

Diagnosis-to-treatment intervals in breast cancer: analysis of the care pathway at an Amazonian referral center

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ABSTRACT

Objective: To evaluate the breast cancer care pathway for patients aged ≥ 18 years treated at the Amazonas State Oncology Control Center Foundation. **Methods:** A retrospective, descriptive, and observational study conducted between March 2022 and March 2024, based on the analysis of physical and electronic medical records. **Results:** A total of 397 patients were evaluated, with a predominance of the 50–59 age group (31.5%). The most common clinical staging was IIIA (20.7%), and the predominant immunohistochemical subtype was Luminal A (24.9%). A high proportion of patients received neoadjuvant chemotherapy (55.2%). The interval between diagnosis and the start of treatment was up to 60 days for 34.3% of patients and up to 90 days for 66%. **Conclusion:** Although 66% of patients began treatment within 90 days of diagnosis, only 34.3% received treatment within the legal 60-day deadline established by Law No. 12,732/2012, indicating that challenges remain in complying with the legislation.

KEYWORDS: breast neoplasms; time-to-treatment; health profile.

INTRODUCTION

Breast cancer is the most common malignant neoplasm among women worldwide and represents a major public health problem due to its high incidence and impact on female mortality. Global estimates indicate that more than 2.3 million new cases were diagnosed in 2020, with a projected increase in the coming decades, possibly exceeding 3 million cases annually by 2040, driven primarily by population aging and changes in reproductive and behavioral patterns^{1,2}.

In Brazil, for the 2026–2028 three-year period, there are an estimated 78,610 new cases of breast cancer annually, with an estimated risk of 71.57 cases per 100,000 women. Despite the high national incidence, significant regional heterogeneity is observed, with the lowest estimated incidence in the Northern region. However,

differences in detection, access to diagnosis, and healthcare system organization may also influence regional estimates³.

Despite advances in diagnosis and treatment, the prognosis for breast cancer remains strongly dependent on early diagnosis and timely initiation of treatment. Evidence shows that early detection is associated with longer survival and better clinical outcomes, while delays in diagnosis and the start of therapy significantly increase cancer mortality^{4,5}. Furthermore, a prolonged interval between diagnosis and treatment is associated with more advanced tumor staging, the need for systemic therapies, and worse clinical outcomes^{5,6}.

To reduce these delays, the Brazilian legislation has established maximum time limits for cancer care, determining that treatment begin within 60 days of a definitive malignant neoplasm

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diagnosis (Law No. 12,732/2012), as well as requiring diagnostic tests to be performed within 30 days in cases of suspected cancer (Law No. 13,896/2019)^{7,8}. However, implementing these regulations faces structural and organizational challenges, especially in regions with significant gaps in healthcare coverage and difficulty in geographic access.

In the state of Amazonas, territorial and logistical characteristics may pose additional barriers to accessing specialized services. Healthcare regionalization in the Amazon is characterized by great distances, a dispersed population, and a predominant reliance on river transportation, hindering timely access to cancer diagnosis and treatment⁹. Furthermore, socioeconomic inequalities and structural healthcare system limitations may contribute to delays in care, especially among patients living in the interior of the state^{10,11}.

Until 2022, mastology care at the Amazonas State Oncology Control Center Foundation (FCECON) was provided predominantly on a walk-in basis, resulting in service overload and long waiting times. Institutional studies showed an average interval of more than six months between diagnosis and the start of treatment, highlighting weaknesses in the care pathway¹². Given this scenario, a new regulated care model was implemented in 2022 (Figure 1). The FCECON care reorganization plan includes the following key initiatives: implementing regulated referrals via The National Regulation System (SISREG), prioritizing patients with a confirmed diagnosis or high suspicion of malignancy, and decentralizing follow-up and treatment of benign lesions and less complex cases to primary and secondary care facilities. These measures aimed to reduce workloads on specialized services and optimize access to cancer care¹³.

Given the context described above, this study aims to evaluate the mastology care pathway after a reorganization

plan implemented in 2022 at a tertiary care hospital. It also describes the clinical profile of patients and the time intervals between diagnosis and the start of treatment.

METHODS

This is a retrospective, observational, epidemiological, and descriptive study conducted from March 2022 to March 2024 at FCECON, involving an active search in physical and electronic medical records of patients aged 18 years or older diagnosed with breast cancer. A total of 397 physical and electronic medical records were selected. The study sample was drawn from medical records available during the study period. The study included patients aged 18 years or older diagnosed with breast cancer who were treated at FCECON between March 2022 and March 2024 and whose medical records were properly completed. Medical records with a high degree of incompleteness—characterized by the absence of information essential to the analysis—were excluded. Isolated absence of data did not constitute an exclusion criterion; such data were recorded as “unknown” in the respective variables. For data collection, researchers completed a form based on the physical and electronic medical records analyzed, containing the following variables: age, origin, Breast Imaging Reporting and Data System (BI-RADS), immunohistochemical panel, histopathological classification, clinical staging, treatment administered, and time from diagnosis to the start of treatment. Time from diagnosis to the start of treatment was classified as follows: <60 days, up to 3 months, up to 6 months, up to 1 year, and more than 1 year.

This study was submitted to the FCECON Teaching and Research Center and approved by the Ethics Committee (CEP/FCECON) (Opinion No. 6,949,124—CAAE 80167024.5.0000.0004). All participants signed the Informed Consent Form (ICF).

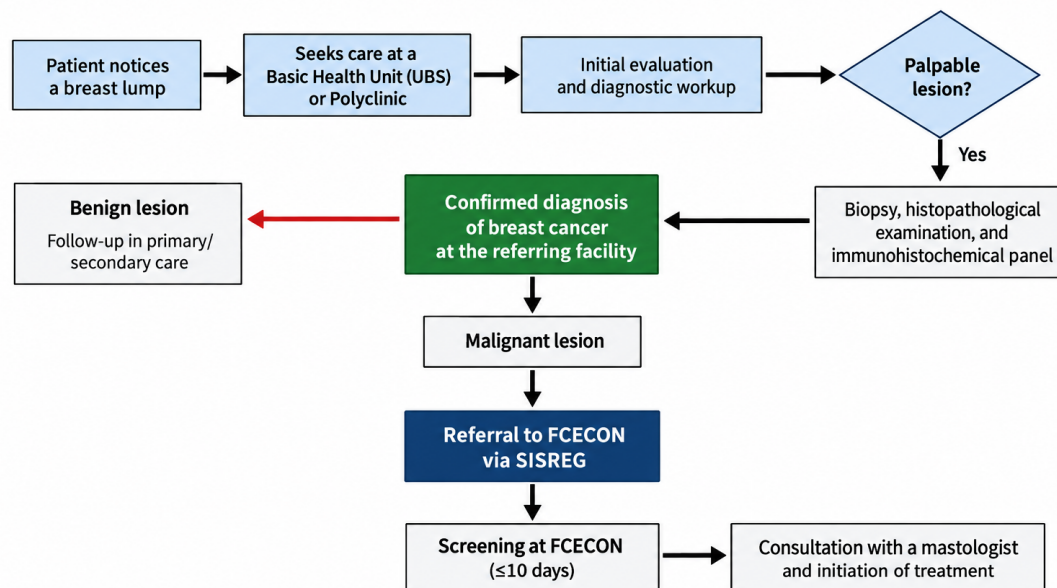


Figure 1. Flowchart of the breast cancer care pathway at FCECON (effective 2022).

RESULTS

The medical records of 397 women diagnosed with breast cancer during the specified period were studied. According to the analysis of sociodemographic characteristics, most of the women treated during that period were in the age group of 40 to 59, with 108 (27.2%) in the age group of 40 to 49 and 125 (31.5%) in the age group of 50 to 59, accounting for 57.8% of the sample. Regarding nationality and place of origin, 385 (97%) women were Brazilian, and 12 were Venezuelan; of these, 191 (48.1%) were from the city of Manaus, and 117 patients were from the interior of the state of Amazonas (Table 1).

Regarding clinical characteristics, of the 397 women analyzed, 87 (21.9%) received a BI-RADS 5 classification, which is one of the highest classifications for suspected breast cancer. Stage IIIA was the most common, found in 82 women (20.7%). According to the immunohistochemical panel results, 99 (24.9%) were classified as Luminal A and 86 (21.7%) as Luminal B, which were the most common classifications for this test. (Table 2). Regarding histopathological classification, 319 (80.4%) women were diagnosed with invasive ductal carcinoma. There was a high proportion of missing data for the BI-RADS (28.5%) and clinical staging (19.6%) variables because some of the medical records analyzed lacked this information.

Considering the treatment characteristics of the women analyzed in terms of time from diagnosis to the start of treatment, 136 (34.3%) began treatment within 60 days and 126 (31.7%) within three months (Figure 2). Regarding treatment, 219 (55.2%) received neoadjuvant chemotherapy (Table 3).

DISCUSSION

Analysis of the patients' sociodemographic profile revealed a higher concentration in the 40–59 age group, a finding consistent

Table 1. Frequency distribution by sociodemographic characteristics of women diagnosed with breast cancer treated at the Amazonas State Oncology Control Center Foundation from 2022 to 2024.

Characteristic	n (397)	%
Age group		
25 to 29	2	0.5
30 to 39	35	8.8
40 to 49	108	27.2
50 to 59	125	31.5
60 to 69	70	17.6
70 and older	57	14.4
Origin		
Capital - Manaus	191	48.1
Interior of the State of Amazonas	117	29.5
Another state	77	19.4
Another country	12	3

with the epidemiology of breast cancer in Brazil, which shows a progressive increase in incidence beginning in the fourth decade of life³. The high proportion of patients from both the state capital and the interior of the state highlights the central role of FCECON as a state-level referral center for oncology, while also revealing significant geographic inequalities in access to specialized services.

In the state of Amazonas, territorial and logistical characteristics impose additional barriers to accessing healthcare services. The region is characterized by a vast territory, a dispersed population, and a predominant reliance on river transportation, which can result in long travel times to specialized centers, especially for patients from remote areas⁹. Furthermore, socioeconomic factors, such as low income and indirect travel expenses, contribute to delays in diagnosis and the initiation of treatment,

Table 2. Frequency distribution by clinical characteristics of women diagnosed with breast cancer treated at the Amazonas State Oncology Control Center Foundation from 2022 to 2024.

Characteristic	n (397)	%
BI-RADS Classification		
0 - Incomplete	9	2.3
1 - Negative	7	1.8
2 - Benign	22	5.5
3 - Probably benign	11	2.8
4A - Low suspicion	57	14.4
4B - Moderate suspicion	28	7.1
4C - High suspicion	38	9.6
5 - Highly suggestive of malignancy	87	21.9
6 - Confirmed malignancy	25	6.3
Unknown	113	28.5
Staging		
IA	30	7.6
IB	7	1.8
IIA	77	19.4
IIB	44	11.1
IIIA	82	20.7
IIIB	48	12.1
IV	31	7.8
Unknown	78	19.6
Immunohistochemical panel		
HER2	92	23.2
Luminal A	99	24.9
Luminal B	86	21.7
Luminal Hybrid	12	3.0
Triple-negative	56	14.1
Unknown	52	13.1

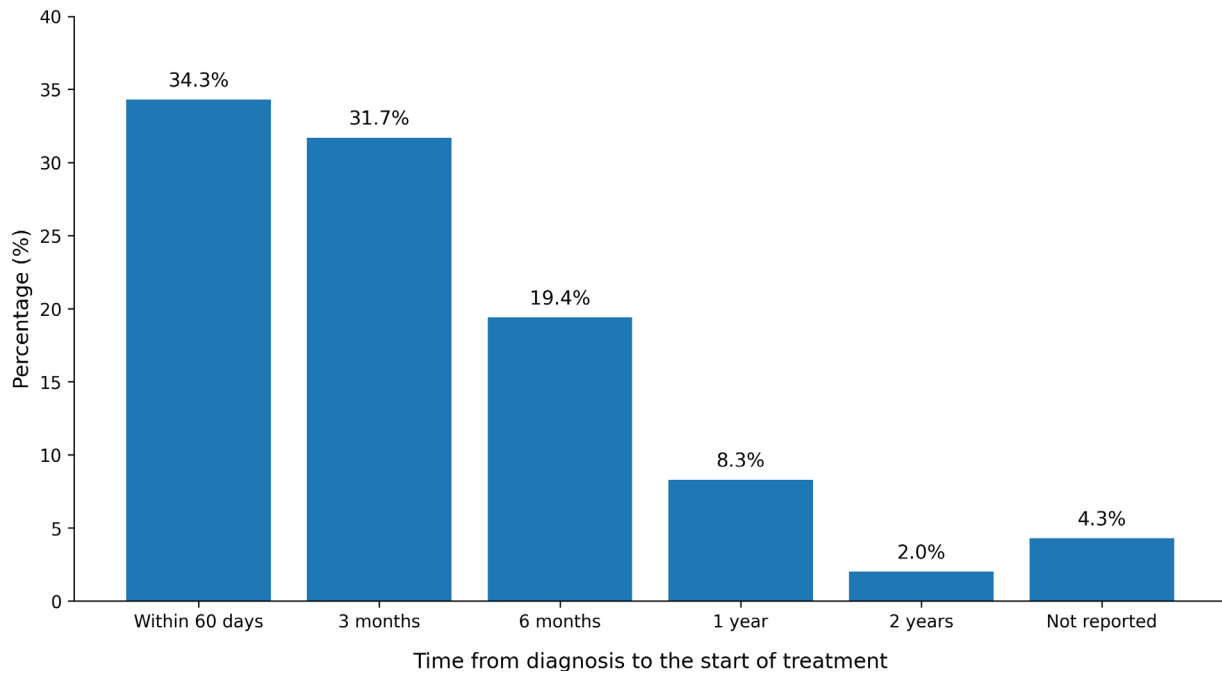


Figure 2. Distribution of time from diagnosis to the start of treatment in women diagnosed with breast cancer treated at the Amazonas State Oncology Control Center Foundation from 2022 to 2024.

Table 3. Distribution of initial treatment modalities among women with breast cancer treated at the Amazonas State Oncology Control Center Foundation from 2022 to 2024.

Characteristic	n (397)	%
Breast-conserving surgery	66	16.6
Mastectomy	95	23.9
Neoadjuvant chemotherapy	219	55.2
Palliative care	1	0.3
Reconstructive	3	0.8
Not reported	13	3.3

compromising the continuity of cancer care^{10,11}. However, similar delays have also been reported in other Brazilian regions, suggesting that organizational, structural, and socioeconomic factors within the healthcare system play a significant role regardless of local geographic characteristics.

Concerning clinical characteristics, advanced stages were frequent, with a predominance of stage IIIA and BI-RADS 5. This finding reflects a persistent pattern of late diagnosis, consistent with data from other national series that point to difficulties in accessing early diagnosis and limited effectiveness in breast cancer screening^{4,6,14}. Furthermore, result interpretation must consider the high proportion of missing data for variables such as BI-RADS and clinical staging. The absence of this information in some medical records may introduce information bias and limit an accurate clinical characterization of the study population.

The presence of patients initially classified as BI-RADS 0, 2, and 3 can be explained by the fact that this piece of information corresponded, in many cases, to the initial imaging exam available in the medical record. In these situations, clinical suspicion, subsequent complementary tests, or histopathological confirmation allowed for the establishment of a definitive diagnosis of breast cancer.

Regarding the immunohistochemical profile, the Luminal A subtype was the most prevalent. This finding is consistent with the national literature, which describes a higher frequency of luminal subtypes among Brazilian women with breast cancer¹⁵. These subtypes generally have a better prognosis and a greater response to hormone therapy. However, evidence suggests that the prognostic benefit associated with luminal tumors may be reduced when there is a delay in diagnosis and treatment initiation, with a negative impact on clinical outcomes⁵.

Regarding the treatment administered, a high proportion of patients received neoadjuvant chemotherapy, a finding possibly associated with the predominance of advanced clinical stages. In addition to tumor extent, this treatment pattern also reflects the molecular profile of the patients treated, with a significant presence of biologically more aggressive subtypes, such as triple-negative and HER2-positive tumors. For these subtypes, neoadjuvant chemotherapy is the initial therapeutic strategy recommended by major international guidelines, especially for locally advanced tumors or those with a higher tumor burden¹⁶.

In the regional context, this is even more relevant considering that patients from the interior of the state of Amazonas frequently

face geographic, socioeconomic, and logistical barriers to regular access to specialized centers, which can compromise treatment continuity and increase the total duration of treatment⁹⁻¹¹. These factors highlight the structural challenges faced by the oncology network in the Northern region, particularly concerning care for populations living outside the state capital.

As for time from diagnosis to the start of treatment, 34.3% of patients began therapy within 60 days, in accordance with Law No. 12,732/2012⁷, and 66% began treatment within 90 days following the care pathway reorganization plan implemented at the institution. However, most patients exceeded this timeframe, indicating that significant challenges remain in complying with the legislation.

Compared to data from other Brazilian regions, the results observed in Amazonas show similar or, in some respects, superior performance. A study conducted in Rio Grande do Sul identified an average time of more than six months between diagnosis and the start of treatment for breast cancer, highlighting a significant delay in access to cancer care¹⁷. Similarly, an analysis conducted in the state of Rio de Janeiro showed that a significant proportion of patients began treatment after the legal 60-day deadline, reflecting structural barriers within the healthcare system¹⁸.

The AMAZONA III study demonstrated inequalities in the interval between breast cancer diagnosis and treatment according to healthcare coverage, with longer intervals observed among women treated in the public healthcare system¹⁹. The AMAZONA III study revealed significant inequalities in access to breast cancer diagnosis and treatment across different regions of the country, demonstrating that delays in care persist even in areas without the geographic barriers characteristic of the Amazon. Thus, although vast geographical distances and reliance on river transport may pose additional obstacles to accessing specialized care, the delays observed in this study likely reflect the interplay of geographical, structural, organizational, and socioeconomic factors shared by different Brazilian regions¹⁹.

This study has some limitations. As a retrospective study based on a review of medical records, it was subject to incomplete information, as evidenced by the high frequency of data classified as “unknown” for some variables, particularly BI-RADS and clinical staging. Furthermore, time from diagnosis to the start of treatment was recorded in time categories, making it impossible to accurately calculate the average time in days for all patients. Another limitation is the absence of a formal comparative analysis between the periods before and after the care pathway reorganization plan implemented in 2022. This prevents a causal relationship from being established between the organizational changes and the outcomes observed.

In this context, the results observed at FCECON provide an up-to-date overview of access to breast cancer treatment at a referral center in the Northern region. Although only 34.3% of patients began treatment within the 60-day timeframe established by Law No. 12,732/2012, the majority began therapy within 90

days of diagnosis. These findings highlight progress in the timeliness of cancer care but also underscore that challenges remain in complying with the legislation.

In addition, the data presented provide an important baseline for monitoring the institution's care indicators following the reorganization plan implemented in 2022. Although the study design does not allow a causal relationship to be established between the organizational changes and the outcomes observed, the findings may inform future evaluations of the impact of the strategies adopted by FCECON and contribute to the continuous improvement of cancer care in the state of Amazonas.

CONCLUSION

The results of this study suggest that the care pathway reorganization plan implemented at FCECON in 2022 improved the timeliness of access to cancer treatment. Although 66% of patients began treatment within 90 days of diagnosis, only 34.3% received treatment within the 60-day legal deadline established by Law No. 12,732/2012, demonstrating that the majority of patients fell outside the timeframe stipulated by law and that significant challenges remain in ensuring timely access to cancer treatment.

The findings provide an updated overview of breast cancer care at a referral center in the Northern region and can be used to monitor the institution's care indicators. Although the study design does not allow a causal relationship to be established between the organizational changes and the results observed, data suggest better timeliness of care compared to institutional data previously reported.

Furthermore, the high frequency of advanced stage diagnoses reinforces the need to strengthen strategies for mammographic screening, early diagnosis, healthcare regulation, and integration of the healthcare network. Continuously improving these measures is key to expanding timely access to treatment, increasing compliance with the legal 60-day deadline, and improving patients' clinical outcomes.

AUTHORS' CONTRIBUTIONS

NBD: Conceptualization; Data curation, Formal analysis, Investigation, Methodology, Visualization, Writing—original draft, Writing—review and editing. CHM: Data curation, Investigation, Visualization, Writing—review and editing. CENM: Data curation, Investigation, Formal analysis, Writing—review and editing. DCD: Methodology, Formal analysis, Validation, Writing—review and editing. IMG: Data curation, Investigation, Writing—review and editing. YOS: Data curation, Investigation, Visualization, Writing—review and editing. YJJ: Data curation, Investigation, Formal analysis, Writing—review and editing. HFBESAP: Conceptualization, Methodology, Project administration, Resources, Supervision, Validation, Writing—review and editing.

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Conflict of interest: nothing to declare.

Artificial Intelligence usage: none

Data availability statement: The data underlying the results of this study are not publicly available, as they are derived from patient medical records and are subject to confidentiality, privacy, and ethical guidelines established for the research.

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