with a longer time to treatment when compared to white patients (relative risk [RR] = 1.63; 95%CI = 1.038–2.579).

Conclusion The current cross-sectional study shows that the level of schooling significantly influenced time to oncological treatment, as confirmed by multivariable analysis as well as self-reported mixed-race ethnicity. Although most participants began treatment within 60 days, the interval between cancer suspicion and diagnosis exceeded the period established by law.

Keywords
- breast neoplasms
- breast cancer
- time to treatment
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- door-to-treatment

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Introduction

Breast cancer (BC) is the most common neoplasm among women in Brazil and worldwide, excluding non-melanoma skin cancer.[1] According to data from the Brazilian National Cancer Institute (Instituto Nacional de Câncer-INCA), 73.610 new cases of BC were estimated in 2023, representing 30% of new cases in women.[1] The increase in incidence of this disease is not only due to longer life expectancy, but also to technologic advances in diagnosis and screening programs.[2] In addition to its impact on health, BC diagnosis brings economic consequences, specially those arising from work absences.[3]

It is essential to offer BC treatment in an adequate time since delays may decrease the chance of cure. A later diagnosis, with a more advanced disease, hinders the use of less aggressive treatments as less invasive axilla and breast surgeries, which may negatively impact patients' quality of life.[4] In the Brazilian Unified Health System (Sistema Único de Saúde, SUS), access to BC specialists is one of the first barriers found by patients to initiate treatment. The time considered ideal for patients to begin oncological treatment is variable in the literature.[5] In Brazil, this period must not exceed 60 days from the biopsy-confirmed BC diagnosis. This time interval was established by the law no. 12.732, known as the "60-Day Law", created to optimize patient pathways to oncological treatment within the SUS.[6] Despite being created in 2012, for several reasons, most Brazilian health institutes struggle to follow it.[7]

Time to first consultation in specialized BC centers depends on several factors including the country region, proximity to cities with healthcare services,[8] and more importantly, the patients' sociodemographic characteristics, such as ethnicity, level of schooling, and age.[9] Retrospective studies have shown that patients older than 50 years of age, nonwhite, and those with less than 8 years of schooling are the most vulnerable to delays in BC treatment.[10]

Identifying factors associated with starting oncological treatment after 60 days is essential to develop public policies towards most vulnerable patients. These actions could reduce barriers that prevent patients from having timely diagnosis and treatment. Therefore, the primary objective of this study was to assess whether low level of schooling is associated with the initiation of oncological treatment after 60 days.

Materials and Methods

This was a cross-sectional study including all female patients with BC between 2022 and 2023 registered in the Cancer Registry (CR) of Hospital de Clínicas de Porto Alegre (HCPA). All study participants received care through the SUS. Inclusion criteria required a histopathological diagnosis of invasive BC, with the first treatment occurring at HCPA in 2022 and 2023. Recurrence cases where the initial tumor was treated before 2022 and patients who did not receive antineoplastic treatment were excluded.

A sample size of 178 subjects was calculated based on retrospective data,[9] with an additional 10% to account for potential losses and refusals, aiming to reach 198 subjects. Statistical power was set as 80%, with a 5% significance level.[11] Although the sample size calculation indicated 178 participants, it was determined that all cases from the years 2022 and 2023 would be included to obtain a larger sample, allowing for a better exploration of the effects of sociodemographic characteristics.

The project was approved by the HCPA Ethics in Research Committee under registration number 71160423.7.0000. 5327 (CAAE). The study followed current guidelines and regulations on research involving human subjects, respecting bioethical principles such as autonomy and non-maleficence.

After identifying eligible patients, phone contact was made to invite them to participate in the study. Upon agreement, the informed consent form was read via phone and a questionnaire regarding sociodemographic characteristics and the patient's journey before the first consultation at HCPA was conducted. Additionally, an individual review of electronic medical records was performed.

The telephonic questionnaire was applied to all participants that answered the phone call from the research team. The questionnaire included questions regarding the date of suspicion and confirmation of BC as well as information related to family structure, ethnicity, marital status, and whether the participant had a paid employment at the time of diagnosis. The collected data was used exclusively for the analyses in this study, with precautions to minimize risks related to confidentiality as provided for in Resolution No. 466/2012 of the Brazilian National Health Council (Conselho Nacional de Saúde CNS). Prediagnosis data was obtained from the Health Department of the State of Rio Grande do Sul. Deceased participants, or those who did not answer the telephone call, as determined by the ethics committee, had their data obtained exclusively from electronic medical records.

Quantitative variables were described based on measures of central tendency and dispersion. Qualitative variables were described according to frequency and proportion. The variable *time to first treatment* was obtained from medical records or through direct contact with the patient. Considering the 60-day law, time to first treatment was dichotomized into "$\leq$ 60 days" or "$>$ 60 days" in order to establish associations with other variables. Prevalence ratio (PR), CIs, and significance values (*p*-values) were calculated to verify the relationship between time to treatment and variables of interest. Relative risk (RR) was estimated through the PR.

Univariate analyses were performed to correlate the time to first oncologic treatment with the participants' sociodemographic variables. Multivariable analysis was conducted using Poisson logistic regression, which is the most appropriate mathematical method for cross-sectional studies.[12] In this model, variables were included if they modified the time to oncologic treatment by more than 10% and had an adequate number of participants.

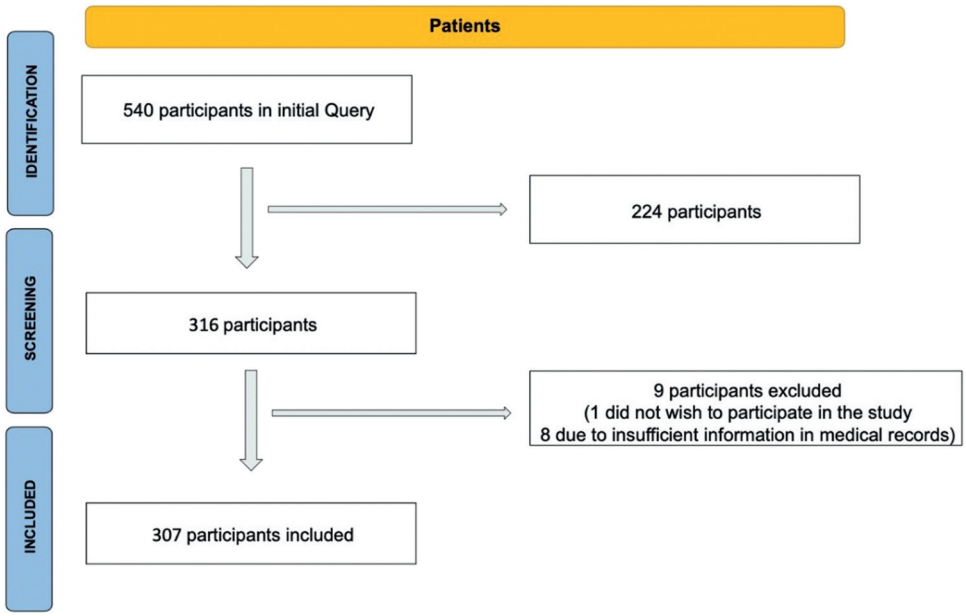

Fig. 1 Inclusion of participants.

Results

During the established period, 540 new patients were treated for BC at HCPA. Of these, 307 met the inclusion criteria and were included in the analysis (►**Fig. 1**). Among the 307 study participants, 170 (55.37%) responded to the phone contact while the remaining participants had their information gathered exclusively through review of electronic medical records. Telephone calls were made from June 1st, 2023, until February 1st, 2024.

Prediagnosis data were available from 284 participants (92.25%) and were collected through the electronic system responsible for municipal consultation scheduling (GERCON). The median age was 63 (27–91) years; 20.20% of the patients were $\leq$ 49, 50.49% were 50 to 70, and 29.31% were $>$ 70-years-old, with one missing value (0.32%).

Self-reported skin color was white in 80.46%, black in 10.75%, and *pardo* (mixed-race) in 8.47% of the participants, with one missing entry (0.32%). The data were collected by phone for 170 participants and from electronic records for the rest.

Regarding the level of schooling, 4.25% of the participants were illiterate, 38.23% had incomplete primary education, 13.73% had completed primary education, 5.23% had incomplete secondary education, 28.10% had completed secondary education, and 10.46% had higher education (►**Table 1**).

The median time to initiate oncologic treatment, measured from the date of the anatomopathological (AP) examination result, was 47 (0–211) days. Furthermore, 90 participants (29.9%) exceeded 60 days to start their treatment.

To identify how the level of schooling influences the time to first treatment, a Poisson log-linear model with robust variance for multivariable analysis was used.[12] In this model, patients were divided into two groups according to their level

Table 1 Clinical and sociodemographic characteristics of the participants

Characteristic	n (%)
Age (median)	**63 years**
Skin color/Ethnicity	
White	247 (80.46)
Pardo	26 (8.47)
Black	33 (10.75)
Not identified	1 (0.32)
Level of Schooling*	
Illiterate	13 (4.25)
Incomplete primary education	117 (38.23)
Complete primary education	42 (13.73)
Incomplete secondary education	16 (5.23)
Complete secondary education	86 (28.10)
Higher education	32 (10.46)
City of origin	
Porto Alegre (capital)	115 (37.79)
Other cities in the state of Rio Grande do Sul	192 (62.21)
Tumor subtype**	
Luminal A	71 (23.36)
Luminal B	136 (44.74)
Luminal-HER2	45 (14.80)
Triple-negative	38 (12.5)
HER-2+	14 (4.6)
Clinical staging***	
I	84 (27.72)
II	126 (41.58)
III	64 (21.12)
IV	29 (9.6)
Site of diagnosis*	
Hospital de Clínicas de Porto Alegre	231 (75)
Other	75 (25)

Notes: *Missing data from one patient; **missing data from three patients; ***missing data from four patients.

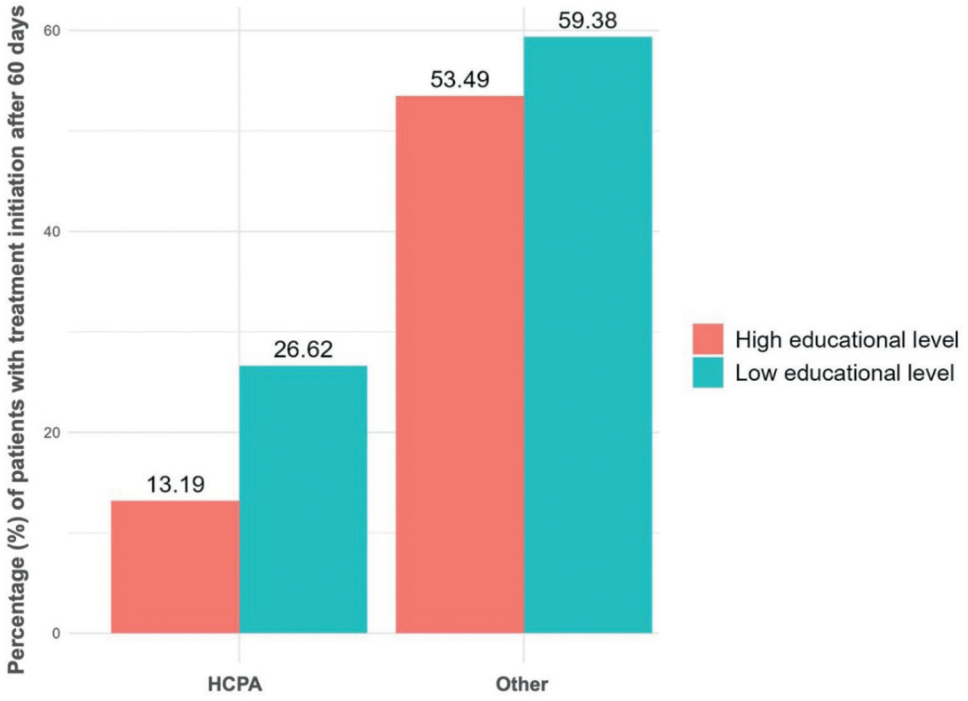

Fig. 2 Multivariable analyses regarding site of diagnostic biopsy and level of schooling.

of schooling. The first consisted of participants with lower level of schooling (illiterate or with incomplete/complete primary education), totaling 172 participants (56%); the second group consisted of participants with higher level of schooling (incomplete/complete secondary education or higher education), totaling 135 participants (44%). Based on this dichotomized level of schooling, an estimated RR of 1.24 (95% CI = 0.872–1.781) was identified for starting treatment after 60 days in the lower schooling group.

The multivariable model included all variables that modified the association effect by 10% or more. Among the variables tested, "biopsy location" was the only that met that criterion. Therefore, in this analysis model, *level of schooling* and *biopsy location* were included. We found that lower level of schooling led to a statistically significant 48% increased risk (RR = 1.48; 95%CI: 1.064–2.062) of delayed initiation of oncologic treatment beyond 60 days compared to participants with higher levels of schooling (►**Fig. 2**).

As a secondary objective, univariable analyses were made evaluating the characteristics of participants that initiated their treatment within or after the established 60-days period (►**Table 2**). Participants self-identified as *pardo* had a statistically higher risk of starting their treatment after 60 days compared to other participants, with a RR of 1.63 (95%CI = 1.038–2.579). The median time to treatment initiation was 58 days for the *pardo* group compared to 43 days for white participants. Black participants showed no significant differences when compared to white participants.

There was a significantly higher risk of delayed treatment among those who underwent biopsy outside of HCPA compared to those who had the procedure performed within the institution, with a RR of 2.64 (95%CI = 1.918–3.633). Age, ethnicity, clinical stage, city of origin, modality of first oncological treatment, and having a relationship at the time of diagnosis did not show significant differences.

Regarding the modality of the first oncologic treatment, 168 participants started with surgery, with a median time of 44 days from diagnosis. In contrast, 101 participants began with chemotherapy with a median time of 51 days. For the subgroup of 32 participants who started with hormone therapy, the median time was 31.5 days. Finally, 5 patients started treatment with radiotherapy and data from 1 patient could not be obtained.

Because the referral time to the first cancer specialist consultation after diagnosis made at the primary health care level can be long, a sensitivity analysis was conducted including 231 participants (75%) that underwent their tumor biopsy at HCPA. Of these, 79.2% (n = 183) had their treatment begun within 60 days from diagnosis, with a median time of 42 days and mean of 45.7 (0–150) days. The influence of sociodemographic factors in this sample was also evaluated, and lower level of schooling remained a risk factor for starting treatment after 60 days, with an RR of 2.019 (95 CI: 1.113–3.660).

The questionnaire applied to participants was analyzed to describe their prediagnostic pathway to care at HCPA (►**Fig. 3**). This analysis illustrates the steps participants, who were not yet diagnosed with BC at that time, followed to reach HCPA. The median time between noticing a breast lump and seeking care at a Primary Health Care Unit (Unidade Básica de Saúde, UBS) was 77 days. This median time was calculated based on the participants who reported detecting a lump before diagnosis (153 women). After the initial consultation at the UBS, a referral for specialized evaluation at HCPA is made. The waiting period for this referral is determined by the GERCON system, which

Table 2 Univariable analyses to identify factors associated with delayed start of treatment (> 60 days after diagnosis)

Parameter	Category	n (%)	Estimated relative risk	95%CI	*p*-value
Age (years)	≤ 49	64 (20.20)	1	–	–
	50–69	148 (50.49)	0.713	0.430–1.184	0.191
	≥ 70	94 (29.31)	0.968	0.634–1.477	0.879
Ethnicity	Other	280 (91.50)	1	–	–
	Pardo	26 (8.50)	1.636	1.038–2.579	0.034
Level of schooling	Low	172 (56.00)	1	–	–
	High	134 (44.00)	1.247	0.872–1.781	0.226
Site of initial biopsy	Hospital de Clínicas de Porto Alegre	231 (75.00)	1	–	–
	Other	75 (25.00)	2.640	1.918–3.633	< 0.001
Clinical stage at diagnosis	I	84 (27.7)	1	–	–
	II	126 (41.6)	1.167	0.768–1.773	0.471
	III	64 (21.1)	0.930	0.548–1.579	0.787
	IV	29 (9.6)	0.845	0.408–1.750	0.650

Note: For the level of schooling, patients were divided into two groups: low (illiterate or with incomplete/complete primary education) or high (incomplete/complete secondary education or higher education).

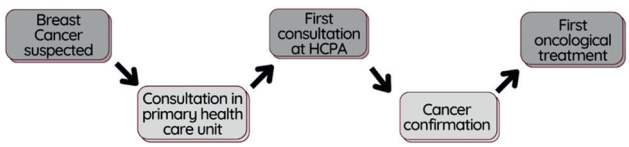

Fig. 3 Diagnostic pathway of participants.

organizes specialized consultation requests from primary care. Data from 278 participants were collected through the Rio Grande do Sul state health department. The median waiting time in GERCON was 17 (3–136) days. Therefore, the prediagnostic pathway to the first consultation at HCPA showed a median time of 94 days.

Although the 60-days law determines that the AP result is the necessary exam to initiate oncological treatment, it is well established that the immunohistochemistry (IHC) test is currently essential to determine the most appropriate first-line treatment modality for BC.[13] This test guides the indication to begin treatment with surgery or chemotherapy, for example.

In this sample, the median time for the IHC result was 16 (0–95) days from the date of the AP report. Among patients who underwent a biopsy at HCPA, this time was shorter, with a median of 7 (0–68) days.

Discussion

The treatment of early-stage BC is initially conducted through four main modalities: chemotherapy, surgery, hormone therapy or radiotherapy. The decision regarding the sequence of these treatments should be made within a multidisciplinary team involving specialists from different fields.[13] According to a meta-analysis, initiating treatment within 3 months of diagnosis results in a 7% absolute risk reduction in cancer-related mortality, compared to patients whose treatment was initiated after 3 to 6 months.[14]

Delays between diagnosis and surgery significantly affect survival.[5,15] A 30-day delay increases cancer-related mortality by 10%,[15] and surgeries performed > 90 days after diagnosis are associated with poorer survival compared to procedures within 30 days.[15,16] In our cohort, the median time to surgery was 44 days.

Regarding time to initiation of chemotherapy, studies have indicated that starting this therapy within 45 days of diagnosis improves survival outcomes.[17] In this sample, among the 101 patients who received chemotherapy as their first oncological treatment, the median time to treatment was 51 days.

Evidence on the time required to obtain a confirmed BC diagnosis remains limited. During the prediagnostic period, multiple barriers hinder timely access to diagnostic centers, resulting in delayed care. The diagnostic process typically begins when a woman detects a breast abnormality or has an abnormal screening mammogram and seeks evaluation at a primary health center. Under Brazilian Law No. 13,896/2019), when malignancy is suspected, diagnostic tests must be completed within 30 days.[18] In our sample, with a 54% rate of low schooling level patients, the median interval between symptom onset and the first specialized consultation at HCPA (where most biopsies occur) was 94 days, exceeding the legally mandated period by about 2 months. Contributing factors include limited knowledge of BC signs, suboptimal screening mammography coverage in Brazil, and restricted healthcare access.[19] Similar delays occur throughout Latin America, where low levels of schooling and limited healthcare availability disproportionately affect vulnerable populations.[20]

In the present study, both low level of schooling and *pardo* skin color had a significant impact in time to treatment initiation, leading to prolonged delays. This association remained significant even when analyzing only participants who received their diagnosis at HCPA indicating that social factors are determinants in the variable *time to treatment initiation* as previously described.[20] Thus, individuals with characteristics of social vulnerability should receive differentiated attention to ensure that care is provided within an appropriate timeframe. On the other hand, older age, distance from the cancer treatment center, and being single did not interfere in time to treatment, factors that have been described as related to late onset of oncological treatment.[20]

The long prediagnostic process also helps explain delays among patients whose diagnoses were confirmed outside HCPA. In this sample, 25% underwent biopsy before their UBS visit and thus already had a BC diagnosis at that consultation. Despite having a confirmed AP result, these patients must follow the same pathway as those without a diagnosis, including waiting for a UBS appointment and GERCON referral. Consequently, they face greater risk of delayed treatment initiation because, under the 60-day law, the countdown begins at diagnosis confirmation. Yet the SUS referral system does not prioritize these patients, which represents a weakness in the process.

Regarding the study's limitations, it is important to note that, as a cross-sectional study conducted at a single institution, caution should be taken when generalizing the reported findings, despite their alignment with the reviewed literature. While some variables showed an impact on the number of days to initiate oncological treatment, this difference did not reach statistical significance, which may reflect the limited sample size. Finally, it is worth emphasizing that, unlike studies based on cancer registry data from public institutions (which are often imprecise), the current study was conducted through an individual review of electronic medical records and, when possible, direct contact with the participants. This approach enhances the accuracy of the reported results.

The study was capable of identifying a large proportion of patients (70.01%) that began treatment within 60 days from diagnosis. When considering only those who underwent biopsy at HCPA, the percentage increased to 79.2%, which is significantly higher than the national average. Between 2016 and 2018, only 55.1% of BC patients in Brazil started treatment within 60 days.[9] This figure dropped to 45.5% in 2019, rising to 51.3% in 2020.[8] In the state of Piauí, for instance, only 28.4% of patients began treatment within the legally mandated period in 2018.[21]

This study identified the groups most vulnerable to treatment delays—patients with low level of schooling and *pardo* skin color—highlighting the need for individualized monitoring to reduce disparities. Implementing patient navigation programs may help address this inequity by guiding patients and families from the prediagnostic phase to treatment initiation. Law No. 14,758 incorporates this strategy into the National Cancer Prevention and Control Policy within the SUS, and evidence shows that patient navigators reduce both time to BC diagnosis[22] and time to treatment initiation.[23]

Conclusion

The treatment of BC is complex and depends on coordinated actions across healthcare services to ensure timely therapy. This study showed that low level of schooling is a significant risk factor for delayed treatment initiation, even among patients biopsied at the same institution where treatment began. Patients with *pardo* skin color were also associated with delays, although this finding requires further investigation due to the small sample size.

In relation to the 60-day law, identifying socially vulnerable groups is crucial to preventing treatment delays. The study also examined the prediagnostic period—an understudied topic in Brazilian guidelines—and found a median of 94 days from suspicion to diagnosis, exceeding the legally defined timeframe. Targeted government measures are needed, including the use of nurse navigators, which have proven effective in reducing time to treatment, and public educational initiatives to raise awareness of cancer warning signs and reduce prediagnostic delays.

Data Availability

Data will be available upon request to the corresponding author.

Authors' Contributions

PMC, AMZ, DDR: conceptualization, data curation, funding acquisition, investigation, writing-original draft and review and editing. PMC, GT, KLM, PLCF: project administration, formal analysis, validation. GT: sotware and resources.

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Conflict of Interests

The authors have no conflict of interests to declare.

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