

## Factors associated with time-to-treatment initiation of breast cancer

Rafael Tavares Jomar (<https://orcid.org/0000-0002-4101-7138>)<sup>1</sup>

Nathália Sodr  Velasco (<https://orcid.org/0000-0001-8608-8784>)<sup>2</sup>

Gelcio Luiz Quintella Mendes (<https://orcid.org/0000-0001-9564-0892>)<sup>1</sup>

Raphael Mendonça Guimarães (<https://orcid.org/0000-0003-1225-6719>)<sup>3</sup>

Vitor Augusto de Oliveira Fonseca (<https://orcid.org/0000-0001-7592-6180>)<sup>4</sup>

Karina Cardoso Meira (<https://orcid.org/0000-0002-1722-5703>)<sup>5</sup>

**Abstract** *The present retrospective study investigated factors associated with time-to-treatment initiation of breast cancer of a cohort of 12,100 cases of health facilities qualified for high complexity in oncology within the scope of the Brazilian Public Health System (SUS) of Rio de Janeiro between 2013 and 2019. Multivariate logistic regression was used to estimate odds ratios and 95% confidence intervals. Of all cases, 82.1% were submitted to the first treatment >60 days. Patients without previous diagnosis history, higher education and in stages III and IV were less likely to have their first treatment >60 days, while treatment at a health facility outside the capital showed a higher probability. Patients with a previous diagnosis history, aged  $\geq 50$ , non-white race/skin color and in stage I were more likely to be submitted to their first treatment >60 days, while subjects with higher education, treated in a health facility outside the capital and in stage IV showed a lower probability. To summarize, socio-demographic, clinical and health facility-related factors are associated with time-to-treatment initiation of breast cancer.*

**Key words** *Breast neoplasms/Diagnosis, Time-to-treatment, Risk factors, Unified Health System, Longitudinal studies*

<sup>1</sup> Coordenação de Assistência, Instituto Nacional de Câncer (INCA). Praça Cruz Vermelha 23, Centro. 20230-130 Rio de Janeiro RJ Brasil. [rafaeljomar@yahoo.com.br](mailto:rafaeljomar@yahoo.com.br)

<sup>2</sup> Programa de Residência Multiprofissional em Oncologia, INCA. Rio de Janeiro RJ Brasil.

<sup>3</sup> Escola Nacional de Saúde Pública Sérgio Arouca, Fundação Oswaldo Cruz (Fiocruz). Rio de Janeiro RJ Brasil.

<sup>4</sup> Programa de Pós-Graduação em Saúde Pública, Fiocruz. Rio de Janeiro RJ Brasil.

<sup>5</sup> Escola de Saúde, Universidade Federal do Rio Grande do Norte. Natal RN Brasil.

## Introduction

Breast cancer (BC) shows the highest incidence among women worldwide, which has turned it into one of the most severe public health issues<sup>1</sup>. In Brazil, 73,610 new cases were estimated every year from 2023 to 2025, i.e., an incidence rate of 66.5 cases/100,000 women<sup>2</sup>. Brazil's Southeastern region, which includes the state of Rio de Janeiro (RJ), has shown the highest BC incidence and mortality rates<sup>2,3</sup>. Approximately 10,290 new cases are expected to occur in 2023 in the state of Rio de Janeiro, i.e., an incidence rate of 111.8 cases/100,000 women<sup>2</sup>.

BC mortality follows a decreasing trend in developed countries, although its incidence has increased over time<sup>1</sup>. This is believed to be due to increased access to health services, which allows early diagnosis and timely treatment, resulting in a higher survival rate<sup>2,3</sup>.

Our research was based on several studies which found that long intervals between diagnosis and treatment initiation are associated with poor quality of life, increased risk of mortality and a lower survival rate<sup>4-6</sup>. These studies also observed that in Brazil, the first treatment most often starts late<sup>7-10</sup> and that the identification of individual and contextual factors associated with time-to-treatment initiation may contribute to the development of proposals to reduce it<sup>11</sup>. The goal of this study was to investigate factors associated with time-to-treatment initiation of BC in health facilities qualified for high complexity in oncology within the scope of the Brazilian Public Health System (SUS) in the state of Rio de Janeiro, given the fact that the Brazilian Federal Law 12,732/2012 establishes that Cancer patients have the right to undergo their first treatment by SUS within 60 days after confirmed diagnosis<sup>12</sup>.

## Methods

### Design and population

This retrospective study used the web system as its data source, since it systematically consolidates information that is obtained from Brazilian Cancer Hospital Records (RHC) by the IntegradorRHC (<https://irhc.inca.gov.br/RHCNet/>, accessed on 11/30/2022). Study cohort consisted of women with BC (topographic code C50 of the International Classification of Diseases

- ICD-10<sup>13</sup>) of the *in situ* ductal or lobular carcinoma and infiltrating types (histological codes 8201/2, 8230/2, 8500/2, 8500/3, 8501/2, 8503/2, 8507/2, 8520/2, 8520/3 and 8522/2 of the International Classification of Diseases for Oncology - ICD-O<sup>14</sup>). Patients were aged 20 years or older (since patients aged up to 19 years are considered children and adolescents<sup>2</sup>), whose first medical consultation took place between June 1<sup>st</sup>, 2013 and December 31, 2019 at health establishments in the state of Rio de Janeiro qualified for high complexity in oncology within the scope of SUS, who provide the IntegradorRHC with information on at least one year of the analyzed time period (N=18,098).

Only cases with histopathological confirmation were included. We excluded cases that lacked the date of diagnosis (N=52), the date of initiation of the first treatment (N=521), that had a history of treatment prior to their arrival at the health facility (N=3,331), that had a time-to-treatment initiation greater than 365 days (N=384), i.e., outliers, and non-analytical cases (N=3,978). The decision to exclude non-analytical cases was taken to minimize the odds of duplication, as the same case could have been registered by the RHC from different establishments, either as an analytical case or a non-analytical one<sup>15</sup>.

### Variables

The response variable "time-to-treatment initiation" was obtained by counting the days between diagnosis date and treatment initiation date. That number was categorized into either  $\leq 60$  days or  $>60$  days, considering Brazilian Federal Law 12,732 of November 22, 2012, which entered into force 180 days after its official publication<sup>12</sup>, justifying why we chose June 2013 to start selecting cases.

Explanatory variables included age at the first medical appointment (20-49, 50-69,  $\geq 70$ ), race/skin color (white, non-white), education (none/partial elementary education, full elementary education/full high school/full higher education), marital status (lives with a partner, lives without a partner), city where the health facility is located (capital city, other), origin of referral (SUS, non-SUS, self-referred), diagnosis history of BC prior to arrival at the health facility (previous diagnosis, no previous diagnosis), clinical staging (*in situ*, I, II, III, IV) and first treatment received (surgery, radiotherapy, chemotherapy).

### Statistical analysis

First, the cases were described using proportions and measures of central tendency and dispersion. The differences between the interquartile ranges and the medians of the time-to-treatment initiation of each year of the period under investigation were examined using the Kruskal-Wallis test, as the Kolmogorov-Smirnov and Shapiro-Wilk tests did not show that this variable did not have a normal distribution. The differences between the proportions of the categories of each variable, according to time-to-treatment initiation, were evaluated using Pearson's chi-square test. The significance level adopted in these analyzes was 5%.

After that, crude odds ratios (OR) and respective 95% confidence intervals (95%CI) were estimated using logistic regression. To investigate the factors associated with time-to-treatment initiation >60 days, multivariate logistic regression models estimated ORs adjusted for all variables that showed, in the previous stage and in at least one category, a significance level of 20% according to the Wald test. These analyzes were stratified by the history of BC diagnosis prior to arrival at the health facility and conducted in Stata 15.

### Ethical aspects

Data provided by IntegradorRHC are anonymous, are part of the public domain and are available for unrestricted access. Thus, as stated by Resolutions No. 466/2012 and No. 510/2016 by the National Health Council, the protocol of this study did not need to be approved by the Research Ethics Committee.

### Results

Twelve thousand one hundred BC cases of women aged 57.2 years on average (standard deviation=12.9) met the study eligibility criteria. Their first treatment was mostly either chemotherapy (49.7%) or surgery (42.7%), which were performed at one of the 20 health facilities authorized for high complexity in oncology that fed the IntegradorRHC during the investigated period. Regarding the legal nature of these establishments, 10 were public sector entities, seven were non-profit entities and three were private clinics. As for their location, 14 were based in the Met-

ropolitan Region of Rio de Janeiro and 10 in the capital itself.

A little more than half (53.7%) of the women were aged between 50-69 years, most of them were non-white (54.0%), had completed high school/higher education (43.2%), lived without a partner (55.4%), had been referred by SUS (95.5%), had a history of BC diagnosis prior to arrival at the health facility (76.8%) and clinical staging II (36.8%) and III (32.7%). They were mostly treated in health facilities located in the city of Rio de Janeiro (81.3%) (Table 1).

Treatment started after >60 days in 82.1% of the analyzed cases. Figure 1 shows that the median and interquartile range of time-to-treatment initiation increased over the investigated period ( $p$ -value<0.001), ranging from 91 (52-140) days in 2013 to 122 (83-170) days in 2019.

Regarding the frequency of time-to-treatment initiation, the variables age group, establishment location, referral origin and clinical staging showed differences ( $p$ -value≤0.003) between the proportions of their categories, regardless of BC diagnosis prior to arrival at the health facility. Regarding cases with a previous BC diagnosis, the variables race/skin color, education and marital status showed differences ( $p$ -value≤0.013) among the ratios of their categories (Table 2).

Multivariate regression models showed that cases with no history of BC diagnosis prior to arrival at the health facility, with complete high school/higher education (OR=0.7; 95%CI: 0.6-0.9) and either clinical stage III (OR=0.6; 95%CI: 0.4-0.9) or IV (OR=0.3; 95%CI: 0.2-0.4) were less likely to submit to the first treatment in >60 days, while treatment in health facilities located outside the capital (OR=1.8; 95%CI: 1.1-2.9) of clinical stage I (OR=2.2; 95%CI: 1.6-3.2) or II (OR=1.8; 95%CI: 1.3-2.5) showed a higher probability. Cases with a history of BC diagnosis prior to arrival at the health facility, aged between 50 and 69 (OR=1.5; 95%CI: 1.2-1.9) or ≥70 years (OR=3.1; 95%CI: 2.1-4.7), non-white race/skin color (OR=1.4; 95%CI: 1.1-1.7) and at clinical stage I (OR=2.5; 95%CI: 1.1-5.9) were more likely to submit to the first treatment in >60 days, while women with full elementary education (RC=0.7; 95%CI: 0.5-0.9), full high school/higher education (OR=0.7; 95%CI: 0.6-0.9), treated in a health facility outside the capital (OR=0.1; 95%CI: 0.1-0.2) and at clinical stage IV (OR=0.2; 95%CI: 0.1-0.4) showed a lower probability (Table 3).

**Table 1.** Case features (N=12,100). Brazilian Public Health System, Rio de Janeiro, 2013-2019.

Variables	n	%
Age group		
20-49 years	3,495	28.9
50-69 years	6,496	53.7
≥70 years	2,109	17.4
Race/skin color		
White	5,382	46.0
Non-white <sup>b</sup>	6,326	54.0
Education		
None/elementary education (partial)	3,423	36.8
Elementary education (full)	1,860	20.0
Middle/higher education (full)	4,018	43.2
Marital status		
Without a partner	6,329	55.4
With a partner	5,107	44.7
Location		
Capital (City of Rio de Janeiro)	9,838	81.3
Others	2,262	18.7
Referred		
By SUS <sup>c</sup>	11,283	95.5
Not by SUS <sup>c</sup>	433	3.7
By herself	92	0.8
Diagnostic history		
Without previous diagnosis	2,797	23.2
With previous diagnosis	9,249	76.8
Staging		
<i>in situ</i>	412	4.4
I	1,497	16.0
II	3,439	36.8
III	3,062	32.7
IV	947	10.1

<sup>a</sup>Cases lacking the following information were excluded from percentage calculations: race/skin color (n=392), educational level (n=2,799), marital status (n=664), origin of referral (n=292), history of diagnosis prior to arrival at the health facility (n=54) and clinical tumor staging (n=2,743). <sup>b</sup>Category composed of black (n=1,855), brown (n=4,410), yellow (n=55) and indigenous (n=06) subjects. <sup>c</sup>SUS: Brazilian Public Health System.

Source: IntegradorRHC.

## Discussion

The present study shows that sociodemographic, clinical and health facility-related factors are associated with time-to-treatment initiation of BC. It also shows a progressive increase in the median of this time in health facilities qualified for high complexity in oncology within the scope of SUS in Rio de Janeiro, where approximately 8 out of

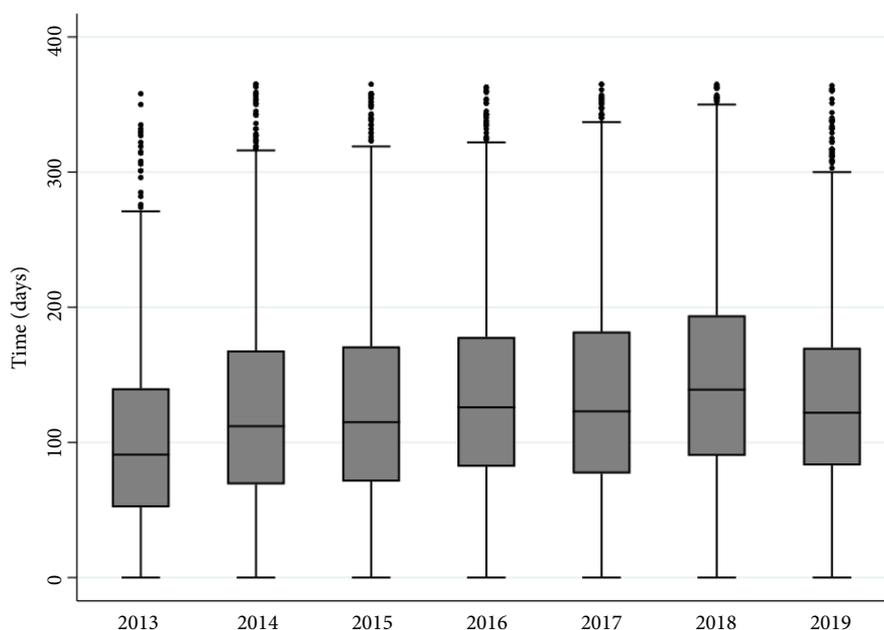
10 cases underwent their first treatment within >60 days, indicating that Law 12,732/2012<sup>12</sup> was not complied with.

In Brazil's Southeastern region, where Rio de Janeiro is located, the probability of a BC case starting treatment in >60 days is approximately 10%<sup>7</sup>. Therefore, other initiatives are required so that patients may start their treatment in a timely manner, such as faster referrals by the High Complexity Regulation Center of Rio de Janeiro, the agency in charge of ensuring agile and fair access to oncological care at SUS health units in the state<sup>16</sup>. This is due to the fact that the frequency of time-to-treatment initiation >60 days of cases with BC diagnosis history prior to arrival at the health facility was almost twice as high as that of cases without history, raising the hypothesis of a delay in referrals by that agency.

The Assistance Regulation issues treatment requests for patients, allowing them to access a SUS health facility. Since 2015, in Rio de Janeiro, if a patient is suspected to have cancer, his physician first requests diagnostic tests at the Municipal Healthcare Management through a basic health unit, which is part of the National Healthcare Management System (SISREG). If those tests confirm the suspected cancer, patients are referred by the SISREG to a specialized unit for consultation and biopsy. After the biopsy report has been issued, patients are referred to an oncologic consultation with a medical description of strong suspicion to a specialized unit via the State Health Management System (SER)<sup>16</sup>. This procedure may explain why time-to-treatment initiation takes so long in patients with a BC diagnosis history prior to arrival at the health facility, since they have to go through two different Health Management processes: one for biopsy via SISREG and another one for treatment via SER.

Thus, it is worth noting that the guidelines for early detection of BC in Brazil recommend priority referral of cases with suspicious signs and symptoms and a confirmed diagnostic to only one clinic to avoid unnecessary intermediate consultations<sup>17</sup> which increase the time required to confirm the diagnostic. However, this strategy strongly depends on the organization of the health system, health care management, network planning and logistics to improve processes<sup>18</sup>, which implies the commitment of SUS managers.

Although our findings are of greater magnitude, they corroborate previous evidence. A study conducted with a cohort of 155 women in two reference hospitals in Piauí between 2016 and 2017 shows that 71.6% of them underwent



**Figure 1.** Boxplot showing the time-to-treatment initiation per year. Brazilian Public Health System, Rio de Janeiro, 2013-2019.

Source: IntegradorRHC.

BC treatment for the first time after >60 days<sup>9</sup>. Another study analyzed 715 cases from 2010 to 2013 of women residing in the capital of Minas Gerais who were registered at the Integrador-RHC by 10 different health establishments and found that 45.7% of them underwent their first treatment after >60 days<sup>8</sup>. A survey conducted with data from IntegradorRHC involving 204,130 cases of BC diagnosed and treated between 2000 and 2017 throughout Brazil showed that 52.8% of them started their first treatment after >60 days, which was more frequent among patients diagnosed between 2012 and 2017<sup>7</sup>, when Law 12,732/2012<sup>12</sup> was already in effect. In addition, it showed that having been diagnosed after the enactment of that law increased the probability of undergoing their first treatment in >60 days by 64% compared to the time period of 2000 to 2005<sup>7</sup>. A similar study suggests that the increase in the frequency of time-to-treatment initiation >60 days over the years may have been related to the increase in the incidence of the disease in Brazil and, as a result, to a greater demand for

therapeutic procedures, which would explain the increase in time-to-treatment initiation<sup>19</sup>.

We may claim that getting treated in a health facility located outside the city of Rio de Janeiro showed a lower probability of time-to-treatment initiation >60 days among cases with a history of previous BC diagnosis due to the fact that health systems outside the capital are better organized, as they refer diagnosed cases for treatment in a timely manner and probably those in the initial stages treated with surgery first, given the fact that SUS chemotherapy and radiotherapy services are mostly located in large urban centers of Brazil<sup>20,21</sup>. Previous studies have shown that in Brazil, long time-to-treatment initiation is related to the lack of organizational strategies at the health care levels, which calls for an appropriate definition of care service flow, ranging from primary care to specialized tertiary care, since long time-to-treatment initiation is not only defined by geographic factors<sup>9,21,22</sup>. It is worth mentioning that the number of cases treated in health facilities outside the city of Rio de Janeiro was much lower than cases

**Table 2.** Frequency of time-to-treatment initiation according to previous diagnosis history. Brazilian Public Health System, Rio de Janeiro, 2013-2019.

Variables	No previous diagnosis		P-value*	With previous diagnosis		P-value*
	≤60 days n (%)	>60 days n (%)		≤60 days n (%)	>60 days n (%)	
Total	1,333 (47.7)	1,464 (52.3)		812 (8.8)	8,437 (91.2)	
Age group			0.003			<0.001
20-49 years	399 (29.9)	355 (24.3)		343 (42.2)	2,380 (28.2)	
50-69 years	696 (52.2)	820 (56.0)		383 (47.2)	4,569 (54.2)	
≥70 years	238 (17.9)	289 (19.7)		86 (10.6)	1,488 (17.6)	
Race/skin color			0.369			0.002
White	544 (42.9)	624 (44.7)		391 (51.8)	3,791 (46.0)	
Non-white	722 (57.1)	772 (55.3)		364 (48.2)	4,449 (54.0)	
Education			0.087			<0.001
Up to elementary education (partial)	380 (37.3)	416 (36.4)		146 (26.1)	2,480 (37.2)	
Elementary education (full)	220 (21.6)	254 (24.1)		121 (21.7)	1,265 (19.0)	
Middle/higher education	419 (41.1)	385 (36.5)		292 (52.2)	2,922 (43.8)	
Marital status			0.547			0.013
Without a partner	669 (54.4)	759 (55.5)		381 (51.3)	4,516 (56.0)	
With a partner	562 (45.6)	608 (44.5)		362 (48.7)	3,546 (44.0)	
Location			<0.001			<0.001
Capital (City of Rio de Janeiro)	1,066 (80.0)	1,065 (72.8)		483 (59.5)	7,220 (85.6)	
Others	267 (20.0)	399 (27.2)		329 (4.05)	1,217 (14.4)	
Referred			<0.001			<0.001
By SUS <sup>a</sup>	1,203 (93.6)	1,390 (97.2)		684 (88.3)	7,972 (96.4)	
Not by SUS <sup>a</sup>	53 (4.1)	20 (1.4)		84 (10.8)	260 (3.2)	
By herself	30 (2.3)	20 (1.4)		07 (0.9)	35 (0.4)	
Staging			<0.001			<0.001
<i>in situ</i>	121 (13.1)	112 (12.0)		08 (1.4)	171 (2.5)	
I	109 (11.8)	243 (26.0)		35 (5.9)	1,110 (16.1)	
II	180 (19.6)	317 (33.9)		134 (22.7)	2,808 (40.6)	
III	271 (29.4)	186 (19.9)		279 (47.4)	2,324 (33.6)	
IV	240 (26.1)	77 (8.2)		133 (22.6)	497 (7.2)	

<sup>a</sup>SUS: Brazilian Public Health System. \*Pearson's chi-square test.

Source: IntegradorRHC.

treated in establishments located in the state capital, which certainly helped to meet the deadline established by Law 12,732/2012<sup>12</sup>.

Compared to *in situ* cases, those with a history of a previous BC diagnosis in stage I were more likely to be submitted to a first treatment in >60 days, as opposed to those in stage IV. Similarly, cases without a previous diagnosis of BC in stages I and II were more likely to be submitted to a first treatment in >60 days, as opposed to those in stages III and IV. These results suggest that the lower probability of being submitted to a first treatment in >60 days is determined by the decisions taken by the clinic staff of health establishments to expedite the treatment of cases at more

advanced cancer stages, since fast intervention is essential for a successful treatment<sup>3</sup>.

Other studies produced similar results, corroborating ours. A study that surveyed a cohort of 155 women who were treated for BC in two reference hospitals in Piauí showed that patients diagnosed in stages I and II were 24% more likely to undergo their first treatment in >60 days than those diagnosed in stages III and IV<sup>9</sup>. Another study that analyzed data provided by the IntegradorRHC involving more than 200,000 BC cases from all over Brazil showed that when compared to cases diagnosed in the initial stages (0 to IIA), cases diagnosed in an advanced stage (IIB to IIIC) had a 28% lower probability of being sub-

**Table 3.** Crude and adjusted odds ratios (OR) and respective 95% confidence intervals (95%CI) of time-to-treatment initiation >60 days according to previous diagnosis history. Brazilian Public Health System, Rio de Janeiro, 2013-2019.

Variables	No previous diagnosis		With previous diagnosis	
	Crude OR (95%CI)	Adjusted OR (95%CI)	Crude OR (95%CI)	Adjusted OR (95%CI)
Age group				
20-49 years	1.0	1.0	1.0	1.0
50-69 years	1.3* (1.1-1.6)	1.2 (0.9-1.6)	1.7* (1.5-2.0)	1.5 (1.2-1.9)
≥70 years	1.4* (1.1-1.7)	1.3 (0.9-1.8)	2.5* (1.9-3.2)	3.1 (2.1-4.7)
Race/skin color				
White	1.0		1.0	1.0
Non-white	0.9 (0.8-1.1)		1.3* (1.1-1.5)	1.4 (1.1-1.7)
Education				
Up to elementary education (partial)	1.0	1.0	1.0	1.0
Elementary education (full)	1.1 (0.8-1.3)	0.9 (0.7-1.2)	0.6* (0.5-0.8)	0.7 (0.5-0.9)
Middle/higher education	0.8* (0.7-1.1)	0.7 (0.6-0.9)	0.6* (0.5-0.7)	0.7 (0.6-0.9)
Marital status				
Without a partner	1.0		1.0	1.0
With a partner	0.9 (0.8-1.1)		0.8* (0.7-0.9)	1.1 (0.9-1.4)
Location				
Capital (City of Rio de Janeiro)	1.0	1.0	1.0	1.0
Others	1.5* (1.3-1.8)	1.8 (1.1-2.9)	0.2* (0.2-0.3)	0.1 (0.1-0.2)
Referred				
By SUS <sup>a</sup>	1.0	1.0	1.0	1.0
Not by SUS <sup>a</sup>	0.3* (0.2-0.5)	0.6 (0.3-1.2)	0.3* (0.2-0.3)	0.6 (0.4-1.1)
By herself	0.6* (0.3-1.1)	0.6 (0.2-1.6)	0.4* (0.2-0.9)	0.6 (0.2-2.1)
Staging				
<i>in situ</i>	1.0	1.0	1.0	1.0
I	2.4* (1.7-3.4)	2.2 (1.6-3.2)	1.5 (0.7-3.2)	2.5 (1.1-5.9)
II	1.9* (1.4-2.6)	1.8 (1.3-2.5)	0.9 (0.5-2.1)	1.4 (0.6-3.1)
III	0.7* (0.5-1.1)	0.6 (0.4-0.9)	0.4* (0.2-0.8)	0.5 (0.2-1.1)
IV	0.3* (0.2-0.5)	0.3 (0.2-0.4)	0.2* (0.1-0.4)	0.2 (0.1-0.4)

<sup>a</sup>SUS: Brazilian Public Health System. \*p-value <0.20 according to Wald test.

Source: IntegradorRHC.

mitted to the first treatment in time-to-treatment initiation >60 days<sup>7</sup>.

Among cases with a history of previous BC diagnosis and aged between 50-69 and ≥70 years, the probability of submission to first treatment in >60 days increased by respectively 1.5 and 3.1 times. The above-mentioned study that examined more than 200,000 BC cases throughout Brazil showed that patients aged between 50-69 and ≥70 years were respectively 24% and 37% more likely to start treatment in >60 days compared to patients aged ≤49 years<sup>7</sup>. Results obtained by a North American study showed that for every ten years added to age, the probability that the time-to-treatment initiation becomes longer increases by 60%<sup>23</sup>. Another explanation

for a greater probability of time-to-treatment initiation >60 days of cases aged ≥ 50 years may also be due to presence of comorbidities, which are very common in this age group and increase the risk of complications related to BC treatment. Therefore, comorbidities need to be adequately controlled before starting any treatment<sup>24</sup>, which can make it difficult to meet the deadline established by Law 12,732/2012<sup>12</sup>. In view of the above, it is worth noting that a systematic review using meta-analysis showed that age at diagnosis >50 years resulted in an independent prognostic effect on BC survival rates<sup>25</sup>.

Education is a social determinant of health, since low levels of education are associated with poor health conditions<sup>26</sup> and inequalities in ac-

cess to healthcare and use of health services<sup>27</sup>. The results of this study corroborate this fact, since they show that regardless of BC diagnosis history prior to arrival at the health facility, higher educational levels decrease the probability of time-to-treatment initiation being >60 days. A review of BC in developing countries showed that low educational levels are associated with longer time-to-treatment initiation<sup>11</sup>. Therefore, we may conclude that low educational levels negatively influence the ability to understand instructions provided at the time of diagnostic confirmation and indication of treatment, while higher educational levels positively influence fast realization of BC pre-treatment tests, as well as the awareness to start treatment as soon as possible.

When compared to white race/skin color cases, non-white cases with a history of previous BC diagnosis were more likely to be submitted to the first treatment in >60 days. It is noteworthy that race/skin color is a proxy variable for the black population's difficulty in accessing health services and that inequalities of health indicators and social position, such as education and income, expose race/skin color as a social determinant of the poorer health of the black population when compared to the white one<sup>28</sup>. Thus, the National Policy for Comprehensive Health of the Black Population<sup>29</sup>, which ensures the human right to health based on the principle of equity, must be considered by the High Complexity Regulation Center of Rio de Janeiro to speed up submission to first treatment of BC cases of non-white race/skin color.

It should be mentioned that the IntegradorRHC was fed in an irregular way by some health facilities qualified for high complexity oncology within the scope of the SUS in Rio de Janeiro during the investigated years. Although sending databases to this health information system is considered a dynamic process due to activations and deactivations that occur over time, none of the 20 health institutions was deactivated in that period. That said, our study reveals that some of these establishments did not fulfill their duty in ensuring the collection, storage, analysis and systematic and continuous disclosure of information on cancer cases they treat and monitor<sup>30</sup>. In addition, irregular feeding of the database

of the IntegradorRHC weakens it and damages the reputation of this valuable source of public health research which, despite issues related to quality and comprehensiveness<sup>31</sup>, has shown to be advantageous in providing information to understand the situation of cancer cases treated in health facilities qualified for high complexity in oncology and to assess issues related to care quality provided by them<sup>7,8</sup>.

The present study is limited by the fact that it had to rely on secondary data showing significant lack of information on the variables education and clinical stages. This is probably due to fact that health professionals have only partially filled out medical records of patients. Therefore, we may not ignore that the estimated OR could be slightly higher and the respective 95%CI narrower if the study had performed multiple imputation of missing data<sup>32</sup>. Another limitation is the irregular feeding of the IntegradorRHC by some health establishments throughout the investigated period, which does not allow us to generalize results and indicates a possible underreporting of BC cases treated by those institutions. Underreporting may have occurred primarily in establishments with less resources, mainly affecting more advanced cases. Thus, the number of cases diagnosed at stages III and IV could be higher than the actual value if we include cases that were not included in the IntegradorRHC, i.e., mostly cases diagnosed at an advanced stage.

Despite those limitations, the results of the study shows that SUS managers need to develop actions that speed up the referral of BC cases for submission to the first treatment at health facilities qualified for the high complexity in oncology in Rio de Janeiro so as to comply with the deadline established by Law 12,732/2012<sup>12</sup>, to better address the most vulnerable cases and start treatment in less than 60 days, i.e.: (i) cases lacking a history of previous diagnosis at clinical stage I and II treated in health establishments outside the capital and (ii) cases with a history of previous diagnosis and aged  $\geq 50$  years, non-white race/skin color, at clinical stage I. In addition, the study indicates that future investigations are required on the impact of this law on the therapeutic itinerary of BC cases within the scope of the SUS.

## Collaborations

RT Jomar participated in project administration, conceptualization, investigation, methodology, data curation, formal analysis, writing - an original draft, critical review, and editing. NS Velasco participated in the investigation and writing - original draft and critical review. GLQ Mendes and RM Guimarães participated in the conceptualization and writing - critical review and editing. VAO Fonseca participated in the writing - a critical review and editing. KC Meira participated in the conceptualization, formal analysis, and writing - critical review and editing. All authors approved the version to be published.

## References

1. Ferlay J, Colombet M, Soerjomataram I, Mathers C, Parkin DM, Piñeros M, Znaor A, Bray F. Estimating the global cancer incidence and mortality in 2018: GLOBOCAN sources and methods. *Int J Cancer* 2019; 144(8):1941-1953.
2. Instituto Nacional de Câncer (INCA). *Estimativa* [Internet]. 2022 [acessado 2022 dez 10]. Disponível em: <https://www.gov.br/inca/pt-br/assuntos/cancer/numeros/estimativa>.
3. Instituto Nacional de Câncer José Alencar Gomes da Silva (INCA). *A situação do câncer de mama no Brasil: síntese de dados dos sistemas de informação*. Rio de Janeiro: INCA; 2019.
4. Caplan L. Delay in breast cancer: implications for stage at diagnosis and survival. *Front Public Health* 2014; 2:87.
5. Williams F. Assessment of breast cancer treatment delay impact on prognosis and survival: a look at the evidence from systematic analysis of the literature. *J Cancer Biol Res* 2015; 3(4):1071.
6. Hanna TP, King WD, Thibodeau S, Jalink M, Paulin GA, Harvey-Jones E, O'Sullivan DE, Booth CM, Sullivan R, Aggarwal A. Mortality due to cancer treatment delay: systematic review and meta-analysis. *BMJ* 2020; 371:m4087.
7. Medeiros GC, Teodózio CGC, Fabro EAN, Aguiar SS, Lopes AHM, Conte BC, Silva EV, Coelho LLP, Muniz NE, Schuab SIPC, Bergmann A, Thuler LCS. Factors associated with delay between diagnosis and initiation of breast cancer treatment: a cohort study with 204,130 cases in Brazil. *Rev Bras Cancerol* 2020; 66(3):e-09979.
8. Cabral ALLV, Giatti L, Casale C, Cherchiglia ML. Social vulnerability and breast cancer: differentials in the interval between diagnosis and treatment of women with different sociodemographic profiles. *Cien Saude Colet* 2019; 24(2):613-622.
9. Sousa SMMT, Carvalho MGFM, Santos Junior LA, Mariano SBC. Access to treatment of women with breast cancer. *Saude Debate* 2019; 43(122):727-741.
10. Lopes TCR, Gravena AAF, Demitto MO, Borghesan DHP, Dell'Agnolo CM, Brischiliari SCR, Carvalho MDB, Pelloso SM. Delay in diagnosis and treatment of breast cancer among women attending a reference service in Brazil. *Asian Pac J Cancer Prev* 2017; 18(11):3017-3023.
11. Rivera-Franco MM, Leon-Rodriguez E. Delays in breast cancer detection and treatment in developing countries. *Breast Cancer (Auckl)* 2018; 12:1178223417752677.
12. Brasil. Lei nº 12.732, 22 de novembro 2012. Dispõe sobre o primeiro tratamento de paciente com neoplasia maligna comprovada e estabelece prazo para seu início. *Diário Oficial da União* 2012; 22 nov.
13. Organização Mundial da Saúde (OMS). *Classificação Estatística Internacional de Doenças e Problemas Relacionados à Saúde*. São Paulo: Editora USP; 2012.
14. Organização Mundial da Saúde (OMS). *CID-O - Classificação Internacional de Doenças para Oncologia*. São Paulo: Editora USP; 2013.
15. Instituto Nacional de Câncer (INCA). *Registros hospitalares de câncer: planejamento e gestão*. Rio de Janeiro: INCA; 2010.

16. Governo do Estado do Rio de Janeiro. Secretaria de Saúde. *Entendendo a regulação assistencial no estado e município do Rio de Janeiro* [Internet]. 2022 [acessado 2022 dez 16]. Disponível em: <https://www.saude.rj.gov.br/regulacao/complexo-regulador-estadual/regulacao-no-estado-e-municipio>.
17. Migowski A, Silva GA, Dias MBK, Diz MDPE, Sant'Ana DR, Nadanovsky P. Guidelines for early detection of breast cancer in Brazil. II - New national recommendations, main evidence, and controversies. *Cad Saude Publica* 2018; 34(6):e00074817.
18. Migowski A, Dias MBK, Nadanovsky P, Silva GA, Sant'Ana DR, Stein AT. Guidelines for early detection of breast cancer in Brazil. III - Challenges for implementation. *Cad Saude Publica* 2018; 34(6):e00046317.
19. Medeiros GC, Bergmann A, Aguiar SS, Thuler LCS. Análise dos determinantes que influenciam o tempo para o início do tratamento de mulheres com câncer de mama no Brasil. *Cad Saude Publica* 2015; 31(6):1269-1282.
20. Silva GA, Bustamante-Teixeira MT, Aquino EML, Tomazelli JG, Silva IS. Acesso à detecção precoce do câncer de mama no Sistema Único de Saúde: uma análise a partir dos dados do Sistema de Informações em Saúde. *Cad Saude Publica* 2014; 30(7):1537-1550.
21. Oliveira EXG, Melo EC, Pinheiro RS, Noronha CP, Carvalho MS. Acesso à assistência oncológica: mapeamento dos fluxos origem-destino das internações e dos atendimentos ambulatoriais. O caso do câncer de mama. *Cad Saude Publica* 2011; 27(2):317-326.
22. Rocha-Brischillari SC, Andrade L, Nihel OK, Brischillari A, Hortelan MS, Carvalho MDB, Pelloso SM. Spatial distribution of breast cancer mortality: Socioeconomic disparities and access to treatment in the state of Parana, Brazil. *PLoS One* 2018; 13(10):e0205253.
23. Williams DL, Tortu S, Thomson J. Factors associated with delays to diagnosis and treatment of breast cancer in women in a Louisiana urban safety net hospital. *Women Health* 2010; 50(8):705-718.
24. Hurria A. Embracing the complexity of comorbidity. *J Clin Oncol* 2011; 29(32):4217-4218.
25. Maajani K, Jalali A, Alipour S, Khodadost M, Tohidinik HR, Yazdani K. The global and regional survival rate of women with breast cancer: a systematic review and meta-analysis. *Clin Breast Cancer* 2019; 19(3):165-177.
26. Schäfer AA, Santos LP, Miranda VIA, Tomasi CD, Soratto J, Quadra MR, Meller FO. Regional and social inequalities in mammography and Papanicolaou tests in Brazilian state capitals in 2019: a cross-sectional study. *Epidemiol Serv Saude* 2021; 30(4):e2021172.
27. Malta DC, Bernal RTI, Gomes CS, Cardoso LSM, Lima MG, Barros MBA. Inequalities in the use of health services by adults and elderly people with and without noncommunicable diseases in Brazil, 2019 National Health Survey. *Rev Bras Epidemiol* 2021; 24(Supl. 2):e210003.
28. Nogueira MC, Maximiliano RG, Cintra JRD, Corrêa CSL, Fayer VA, Bustamante-Teixeira MT. Disparidade racial na sobrevivência em 10 anos para o câncer de mama: uma análise de mediação usando abordagem de respostas potenciais. *Cad Saude Publica* 2018; 34(9):e00211717.
29. Brasil. Ministério da Saúde (MS). *Política nacional de saúde integral da população negra: uma política para o SUS*. Brasília: MS; 2017.
30. Brasil. Portaria SAES/MS nº 1.399, 17 de dezembro de 2019. Redefine os critérios e parâmetros referenciais para a habilitação de estabelecimentos de saúde na alta complexidade em oncologia no âmbito do SUS. *Diário Oficial da União* 2019; 17 dez.
31. Oliveira JCS, Azevedo EFS, Caló RS, Atanaka M, Galvão ND, Silva AMC. Registros Hospitalares de Câncer de Mato Grosso: análise da completitude e da consistência. *Cad Saude Colet* 2021; 29(3):330-343.
32. Camargos VP, César CC, Caiaffa WT, Xavier CC, Proietti FA. Imputação múltipla e análise de casos completos em modelos de regressão logística: uma avaliação prática do impacto das perdas em covariáveis. *Cad Saude Publica* 2011; 27(12):2299-2313.

---

Article submitted 20/09/2022

Approved 03/01/2023

Final version submitted 05/01/2023

---

Chief editors: Romeu Gomes, Antônio Augusto Moura da Silva