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Time delay diagnosis and advanced stages in women with breast cancer in Bolivia: a single institution experience

M T Maria Tereza Nieto-Coronel[1a], Daniela Shveid Gerson[2b], Gian Karla Urey Cuellar[3], Navia-Bueno Ma Pilar[4c] and Maribel Marmol Casas[5]

[1]Medical Oncology , Oncopalia-MyAMedic Center, La Paz 00591, Bolivia
[2]Centro Médico ABC, Mexico City 05300, México
[3]Hospital German Urquidi, Cochabamba 00591, Bolivia
[4]Chief of the Clinical Epidemiology Unit, Instituto de Investigación en Salud y Desarrollo, Universidad Mayor de San Andrés, La Paz 00591, Bolivia
[5]Medical Oncology, Hospital German Urquidi, Cochabamba 00591, Bolivia
[a] https://orcid.org/0000-0002-5606-6434
[b] https://orcid.org/0000-0002-950
[c] https://orcid.org/0000-0002-5115-9578

Abstract

Background: Breast cancer remains the leading cause of cancer-related mortality among women worldwide, and outcomes are disproportionately poor in low- and middle-income countries, largely as a result of delays along the diagnostic–therapeutic pathway. However, in Bolivia, quantitative data on care intervals and stage at diagnosis remain scarce.

Methods: We conducted a retrospective, single-centre, cross-sectional study of women aged ≥18 years with histologically confirmed invasive breast cancer treated at a public referral centre in Cochabamba, Bolivia (January 2019–December 2021). Clinical, pathological and molecular data were extracted. Following Aarhus Statement guidelines, we calculated the partial diagnostic interval (first diagnostic imaging to histopathological confirmation) and the early pretreatment interval (diagnosis to first medical oncology consultation). Advanced stage was defined as III–IV. Group comparisons used Kruskal–Wallis tests (significance: $p < 0.05$). Multivariate logistic regression with multiple imputations (five imputations) was performed to identify independent predictors of advanced-stage disease (significance: $p < 0.05$).

Results: Among 242 patients, the mean age was 52.1 years. Overweight/obesity prevalence was 74.8%. Invasive ductal carcinoma predominated (89.7%), and Luminal B-like was the most frequent molecular subtype (40.1%). Notably, 58.7% presented with advanced-stage disease (stage III: 46.3%; stage IV: 12.4%). The mean partial diagnostic interval was 79.0 days (SD 119.0), and the mean early pretreatment interval was 65.7 days (SD 111.7). Interval durations did not differ significantly by molecular subtype or tumour stage in univariate comparisons ($p > 0.05$). In the multivariate analysis, molecular subtype was the only independent predictor of advanced-stage presentation. Compared to triple-negative breast cancer, patients with Luminal A had significantly lower odds of presenting with advanced-stage disease (OR 0.09, 95% CI 0.02–0.32, $p < 0.001$), and those with Luminal B also showed reduced odds (OR 0.30, 95% CI 0.10–0.96, $p = 0.043$). Crucially, neither the partial diagnostic interval nor the early pretreatment interval was significantly associated with advanced-stage presentation after multivariate adjustment.

Research

Correspondence to: Maria Tereza Nieto Coronel
Email: maytemtnc@gmail.com

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Conclusion: In this Bolivian reference institution, advanced-stage breast cancer (III–IV) was prevalent alongside partial system delays. However, multivariate analysis demonstrated that measured diagnostic and pretreatment intervals were not independently associated with stage at diagnosis. Despite methodological constraints regarding partial intervals, these findings underscore the critical role of tumour biology over system delays in stage presentation. There is an urgent need for structured early-detection programs and prospective studies mapping the complete diagnostic–therapeutic pathway in Bolivia.

Keywords: *breast cancer, diagnostic delay, services accessibility, Bolivia, early detection of cancer, low-income countries*

Introduction

Breast cancer accounts for approximately one in four cancer diagnoses in women worldwide, and is the leading cause of cancer-related mortality among this population [1]. Women in low- and middle-income countries (LMICs) face multiple barriers to breast cancer care, ranging from limited access to early detection programs to delays in obtaining a timely diagnosis and appropriate treatment. These disparities are reflected in 5-year breast cancer survival rates, which range from 40% to 60% in LMICs compared to 84% in North America [2].

In Bolivia, breast cancer epidemiology remains poorly documented due to the absence of a functional national cancer registry. Available estimates from GLOBOCAN 2024 report 1,679 new cases and 514 annual deaths; however, these figures likely underestimate the true burden given limitations in diagnostic capacity and underreporting [3]. As part of the Latin American region, Bolivia faces a high proportion of women presenting with advanced stages (III–IV), a pattern consistently associated with delays in diagnosis and treatment initiation in resource-limited settings [4].

The Bolivian healthcare system is fragmented into multiple subsystems with limited coordination among them [5]. When a woman detects a breast symptom, her first point of contact is typically a primary care physician or general practitioner at a public health centre, where mammography and ultrasound are frequently unavailable. Referral to a gynaecologist or mastologist often requires navigating multiple administrative levels, and waiting times for imaging and biopsy can extend for weeks to months. Bolivia also lacks a national organised breast cancer screening program [5]; opportunistic screening is available in some urban centres, but coverage is limited, particularly in rural and indigenous communities.

Healthcare financing in Bolivia relies on a mix of public funding through the Sistema Único de Salud [5], which provides free care at public facilities but frequently faces medication and resource shortages, and private-sector care, which entails substantial out-of-pocket expenditure, given the incomplete universal coverage for cancer treatment. For many patients, these costs can become catastrophic.

Timely diagnosis constitutes a critical determinant of survival; disease-free survival for cancers treated at early stages is approximately 90% [6]. A meta-analysis concluded that each additional 4-week delay between diagnostic confirmation and treatment initiation increases mortality risk by more than 10% [7].

These delays are operationally categorised into patient-related intervals (from symptom perception to first medical consultation) and health system-related intervals (from first consultation to treatment initiation), with the latter subdivided into diagnostic interval (until histopathological confirmation) and therapeutic interval (until initiation of oncological treatment) (Table 1) [8–11].

Notably, whereas patient-related delays predominate in high-income countries, system-related delays in LMICs – stemming from restricted access, delayed care delivery and resource limitations – tend to be the determining and modifiable factors [6].

The World Health Organization's (WHO) Global Breast Cancer Initiative (GBCI) has established three pillars with specific targets for improving breast cancer outcomes globally. Pillar 1 focuses on health promotion and early detection, with a target of diagnosing at least 60% of breast cancers at stage I or II. Pillar 2 addresses timely diagnosis, with a target of completing the diagnostic process within 60 days from first presentation. Pillar 3 focuses on comprehensive breast cancer management, including access to surgery, radiotherapy and systemic therapies [12]. These metrics provide a valuable framework for evaluating breast cancer care in low-resource settings such as Bolivia.

Table 1. Operational definitions of delay intervals in oncology care.

Interval	Start point	End point	Operational definition
Total care interval	Patient's self-perception of first cancer-attributable symptom	Initiation of definitive oncological treatment	Time elapsed between the patient's recognition of first symptoms suggestive of cancer and the commencement of antineoplastic treatment
Patient-related delay	Patient's self-perception of first cancer-attributable symptom	First consultation with a healthcare professional for symptom evaluation	Period during which the patient recognises symptoms but does not seek formal medical attention
Health system-related delay	First consultation with a healthcare professional for symptom evaluation	Initiation of definitive oncological treatment	Time elapsed within the healthcare system, from initial medical assessment to treatment initiation
Diagnostic sub-interval	First consultation with a healthcare professional for symptom evaluation	Histopathological confirmation of cancer diagnosis	Period between initial clinical evaluation and obtainment of definitive anatomopathological diagnosis
Treatment sub-interval	Histopathological confirmation of cancer diagnosis	Initiation of definitive oncological treatment	Time elapsed between diagnostic confirmation and administration of the first antineoplastic therapeutic modality (surgery, chemotherapy, radiotherapy or other)

Note: Intervals are expressed in days or weeks according to study convention [8–11]

Despite the recognised impact of care timelines on oncological outcomes, there remains a marked scarcity of quantitative data on diagnostic–therapeutic intervals in Bolivia. Regional literature has focused primarily on urban centres in neighbouring countries, with limited representation of the Bolivian context, where sociocultural factors, the absence of a national screening programme, and the fragmentation of the health system may uniquely shape care trajectories. To our knowledge, no published evidence has systematically evaluated the association between care intervals and disease stage at diagnosis within the Bolivian public oncology network.

This retrospective observational study, conducted at a single public institution specialised in breast pathology in Cochabamba, Bolivia, aimed to evaluate key intervals leading to treatment initiation and their association with advanced stages.

Methodology

Study design and population

This retrospective observational, cross-sectional study was based on clinical records of women diagnosed with breast cancer treated at the German Urquidi Hospital in Cochabamba, Bolivia. Patients aged ≥18 years with histopathologically confirmed invasive breast carcinoma, at any clinical stage, between January 2019 and December 2021 were included.

Variables and data collection

We collected demographic data (age, body mass index (BMI)), clinical data (tumour size, lymph node involvement, time from imaging studies to oncology visit), pathological data (histological type, tumour grade, oestrogen receptor (ER), progesterone receptor (PR), HER2 and Ki-67 expression).

Staging was performed using the anatomic staging system of the American Joint Committee on Cancer (AJCC) 8th edition, based on tumour size (T), nodal status (N) and presence of distant metastasis (M). For the purposes of this study, disease stages were categorised as follows: early-stage (stages I–II) and advanced disease (stages III–IV).

Clinical staging was assigned at the time of the first oncology visit, incorporating all available clinical examination findings, imaging studies (mammography, ultrasound, chest X-ray, abdominal ultrasound, or computed tomography scan when performed), and pathological data.

Molecular subtype by immunohistochemistry (Luminal A, Luminal B, HER2-positive and triple-negative) and treatments received (surgery, chemotherapy and radiotherapy) and vital status at time of analysis were also recorded.

Nutritional status was classified according to WHO criteria: underweight (<18.5 kg/m^2), normal weight (18.5–24.9), overweight (25–29.9), obesity grade I (30–34.9), grade II (35–39.9) and grade III (≥40).

Variable definitions

Following recommendations from the Aarhus Statement [9] for standardisation of early cancer diagnosis studies, the following time-points and intervals were defined:

1. **Date of diagnosis:** Defined as the date of the pathological report confirming cancer presence, consistent with criterion 1c of the European Network of Cancer Registries (ENCR) hierarchy [8], which states that in the absence of biopsy date or pathologist receipt date, the histopathological report date should be used.
2. **First diagnostic investigation for suspected cancer:** Defined as the time when the first imaging study (mammography or ultrasound) explicitly indicated for clinical suspicion of breast cancer was performed, as documented in the medical record. This milestone marks the initiation of structured diagnostic investigations and represents a relevant point within the diagnostic interval.
3. **First oncology consultation:** Defined as the first in-person evaluation of the patient by a medical oncology specialist following diagnostic confirmation. This event is considered part of the treatment planning phase, within the treatment interval spanning from diagnosis to effective initiation of oncological treatment.

Based on the above, two key intervals were calculated:

- **Partial diagnostic interval:** Time elapsed between first diagnostic investigation for suspected cancer (imaging) and date of diagnosis (pathological report).
- **Early pretreatment interval:** Time elapsed between date of diagnosis and first consultation with oncology specialist.

All times are expressed in days and calculated from dates extracted from institutional clinical records.

Given the retrospective design and reliance on institutional clinical records, we prioritised intervals with reliably documented timestamps. The patient-related interval (from symptom perception to first consultation) was excluded due to inconsistent documentation of symptom onset in medical charts, and the interval from oncology consultation to treatment initiation could not be captured because of incomplete records. By restricting the analysis to objectively recorded clinical milestones, we aimed to ensure data validity and reproducibility.

Statistical analysis

Data were analysed using IBM SPSS Statistics version 26. Between-group comparisons used Kruskal–Wallis tests, with $p < 0.05$ considered statistically significant.

To identify independent predictors of advanced-stage disease (AJCC stages III–IV versus I–II), multivariate logistic regression was performed using multiple imputations (five datasets, fully conditional specification method) to address missing data. Results were pooled using Rubin's rules. The model included age group (<40 years versus ≥40 years), molecular subtype (reference: triple-negative), tumour grade (1–2 versus 3), partial diagnostic interval and early pretreatment interval.

Ethical considerations

The study complied with ethical standards established in the Declaration of Helsinki. Approval was obtained from the institutional ethics and research committee. Due to the anonymous and retrospective nature of the analysis, informed consent was waived following ethics committee guidelines.

Results

Demographic and clinical characteristics

Mean age at diagnosis was 52.07 years (range: 23–94), with a median of 51%. Regarding age group classification, 18.6% were under 40 years old (Table 2).

Nutritional status at diagnosis showed a high prevalence of overweight and obesity: 40.5% were overweight, 25.6% had grade I obesity, 6.2% grade II obesity and 2.5% grade III obesity. Only 20.7% had normal weight and 1.7% were underweight. Mean BMI was 28.55 kg/m² (range: 17–53), with a median of 28,28% (Table 2).

Table 2. Demographic and clinical characteristics of the cohort (*n* = 242).

Variable	*n* (%)	Mean ± SD
Age at diagnosis (years)	–	52.1 ± 14.3
<40 years	45 (18.6%)	—
40–49 years	65 (27.2%)	–
50–69 years	105 (43.9%)	–
≥ 70 years	24 (10.0%)	–
BMI (kg/m²)	–	28.6 ± 6.8
Underweight (<18.5)	4 (1.7%)	–
Normal weight (18.5–24.9)	50 (20.7%)	–
Overweight (25–29.9)	98 (40.5%)	–
Obesity class I (30–34.9)	62 (25.6%)	–
Obesity class II (35–39.9)	15 (6.2%)	–
Obesity class III (≥40)	6 (2.5%)	–
Missing data	7 (2.9%)	–
Stage at diagnosis		
I	14 (5.8%)	–
II	66 (27.3%)	–
III	112 (46.3%)	–
IV	30 (12.4%)	–
Missing data	20 (8.3%)	–
Advanced stages (III–IV)	142 (58.7%)	–

Abbreviations: BMI = body mass index; SD = standard deviation

Breast cancer characterisation

Regarding histological subtype, the majority of cases corresponded to invasive ductal carcinoma (IDC), accounting for 89.7% (*n* = 217), followed by lobular carcinoma (4.5%) and other types (0.8%). Histological grade showed that 64.5% of tumours were grade 2 (*n* = 156) and 19.8% grade 3 (*n* = 48), while only 3.3% were grade 1. Tumour grade data were unavailable in 12% of cases (Table 3).

Regarding molecular subtype by immunohistochemistry, Luminal B-like was the most frequent (40.1%, *n* = 97), followed by Luminal A-like (15.3%, *n* = 37), triple-negative (18.2%, *n* = 44) and HER2-positive (10.3%, *n* = 25). Among patients with Luminal B-like subtype, 75% were Luminal B HER2-negative and 25% Luminal B HER2-positive (Table 3).

Hormone receptor expression showed that 94.6% of patients were ER-positive (*n* = 229) and 85.1% PR-positive (*n* = 206). The Ki-67 marker had a mean of 31.88% (range: 1–95), with a median of 30%, consistent with intermediate to high cellular proliferation [12], particularly in subtypes such as Luminal B and triple-negative.

Staging and tumour extension

About 46.3% of patients were diagnosed at stage III (*n* = 112), followed by stage II (27.3%, *n* = 66), stage IV (12.4%, *n* = 30) and stage I (5.8%, *n* = 14). This indicates that over 70% of patients accessed the health system at stages II and III, representing a critical finding of the study (Table 2).

Table 3. Pathological and molecular tumour characteristics.

Characteristic	*n* (%)
Histological subtype	
IDC	217 (89.7%)
Invasive lobular carcinoma	11 (4.5%)
Other types	2 (0.8%)
Missing data	12 (5.0%)
Histological grade	
Grade 1	8 (3.3%)
Grade 2	156 (64.5%)
Grade 3	48 (19.8%)
Missing data	29 (12.0%)
Molecular subtype (IHC)	
Luminal A-like	37 (15.3%)
Luminal B-like*	97 (40.1%)
HER2-negative	73 (75.3% of Luminal B)
HER2-positive	24 (24.7% of Luminal B)
HER2-positive (non-luminal)	25 (10.3%)
Triple-negative	44 (18.2%)
Missing data	39 (16.1%)

Abbreviations: IHC = immunohistochemistry
*Note: Luminal B-like defined as ER-positive and/or PR-positive with Ki-67 ≥20% and/or HER2-positive per St. Gallen consensus criteria

Regarding tumour size (T), 38.4% presented with T3 tumours (*n* = 93) and 25.6% with T4 (*n* = 62), indicating locally advanced disease in over 60% of cases. About 45.5% of patients had axillary lymph node involvement (N1, N2 or N3), with N1 being most common (45.5%, *n* = 110), while 26.4% had no lymphadenopathy (N0).

Distant metastasis (M) was documented in 12.0% of cases (*n* = 29), while 69.4% (*n* = 168) presented without evidence of metastasis (M0). However, this information was unavailable in 18.6% of patients.

Diagnostic delay times

The partial diagnostic interval – defined as time between first diagnostic investigation indicated for clinical suspicion of cancer (ultrasound or mammography) and date of diagnosis, established as the date of pathological report (criterion 1c of the ENCR) [9] – had a mean of 79 days (range: 0–734 days; SD = 119.0), representing approximately 11 weeks (Table 4).

Following diagnosis, the early pretreatment interval – i.e. time elapsed between date of diagnosis and first consultation with an oncology specialist, as part of the treatment planning phase – showed a mean of 65.7 days (range: 0–702 days; SD = 111.73), representing approximately 9 weeks (Table 4).

These intervals combined yield a mean of 144.7 days (~20 weeks); it should be noted that these are partial intervals and do not represent total diagnostic-to-treatment delay time.

Time intervals along the diagnostic–therapeutic pathway showed no significant differences according to breast cancer molecular subtype. The interval between histopathological diagnosis and first medical oncology consultation did not vary significantly among molecular subtypes (Kruskal–Wallis test: H(3) = 2.334; $p = 0.506$; *n* = 187). Similarly, time elapsed between first medical consultation and mammography performance did not differ among molecular subtypes (H(3) = 1.649; $p = 0.648$; *n* = 167) (Table 5).

Table 4. Diagnostic–therapeutic delay intervals (days).

Interval	Mean ± SD	Median (P25–P75)	Range
Partial diagnostic interval*	79.0 ± 119.0	45 (21–98)	0–734
Early pretreatment interval†	65.7 ± 111.7	38 (15–82)	0–702
Total (diagnostic + pretreatment)	144.7 ± 186.5	92 (48–165)	0–987

Abbreviations: SD = standard deviation; P25–P75 = 25th–75th percentiles (interquartile range)
Notes:* Defined as time elapsed between first diagnostic imaging (mammography or ultrasound) and histopathological report date
† Defined as time elapsed between histopathological diagnosis and first consultation with medical oncology specialist

Table 5. Time intervals across the diagnostic–therapeutic pathway by molecular subtype (days)

Molecular subtype	Diagnosis to oncology consultation Mean ± SD (*n*)	Diagnostic interval imaging to pathology report mean ± SD (*n*)
Luminal A	42.5 ± 50.9 (33)	21.6 ± 43.1 (34)
Luminal B	57.1 ± 90.8 (90)	41.2 ± 82.3 (80)
HER2-positive	103.1 ± 172.3 (23)	33.7 ± 61.7 (21)
Triple-negative	61.5 ± 107.9 (41)	21.9 ± 33.3 (32)
Total	61.1 ± 103.4 (187)	32.5 ± 65.9 (167)

Notes: All values expressed as mean ± standard deviation (SD) in days
The mean partial diagnostic interval of 79 days (SD 119) reflects the full cohort with available data (*n* = 181). The total value in this table reflects the subset of patients with complete data for this evaluation

No significant differences were observed according to tumour stage either. The diagnostic interval (time between first diagnostic imaging indicated for clinical suspicion and histopathological report) was homogeneous across stages I–IV ($H(3) = 0.280$; $p = 0.964$; $n = 181$). Similarly, the interval from histopathological diagnosis to first consultation with a medical oncology specialist did not vary among stages ($H(3) = 2.218$; $p = 0.528$; $n = 201$) (Table 6).

Multivariate predictors of advanced-stage disease

In the multivariate logistic regression analysis with multiple imputations ($n = 242$, five imputations), molecular subtype emerged as the only independent predictor of advanced-stage presentation at diagnosis. Compared to triple-negative breast cancer, patients with Luminal A subtype had significantly lower odds of presenting with advanced-stage disease (OR 0.09, 95% CI 0.02–0.32, $p < 0.001$), and those with Luminal B subtype also showed reduced odds (OR 0.30, 95% CI 0.10–0.96, $p = 0.043$). HER2-positive subtype showed a trend towards lower odds but did not reach statistical significance (OR 0.41, 95% CI 0.10–1.71, $p = 0.221$) (Table 7).

Notably, neither the partial diagnostic interval (OR 1.00 per day, 95% CI 0.996–1.002, $p = 0.581$) nor the early pretreatment interval (OR 1.00 per day, 95% CI 0.998–1.005, $p = 0.460$) was significantly associated with advanced-stage presentation after adjusting for molecular subtype, age, tumour grade and BMI category. The total combined interval also showed no significant association (OR 1.01 per day, 95% CI 0.993–1.036, $p = 0.184$) (Table 7).

Age younger than 40 years (OR 0.73, 95% CI 0.30–1.79, $p = 0.492$), tumour grade ($p > 0.05$ for all comparisons) and BMI category ($p > 0.05$ for all comparisons) were not independently associated with stage at diagnosis in the multivariate model.

Discussion

The most striking finding of our study is that 58.7% of women with breast cancer at a public referral centre in Bolivia are present with advanced-stage disease (stages III–IV), with nearly one in eight patients (12.4%) having distant metastases at diagnosis. This figure exceeds the regional Latin American average of 41% reported in a recent meta-analysis [13] and falls far short of the WHO GBCI Pillar 1 target of diagnosing at least 60% of breast cancers at stages I–II [12]. Additionally, 40.1% of tumours were Luminal B-like, a subtype associated with more aggressive biology and poorer prognosis than Luminal A. Also, our results show prolonged partial intervals, with a mean of 144 days (~20 weeks) on average in a smaller country with more limited resources.

About 58.7% of patients enter the health system at advanced stages (III–IV). These findings align with previously reported literature; studies indicate that 30%–80% of breast cancer patients in low-resource countries present with metastatic or locally advanced disease due to prolonged care intervals [6, 8]. In Latin America, alarming rates of advanced stages have been described; a meta-analysis reported 41% of stages III–IV [13], percentages exceeded in the Bolivian population studied.

Table 6. Time intervals across the diagnostic–therapeutic pathway by disease stage (days).

Disease stage	Diagnosis to oncology consultation Mean ± SD (*n*)	Diagnostic interval imaging to pathology report Mean ± SD (*n*)
Stage I	35.9 ± 32.5 (13)	19.7 ± 18.6 (11)
Stage II	45.4 ± 67.5 (61)	40.3 ± 84.0 (52)
Stage III	75.6 ± 123.3 (102)	29.4 ± 59.3 (93)
Stage IV	55.1 ± 92.3 (25)	25.0 ± 38.1 (25)
Total	61.3 ± 101.8 (201)	31.3 ± 63.6 (181)

Notes: All values expressed as mean ± standard deviation (SD) in days
The mean partial diagnostic interval of 79 days (SD 119) reflects the full cohort with available data ($n = 181$). The total value in this table reflects the subset of patients with complete data for this evaluation

Table 7. Multivariate predictors of advanced-stage disease (stages III–IV versus I–II) using multiple imputations (*n* = 242, five imputations).

Variable	Adjusted OR	95% CI	*p*-value
Age <40 years (versus ≥40)	0.73	0.30–1.79	0.492
Molecular subtype (ref: Triple-negative)			
Luminal A	0.09	0.02–0.32	<0.001
Luminal B	0.30	0.10–0.96	0.043
HER2-positive	0.41	0.10–1.71	0.221
Tumour grade (ref: Grade 3)			
Grade 1	0.71	0.10–4.93	0.729
Grade 2	0.75	0.27–2.07	0.574
BMI category (ref: Normal/Underweight)			
Overweight	0.62	0.05–8.16	0.719
Obesity I	0.64	0.05–7.88	0.727
Obesity II	0.50	0.04–6.22	0.586
Obesity III	0.64	0.04–10.29	0.752
Diagnostic interval (per day)	1.00	0.996–1.002	0.581
Pretreatment interval (per day)	1.00	0.998–1.005	0.460
Total interval (per day)	1.01	0.993–1.036	0.184

Abbreviations: OR = odds ratio; CI = confidence interval; BMI = body mass index

Globally, mean total delay time has been described as 13.8 weeks (median 10.0) [14]. Mean total delay time (encompassing patient- and system-related delays) has been reported as 4.9 weeks in the United States and 9.3 weeks in Denmark [14]. Longer delays have been observed in Malaysia (3–6 months) [14, 15]; and in India, where total delay was 67.5 days (9.6 weeks) in rural areas and 53.7 days (7.6 weeks) in urban areas, with additional differences between illiterate and literate patients [14, 16]. In Mexico, a study reported a median patient interval of 10 days and a median diagnostic interval of 128 days (approximately 16 weeks) [8]. The LATINA Breast Study (LACOG 0615/MO39485) also reported a median of 55 days (~7 weeks) from diagnosis to first oncological treatment [17].

Another study in Sri Lanka considered delays as >4 weeks from pathology report to first day of treatment (treatment delay) and >4 weeks from healthcare professional consultation to pathological diagnosis (diagnostic delay); diagnostic delay was observed in one-third of cases (36.7%, 95% CI: 33.4%–40.0%), while treatment delays (13.2%, 95% CI: 10.8%–15.5%) were less frequent [6]. Jassem *et al* [18] reported mean patient-related delay and total delay times of 4.7 weeks (range: 3.4–6.2) and 14.4 weeks (range: 11.5–29.4), respectively. In comparison, our results show considerably longer partial intervals, with a mean of 144 days (~20 weeks) in Bolivia – a smaller country with more constrained health-system resources than several of those reported above.

Regarding the biology of delay, tumour doubling times vary enormously within and between studies, partly due to non-linear (Gompertzian) growth kinetics; total tumour lifespan also cannot be precisely determined, further obscuring the relationship between tumour doubling times, delays and outcomes. Nevertheless, time to surgery, chemotherapy and radiotherapy initiation has been shown to influence oncological outcomes [19].

These partial data are concerning, considering that meta-analyses have demonstrated that total delays exceeding 3 months are associated with decreased survival [10, 14, 20]; furthermore, delays lead to more aggressive treatments, higher mastectomy rates, treatments with greater toxicity and duration and significant psychological morbidity, thereby affecting patients' quality of life [10].

Generating hypotheses regarding causes of delay in this Bolivian population sample, we should reference prior studies showing that patient interval was longer among single women, who interpreted symptoms as non-concerning, concealed symptoms and perceived lack of financial resources and difficulty missing work as barriers to seeking care [8]. In the Sri Lankan study, the following causes of delay were identified: low monthly family income, limited health literacy, need for more than two visits to the first healthcare provider before diagnosis; poor knowledge about breast cancer, whereas direct contact with an appropriate specialised healthcare provider upon lump detection reduced diagnostic delay [6].

In Latin America, delays in diagnosis and treatment contribute to cancer mortality rates; although further research is needed, it is suggested that longer delays in the region are provider-related rather than patient-related [21].

Considering all the above, being in a resource-limited country such as Bolivia, with a fragmented health system, lack of mammography equipment, personnel trained in biopsy procedures and absence of undergraduate oncology training, may explain the observed delays, which lead to the factors identified in prior studies.

Our findings reveal a critical paradox in breast cancer diagnosis in Bolivia: over 58% of patients entered the health system at advanced stages (III–IV), despite the absence of significant differences across clinical stages. In resource-limited contexts such as ours, factors such as low awareness of warning signs, cultural beliefs, fear of diagnosis, geographical distance to health centres and economic difficulties often prolong this first critical interval, leading most women to enter the system only once the disease is already locally advanced [22]. Therefore, causal interpretations should be made with caution. The observed pattern could also reflect a combination of patient-related and unmeasured system-level factors operating before the first diagnostic imaging, such as inadequate primary care evaluation or multiple referrals before appropriate imaging is ordered.

Multivariate analysis revealed that molecular subtype, rather than diagnostic or pretreatment intervals, was the primary independent predictor of advanced-stage presentation. Triple-negative breast cancer was associated with significantly higher odds of advanced-stage diagnosis compared to Luminal subtypes, consistent with the known aggressive biology and rapid growth kinetics of this subtype [22]. This finding suggests that biological factors may play a more important role than system-level delays in determining stage at presentation for certain molecular subtypes.

Several Latin American countries have implemented some strategies to reduce breast cancer delays. Mexico's Seguro Popular established the Fund for Protection Against Catastrophic Expenditures, which expanded financial coverage for breast cancer diagnosis and treatment through accredited centres. However, subsequent evaluations did not demonstrate a significant reduction in patient or treatment delays after its implementation [23]. Chile's Universal Access with Explicit Guarantees (Acceso Universal con Garantías Explícitas) program provides legally enforceable guarantees for timely breast cancer diagnosis and treatment within predefined timeframes. When these guarantees cannot be met in the public sector, patients must be referred to another accredited provider with financial coverage maintained by the public insurance system (FONASA) [24].

Based on these experiences and the particularities of the Bolivian context, we propose the following specific next steps: establishing a national organised screening program, guaranteeing diagnostic timelines, strengthening pathology and imaging capacity, developing a functional national cancer registry, implementing financial protection mechanisms and launching culturally appropriate health literacy campaigns.

Study limitations

Several limitations of this study warrant consideration. Firstly, its retrospective nature inherently relied on the quality and completeness of existing medical records, which resulted in missing data for specific segments of the diagnostic–therapeutic pathway. Consequently, we were unable to measure the patient interval (symptom onset to first consultation), the time from first consultation to treatment initiation interval. Secondly, due to these documentation constraints, we could not directly assess system-dependent bottlenecks or patient-related delays. This includes socioeconomic, educational, geographic and cultural factors that may heavily influence healthcare-seeking behaviour.

Conclusion

In this reference public institution in Bolivia, women with breast cancer frequently present at advanced stages (III–IV), are accompanied by partial time delays. However, multivariate analysis revealed that these measured diagnostic and pretreatment intervals are not independently associated with stage at diagnosis. Instead, tumour biology – specifically the triple-negative molecular subtype – emerged as the primary independent predictor of advanced presentation.

These findings warrant cautious interpretation in light of the evaluated partial intervals and inherent methodological constraints. Nevertheless, they underscore the urgent need to implement structured early-detection programs, health literacy initiatives and streamlined care pathways to improve oncological outcomes. Furthermore, prospective studies measuring the complete diagnostic–therapeutic pathway – particularly patient-related intervals – remain essential to fully characterise these barriers and design effective, targeted interventions in Bolivia.

Conflicts of interest

The authors declare no competing interests.

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AI declaration

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