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# Clinical presentation, diagnostic pathway, treatment patterns, and survival among women with cytologically diagnosed breast cancer in two national referral hospitals in Niger: A five-year retrospective multicenter cohort study

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## ABSTRACT

### Background
Breast cancer is the leading cancer among women worldwide, with disproportionately high mortality in low- and middle-income countries due to delayed diagnosis and limited access to comprehensive care. Contemporary data describing breast cancer management in Niger remain scarce. This study aimed to describe the clinical presentation, diagnostic pathway, treatment patterns, and survival of women with breast cancer managed in the country's two national referral hospitals.

### Methods
We conducted a retrospective multicenter cohort study including women with breast cancer diagnosed by fine-needle aspiration cytology (FNAC), with or without subsequent histopathological confirmation, between January 2020 and December 2024 at the National Cancer Control Center (CNLC) of Niamey and the Issaka Gazoby Maternity Hospital(MIG). Duplicate records were identified and merged using the unique national identification number assigned by the National Cancer Control Center, ensuring that each patient was included only once. Demographic, clinicopathological, treatment, and follow-up data were extracted from medical records. Overall survival was estimated using the Kaplan-Meier product-limit method

from the date of cytological diagnosis to death or censoring. Patients alive at five years, alive at the last documented contact, or lost to follow-up were censored at their last known date alive.

**Results**

A total of 674 women were included. The median age was 45 years (interquartile range: 35-53), and 70.0% presented with AJCC Stage III-IV disease after a median consultation delay of 7 months. Although FNAC established the diagnosis in all patients, only 25.5% underwent histopathological confirmation, and no patients received immunohistochemical characterization. Modified radical mastectomy was the predominant surgical procedure, and chemotherapy was administered to most patients, whereas radiotherapy and endocrine therapy remained available to only about one-third of women. During follow-up, 10.4% died and 28.5% were lost to follow-up. Kaplan-Meier analysis demonstrated significantly poorer overall survival among women presenting with advanced-stage disease (log-rank $P < 0.001$).

**Conclusions**

Breast cancer in Niger is characterized by delayed presentation, advanced-stage disease, and major deficiencies in pathological diagnosis despite universal access to cytological confirmation. Limited availability of histopathology, immunohistochemistry, radiotherapy, and long-term follow-up constrain delivery of guideline-concordant care. Strengthening early diagnosis, expanding pathology and molecular diagnostic services, reducing financial barriers, and improving continuity of care should be priorities for breast cancer control in Niger and similar resource-constrained settings.

**Keywords:** Breast cancer; Fine-needle aspiration cytology; Histopathology; Survival; Breast neoplasms; Sub-Saharan Africa; Niger; Low-resource settings.

## 1. BACKGROUND

Breast cancer is the most commonly diagnosed malignancy and the leading cause of cancer-related death among women worldwide. Global Cancer Statistics, 2022, estimated approximately 2.3 million new cases and 670,000 deaths, with mortality disproportionately concentrated in low- and middle-income countries, where delayed diagnosis and limited access to comprehensive care adversely affect survival [1].

The burden of breast cancer has increased steadily across Sub-Saharan Africa because of population growth, longer life expectancy, urbanization, and changing reproductive and lifestyle patterns. Survival remains substantially lower than in high-income countries, largely because many women present with advanced disease and face persistent barriers to timely diagnosis, pathology services, and effective multimodal treatment [2-4].

To address these disparities, the World Health Organization launched the Global Breast Cancer Initiative, which aims to reduce breast cancer mortality through earlier diagnosis, timely diagnostic assessment, and equitable access to quality treatment. The initiative recommends that at least 60% of breast cancers be diagnosed at stages I-II and emphasizes rapid referral and timely initiation of evidence-based care [5]. Achieving these targets remains difficult in many African countries because pathology services, radiotherapy facilities, specialized personnel, and coordinated referral systems remain limited [5].

Studies from Nigeria, Ethiopia, Tanzania, Rwanda, Uganda, Botswana, South Africa, and other sub-Saharan African settings consistently report prolonged diagnostic delays and frequent presentation with large tumors, axillary lymphadenopathy, or metastatic disease [6-13]. These delays have been associated with limited awareness, low educational attainment, financial hardship, geographical barriers, sociocultural beliefs, and weaknesses in referral pathways. Inadequate access to histopathological confirmation and biomarker testing further restricts accurate tumor classification and the use of personalized treatment strategies [5,14].
In Niger, breast cancer is the most frequently diagnosed malignancy among women and a major cause of cancer-related mortality [15]. Specialized services are concentrated in a small number of referral institutions, requiring many patients to travel long distances for care. Female cancer staging investigations and oncological treatments were supported within the public system (Decree N° 2007-261/PRN/MSP (Juily 19th 2007)[16], whereas FNAC, core needle biopsy, histopathological examination, and other essential diagnostic procedures were commonly financed through out-of-pocket payments. Pathology services were also scarce, and some surgical specimens were not submitted for examination because of financial limitations or local practices involving the return of excised tissues to families. Consequently, treatment decisions frequently relied on cytological findings, clinical staging, and available imaging, rather than complete pathological and immunohistochemical characterization.
Published evidence on breast cancer care in Niger remains limited and is largely derived from small single-center series or narrative reviews [17]. Contemporary multicenter data describing clinical presentation, diagnostic pathways, treatment patterns, and follow-up outcomes are therefore needed to identify priorities for service improvement.

This study aimed to characterize the clinical presentation, diagnostic pathway, treatment patterns, and survival status of women with cytologically diagnosed breast cancer managed over five years in the two principal national referral hospitals in Niamey. By documenting routine care in a resource-constrained setting, the study seeks to inform strategies for earlier diagnosis, improved pathological confirmation, more equitable access to treatment, and strengthened breast cancer services in Niger.

## 2. METHODS

### 2.1 Study design and setting

We conducted a multicenter, retrospective cohort study of women with breast cancer managed between 1 January 2020 and 31 December 2024 in the two principal national referral hospitals for breast cancer care in Niamey, Niger: Issaka Gazobi Maternity Hospital (MIG) and the National Cancer Control Center (CNLC).
MIG is the country's largest tertiary referral maternity hospital and serves as a referral center for surgery and hospitalization for breast and gynecological cancers from all eight administrative regions of Niger. Surgical management of breast diseases is performed within its Department of Obstetrics and Gynecology.

The CNLC is the national referral institution responsible for cancer diagnosis and treatment.
In Niger, women with suspected breast cancer are initially evaluated at peripheral health facilities or referral hospitals. Following cytological or histopathological diagnosis, patients

requiring oncological management are systematically referred to the National Cancer Control Center (Centre National de Lutte Contre le Cancer, CNLC), which coordinates systemic treatment and provides government-funded cancer care. Each patient receives a unique CNLC identification number that is retained throughout treatment, irrespective of the hospital where the diagnosis or initial surgery was performed. This centralized referral system enables reliable linkage of medical records across participating institutions and facilitates longitudinal follow-up.

### 2.2 Health system context

Breast cancer diagnosis in Niger is performed under important resource constraints. During the study period, fine-needle aspiration cytology (FNAC) represented the most accessible diagnostic procedure and was routinely used before treatment initiation.

Although the Government of Niger financed cancer staging investigations and oncological treatment, diagnostic procedures required before treatment including FNAC, core needle biopsy, and histopathological examination of surgical specimens were generally financed through out-of-pocket payments by patients [16].

Furthermore, histopathological examination of surgical specimens was frequently not performed because of availability (for all eight administrative regions of Niger, histopathology laboratories were available only in Niamey and Zinder), financial constraints or cultural practices whereby excised breast specimens were taken home and buried by relatives without laboratory analysis. Consequently, immunohistochemistry was unavailable for all patients included in the study, and treatment decisions were primarily based on cytological findings, clinical examination, and imaging when available.

This context is essential for interpreting the diagnostic pathway and treatment patterns observed in the present study.

### 2.3 Study population

Eligible participants were women with a diagnosis of breast cancer established by fine-needle aspiration cytology (FNAC), with or without subsequent histopathological confirmation, between 1 January 2020 and 31 December 2024, who subsequently received oncological management through the CNLC.

### 2.4 Inclusion criteria

Patients were included if their medical records contained:

a cytological or histological diagnosis of breast carcinoma; demographic and clinical information at diagnosis; TNM stage at presentation; treatment information; and at least one documented follow-up visit or vital status after diagnosis.

### 2.5 Exclusion criteria

Patients with benign breast lesions, non-diagnostic cytology or histology, recurrent breast cancer diagnosed before the study period, or medical records lacking essential baseline information were excluded.

### 2.6 Identification of participants and duplicate management

Potentially eligible patients were identified from pathology laboratory registers, surgical registers, oncology records, and CNLC treatment databases.

Because many women underwent diagnosis, biopsy, or surgery at one institution before referral to the CNLC for oncological treatment, duplicate records could occur across hospitals. Duplicate entries were identified and removed using the unique national CNLC identification number, which is assigned to every patient receiving cancer treatment in Niger. When duplicate records were identified, information from all available sources was merged into a single study record to maximize completeness while ensuring that each woman contributed only once to the cohort.

**2.7 Data collection**

Data were extracted from standardized medical records using a predefined collection form by trained investigators.

Whenever possible, information was cross-checked using surgical registers, chemotherapy records, pathology reports, imaging reports, hospitalization records, and outpatient oncology files to improve data completeness and accuracy.

**2.8 Variables**

Variables collected included:

Age; place of residence; educational level;
reproductive history; consultation delay; clinical presentation; tumor laterality; tumor size; axillary lymph node involvement;
AJCC clinical TNM stage; cytological diagnosis; histopathological confirmation; immunohistochemistry;
surgical procedures; systemic treatment; radiotherapy; endocrine therapy; treatment completion; recurrence; vital status; and dates of diagnosis, treatment, follow-up, and death when available.

Clinical staging was assigned according to the 8th edition of the American Joint Committee on Cancer (AJCC) TNM classification using clinical examination and available imaging performed before initiation of treatment.

**2.9 Outcomes**

The primary outcomes were: clinical stage at diagnosis; diagnostic pathway; treatment patterns; and overall survival.

Overall survival was defined as the interval between the date of cytological diagnosis (FNAC) and death from any cause.

Women who remained alive at the administrative end of follow-up (five years after diagnosis) or at their last documented clinical contact were right-censored at that date. Patients lost to follow-up were not excluded from survival analyses; instead, they were censored on the date of their last documented contact.

Advanced-stage disease was defined as American Joint Committee on Cancer (AJCC) stage III or IV, whereas stages I and II were classified as early-stage disease.

Consultation delay corresponded to the interval between the patient's first recognition of breast symptoms and her first consultation with a qualified healthcare professional.

**2.10 Statistical analysis**

Analyses were performed using SPSS Statistics version 27.0.2. Continuous variables were summarized as means with standard deviations (SD) or medians with interquartile ranges (IQR), depending on their distribution. Categorical variables were presented as frequencies and percentages.
Overall survival was estimated using the Kaplan-Meier product-limit method, with survival time calculated from the date of cytological diagnosis to death or censoring. Survival curves were compared using the log-rank test. Patients alive at five years, alive at the last recorded follow-up before five years, or lost to follow-up were treated as censored observations at their last known date alive. No patients were excluded from the survival analysis because of loss to follow-up.
Median follow-up was estimated using the reverse Kaplan-Meier method.

All statistical tests were two-sided, and a P value $<0.05$ was considered statistically significant.

### 2.11 Ethical considerations

The study was approved by the Institutional Review Board of the Faculty of Health Sciences, Abdou Moumouni University, Niamey, Niger (Approval No. 000978/2AUA/FSS/SS).

Because of the retrospective design and the exclusive use of anonymized, routinely collected medical records, the Institutional Review Board waived the requirement for informed consent. All data were anonymized before analysis, and the study was conducted in accordance with the principles of the Declaration of Helsinki.

## 3. RESULTS

### 3.1 Study population

During the five-year study period (January 2020 to December 2024), 1,155 women were managed for malignant diseases at the two participating national referral hospitals. Of these, 674 women were diagnosed with breast cancer, representing 58.4% of all female cancer cases managed during the study period. Following the application of the predefined eligibility criteria, all 674 women with cytologically diagnosed breast cancer were included in the final analysis (Figure 1).
The annual number of women managed for breast cancer increased steadily throughout the study period, rising from 69 cases in 2020 to 209 cases in 2024, corresponding to an approximately threefold increase.

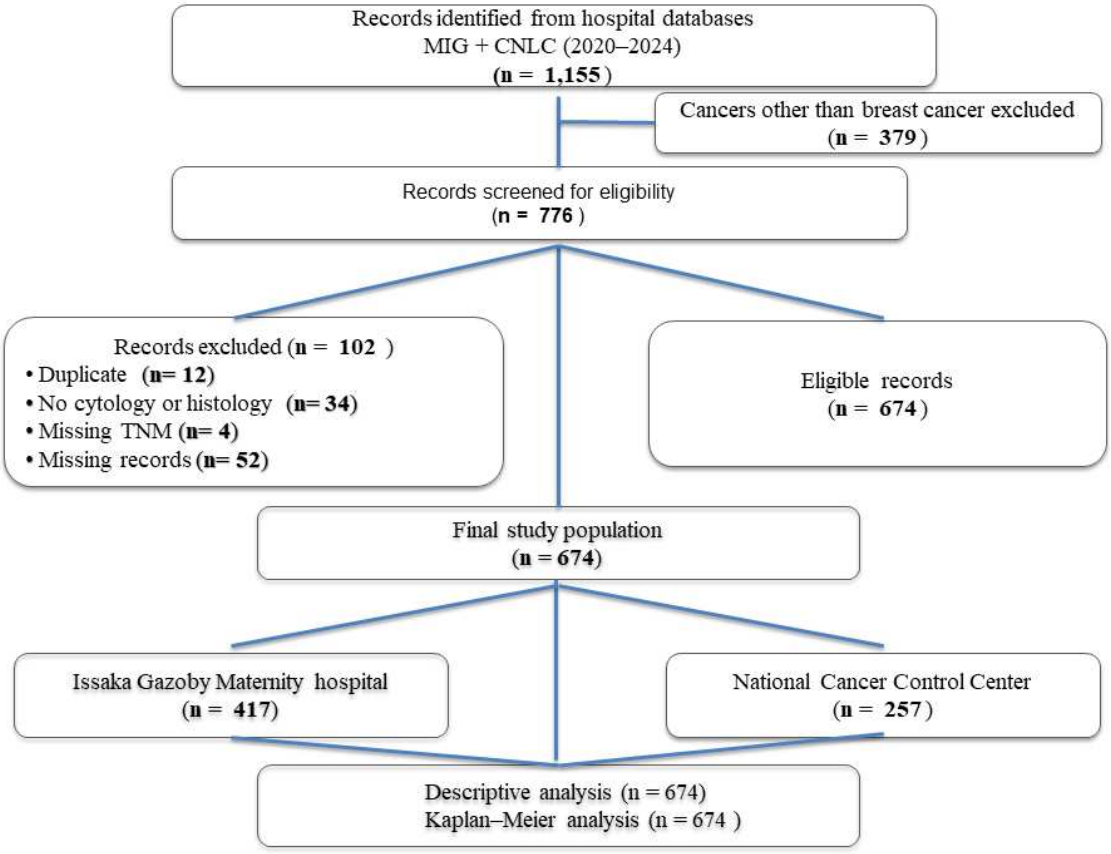



**Figure 1**. STROBE flow diagram of participant selection

### 3.2 Sociodemographic and reproductive characteristics

The sociodemographic and reproductive characteristics of the study population are summarized in Table 1. The mean age of the participants was 46.5±12.6 years (range: 14-92 years), with a median age of 45 years (IQR: 35-53). Women aged 50-69 years constituted the largest age group (32.5%), while 38 women (5.7%) were younger than 30 years, including two adolescents aged 14 years. Women aged 70 years or older accounted for 6.4% of the study population.

Most participants were housewives (80.0%), married (76.5%), had no formal education (64.7%), and resided in rural areas (61.5%). Premenopausal and postmenopausal women represented 48.8% and 51.2% of the cohort, respectively. The mean parity was 3.6±2.5, and 50.3% of women had four or more previous deliveries.

A family history of breast cancer was reported by 17.0% of women, whereas a family history of gynecological malignancy was uncommon. A previous history of contralateral breast cancer was documented in 13 patients (1.9%). No patient had a documented history of ovarian or endometrial cancer. Previous hormonal contraceptive use was reported by 7.9% of participants, while 98.4% reported history of breastfeeding. Hormone replacement therapy was exceptionally rare, being documented in only two women (0.3%).

**Table 1.** Sociodemographic and reproductive characteristics of women with cytologically diagnosed breast cancer managed in two national referral hospitals in Niger (N = 674).

| Variable | Category | N | % |
|---|---|---|---|
| Age (years) | Mean ± SD | 46.5±12.6 | |
| | Median (IQR) | 45(35-53) | |
| | <40 | 209 | 31.0 |
| | 40-49 | 203 | 30.1 |
| | 50-69 | 219 | 32.5 |
| | ≥70 | 43 | 6.4 |
| Marital status | Single | 16 | 2.4 |
| | Married | 516 | 76.5 |
| | Divorced/Separated | 36 | 5.3 |
| | Widowed | 106 | 15.7 |
| Educational level | No formal education | 436 | 64.7 |
| | Primary | 73 | 10.8 |
| | Secondary | 115 | 17.0 |
| | Higher | 50 | 7.4 |
| Occupation | Housewife | 539 | 80.0 |
| | Civil servant | 40 | 5.9 |
| | Trader | 32 | 4.8 |
| | Other | 63 | 9.3 |
| Residence | Urban | 259 | 38.5 |
| | Rural | 415 | 61.5 |
| Menopausal status | Premenopausal | 329 | 48.8 |
| | Postmenopausal | 345 | 51.2 |
| Parity | Mean ± SD | 3.6 ± 2.5 | |
| | Nulliparous | 10 | 1.5 |
| | 1–3 | 325 | 48.2 |
| | ≥4 | 339 | 50.3 |
| Family history of breast cancer | Yes | 115 | 17.0 |
| | No | 559 | 83.0 |
| Hormonal contraceptive use | No | 621 | 92.1 |
| | Yes | 53 | 7.9 |
| Breastfeeding history | Yes | 663 | 98.4 |
| | No | 11 | 1.6 |

Abbreviations: SD: standard deviation; IQR: interquartile range.

### 3.3 Clinical presentation and diagnostic pathway

The clinical presentation and diagnostic pathway of the study population are summarized in Table 2. Overall, 65.4% of women were referred from hospitals located outside Niamey, while 53.7% were referred by another healthcare facility. Eight patients (1.2%) originated from neighboring countries, including Nigeria and Benin, reflecting the regional referral role of the participating institutions.

A palpable breast lump was the most common presenting complaint, reported by 469 women (69.6%), followed by breast pain (7.6%), ulceration (5.9%), nipple discharge (5.5%), and other

breast-related symptoms (11.4%). The median consultation delay was 7 months (IQR: 4-12), with a mean delay of 10.4 ±11.8 months (range: 3 days to 96 months). More than 60% of women sought medical attention only after six months from symptom onset.

Breast cancer involved the left breast in 49.5% of patients, the right breast in 45.7%, and was bilateral in 4.7%. The upper outer quadrant was the most frequently affected location (54.4%). Ipsilateral clinical axillary lymphadenopathy was present in 72.1% of women, indicating a high burden of locoregional advanced disease at presentation.

All women had a malignant fine-needle aspiration cytology (FNAC) result, which constituted the primary diagnostic method in this cohort. Additional breast imaging was performed selectively, with mammography and breast ultrasound available for only a minority of patients. Core needle biopsy was performed in 13 women (1.9%), whereas histopathological confirmation was obtained for only 172 patients (25.5%). Among these, invasive ductal carcinoma was the predominant histological subtype (81.4%), and Grade II tumors represented the most frequent histological grade (61.0%). No patients underwent immunohistochemical characterization during the study period.

Clinical staging demonstrated that 472 patients (70.0%) were diagnosed with advanced-stage disease (AJCC stages III-IV), including 430 (63.8%) with stage III disease and 42 (6.2%) with stage IV disease. Conversely, only 202 patients (30.0%) presented with early-stage disease (stages I-II). The distribution of clinical stage at diagnosis is illustrated in Figure 2.

**Table 2** Clinical presentation and diagnostic pathway of women with cytologically diagnosed breast cancer managed in two national referral hospitals in Niger (N = 674).

| **Variable** | **Category** | **N** | **%** |
|---|---|---|---|
| Consultation delay (months) | Mean ± SD | 10.4±11.8 | |
| | Median (IQR) | 7 (4-12) | |
| | <3 | 77 | 11.4 |
| | 3-5 | 189 | 28.0 |
| | 6-11 | 239 | 35.5 |
| | ≥12 | 169 | 25.0 |
| Reason for consultation | Breast lump | 469 | 69.6 |
| | Breast pain | 51 | 7.6 |
| | Ulceration | 40 | 5.9 |
| | Nipple discharge | 37 | 5.5 |
| | Other | 77 | 11.4 |
| Tumor laterality | Right | 308 | 45.7 |
| | Left | 334 | 49.5 |
| | Bilateral | 32 | 4.7 |
| Breast quadrant (n=706)* *32 bilateral cases | Upper outer | 384 | 54.4 |
| | Upper inner | 180 | 25.5 |
| | Lower outer | 46 | 6.5 |
| | Lower inner | 49 | 7.0 |
| | Central | 47 | 6.6 |
| Clinical tumor size | ≤2 cm | 78 | 11.6 |
| | >2-5 cm | 512 | 76.0 |
| | >5 cm | 84 | 12.5 |

| | | | |
|---|---|---|---|
| Clinical axillary lymphadenopathy | Present | 486 | 72.1 |
| | Absent | 188 | 27.9 |
| Clinical stage (AJCC) | Stage I | 82 | 12.2 |
| | Stage II | 120 | 17.8 |
| | Stage III | 430 | 63.8 |
| | Stage IV | 42 | 6.2 |
| Diagnostic pathway | FNAC performed | 674 | 100 |
| | Core needle biopsy performed | 13 | 1.9 |
| | Histopathological confirmation available | 172 | 25.5 |
| | Histopathological confirmation unavailable | 502 | 74.5 |
| | Surgical specimen and/or core biopsy submitted for pathology * | 185 | 27.4 |
| | Surgical specimen not submitted | 502 | 74.5 |
| | Immunohistochemistry performed | 0 | 0.0 |
| | Immunohistochemistry unavailable | 674 | 100 |
| Histological subtype (n=172) | Invasive ductal carcinoma | 140 | 81.4 |
| | Invasive papillary carcinoma | 14 | 8.2 |
| | Invasive lobular carcinoma | 9 | 5.2 |
| | Other | 9 | 5.2 |
| Histological grade (n=172) | Grade I | 24 | 14.0 |
| | Grade II | 105 | 61.0 |
| | Grade III | 43 | 25.0 |

Abbreviations: **FNAC**: fine-needle aspiration cytology; **AJCC**: American Joint Committee on Cancer; **SD**: standard deviation; **IQR**: interquartile range; * for 13 women biopsy and surgical specimen were submitted for pathology.

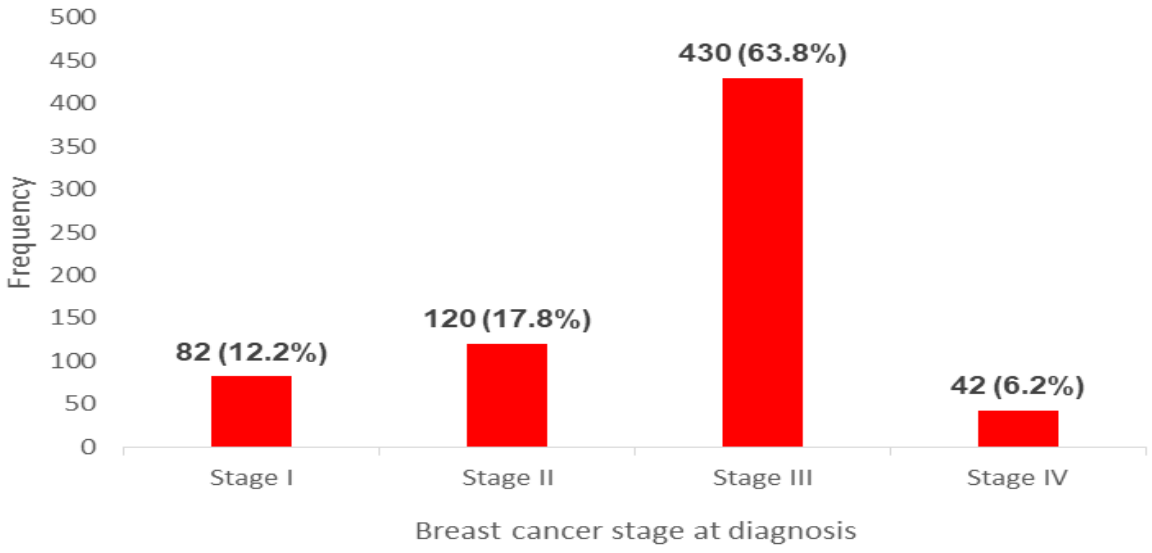



**Figure 2.** Distribution of clinical stage at diagnosis according to the AJCC classification

### 3.4 Treatment patterns

Treatment patterns are summarized in Table 3. Overall, 511 women (75.8%) underwent surgical treatment, whereas 163 (24.2%) did not receive surgery. Among those who underwent surgery, modified radical mastectomy was by far the most frequently performed procedure (377/511, 73.8%), followed by breast-conserving surgery (15.3%) and toilet mastectomy (10.9%). Axillary lymph node dissection accompanied most surgical procedures (70.8%), whereas sentinel lymph node biopsy was performed in only 13 patients (1.9%).

Overall, 515 women (76.4%) received chemotherapy. The initial therapeutic strategy consisted of primary surgery in 40.3% of patients, neoadjuvant chemotherapy in 33.5%, and palliative treatment in 16.9%, while 9.2% received best supportive care only. Among women receiving chemotherapy, the median number of administered cycles was 6 (IQR: 4-8), with a mean of 5.9±2.8 cycles. The fluorouracil-doxorubicin-cyclophosphamide (FAC) regimen was the most frequently prescribed protocol (68.7%), followed by taxane-containing regimens.

Treatment discontinuation during chemotherapy was documented in 92 women (17.9%), mainly because of treatment-related adverse events, recorded in the medical files. Radiotherapy was administered to 226 women (33.5%), whereas 246 (36.5%) received endocrine therapy. No patients received HER2-targeted therapy, as immunohistochemical assessment of HER2 status was unavailable throughout the study period. The absence of immunohistochemical characterization precluded molecular subtype classification and limited access to biomarker-guided systemic therapies. At the completion of initial management, 550 women (81.6%) had completed their planned treatment, while 124 (18.4%) had not.

**Table 3.** Treatment patterns among women with cytologically diagnosed breast cancer managed in two national referral hospitals in Niger (N = 674).

| **Variable** | **Category** | **N** | **%** |
|---|---|---|---|
| Initial treatment strategy | Neoadjuvant chemotherapy | 226 | 33.5 |
| | Primary surgery | 272 | 40.3 |
| | Palliative treatment | 114 | 16.9 |
| | Best supportive care | 62 | 9.2 |
| Breast surgery | Yes | 511 | 75.8 |
| | No | 163 | 24.2 |
| Type of breast surgery(N=511) | Breast conserving surgery | 78 | 15.3 |
| | Modified radical mastectomy | 377 | 73.8 |
| | Toilet mastectomy | 56 | 10.9 |
| Axillary surgery (n=511) | Axillary lymph node dissection | 477 | 93.3 |
| | Sentinel lymph node biopsy | 13 | 2.5 |
| | None | 21 | 4.1 |
| Chemotherapy | Received | 515 | 76.4 |
| | Not received | 159 | 23.6 |
| Chemotherapy setting (N=515) | Neoadjuvant | 226 | 43.9 |
| | Adjuvant | 175 | 34.0 |
| | Palliative | 114 | 22.1 |
| Chemotherapy regimen (N=515) | FAC | 354 | 68.7 |
| | AC | 14 | 2.7 |
| | Taxane-based | 43 | 8.3 |
| | FAC+Taxane | 79 | 15.3 |

| | | | |
|---|---|---|---|
| | AC+Taxane | 12 | 2.3 |
| | Other | 13 | 2.5 |
| Number of chemotherapy cycles (N=515) | Mean ± SD | 5.9±2.8 | |
| | Median (IQR) | 6 (4-8) | |
| | 1-3 | 94 | 18.3 |
| | 4-6 | 256 | 49.7 |
| | ≥7 | 165 | 32.0 |
| Radiotherapy | Received | 226 | 33.5 |
| | Not received | 448 | 66.5 |
| Five-years empiric endocrine therapy (Tamoxifen) | Received | 246 | 36.5 |
| | Not received | 428 | 63.5 |
| Targeted therapy (anti-HER2) | Received | 0 | 0.0 |
| | Not received | 674 | 100 |
| Clinical status at last follow-up | Alive | 412 | 61.1 |
| | Dead | 70 | 10.4 |
| | Lost to follow-up | 192 | 28.5 |

**Abbreviations: AC**: doxorubicin-cyclophosphamide; **FAC**: fluorouracil-doxorubicin-cyclophosphamide; **HER2**: human epidermal growth factor receptor 2; **SD**: standard deviation; **IQR**: interquartile range.

### 3.5 Clinical outcomes

The median follow-up duration was 24 months (range: 1.3-60 months). At the end of follow-up, 412 women (61.1%) were alive, 70 (10.4%) had died, and 192 (28.5%) were lost to follow-up. Disease recurrence was documented in 11 patients (1.6%) during the study period.
Among women, six (0.9%) died in the first follow up year, which is 8.6% of the observed deaths within the study period. Similarly, the proportion of deaths at the second, fourth, and fifth follow up years was 2.2%, 3.0%, and 2.0%, respectively (Fig. 3).
Overall survival estimated by the Kaplan-Meier method declined progressively during follow-up. Estimated survival probabilities were : 97.90% (95%CI:94.67-98.73), 95.00% (95%CI:93.34-96.87), and 92.00% (95%CI:91.35-93.07) at one, two, and three years, respectively. Survival continued to decrease thereafter, with significantly poorer survival among women presenting with AJCC stages III-IV disease than among those with stages I-II disease (log-rank, P<0.001).

The diagnostic and treatment pathway of women with cytologically diagnosed breast cancer, together with the major health-system barriers encountered during care, is illustrated in Fig. 4.

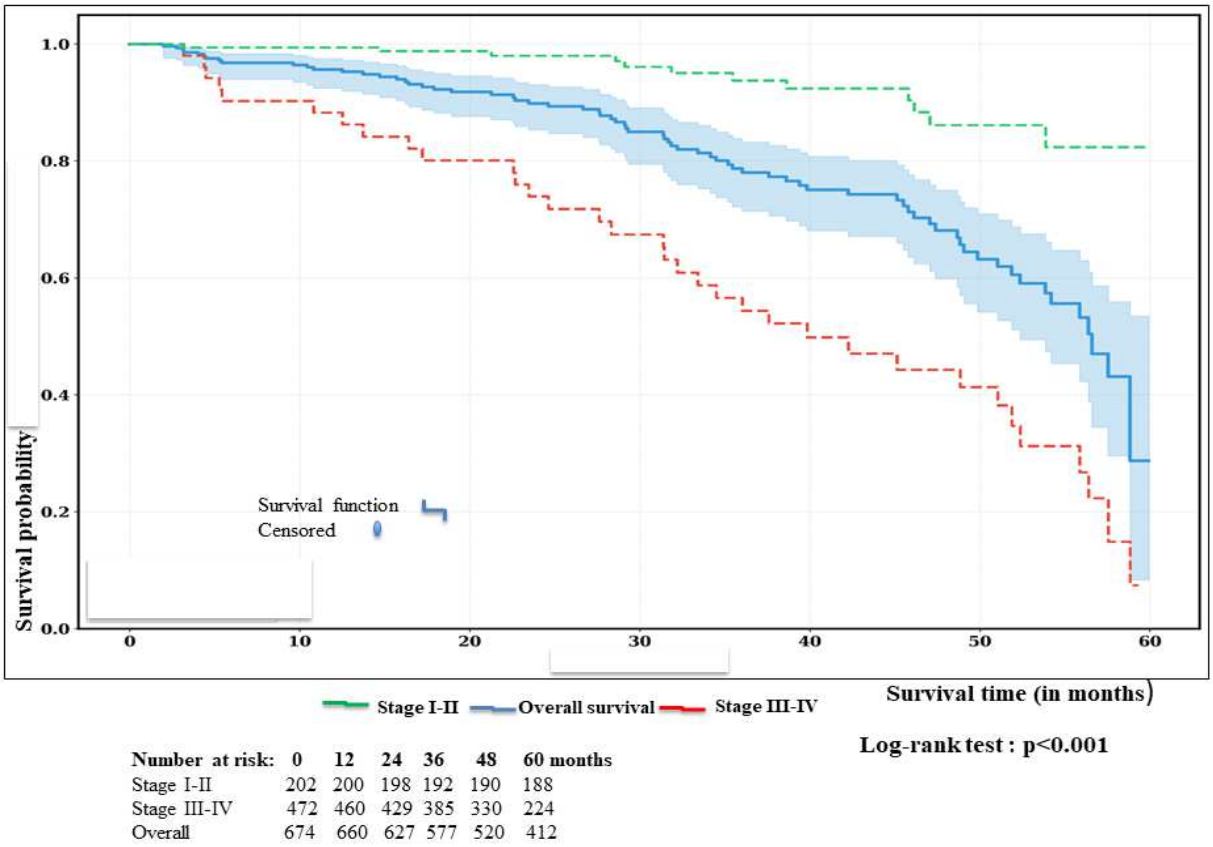



**Figure 3**. Kaplan-Meier overall survival according to AJCC stage among women with cytologically diagnosed breast cancer in Niger. Numbers at risk are shown below the x-axis.

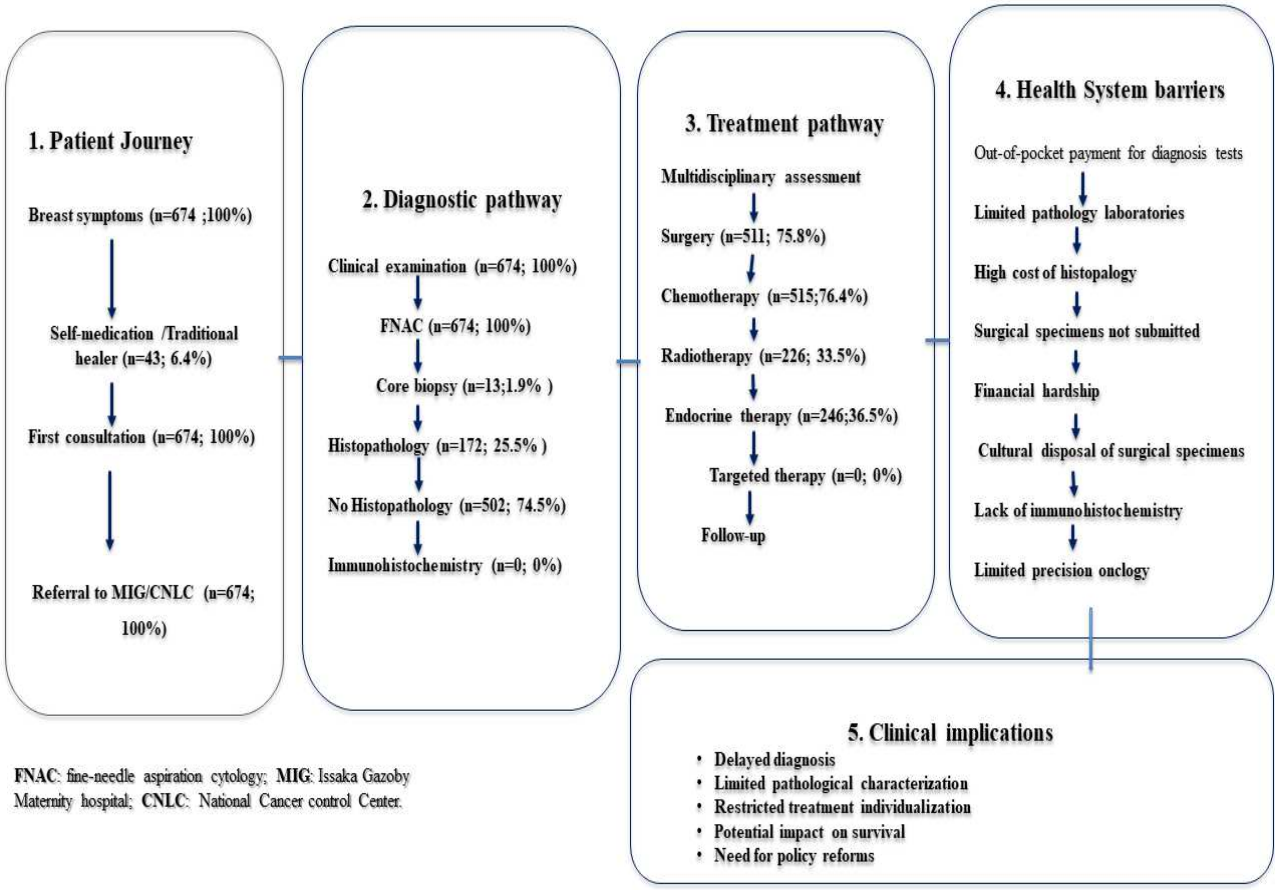



**Figure 4.** Diagnostic and treatment pathway of women with cytologically diagnosed breast cancer in Niger

## 4. DISCUSSION

### Principal findings

This multicenter study provides one of the largest contemporary descriptions of breast cancer care in Niger and offers insight into routine practice in a resource-constrained setting. Most women presented after prolonged consultation delays and were diagnosed with advanced-stage disease. Although fine-needle aspiration cytology (FNAC) provided a diagnosis for all included patients, only one-quarter underwent histopathological confirmation, and none received immunohistochemical characterization. Despite these diagnostic limitations, most women underwent surgery and chemotherapy, whereas access to radiotherapy, endocrine therapy, and HER2-targeted treatment remained limited. The high proportion of patients lost to follow-up further highlights weaknesses across the breast cancer care continuum [5,14, 18-20].

The predominance of advanced-stage disease is consistent with patterns reported across Sub-Saharan Africa, where delayed presentation, financial barriers, inadequate pathology infrastructure, and restricted access to specialized oncology services contribute to poor outcomes [1, 2, 21]. A distinctive feature of the Nigerien setting was the marked discrepancy between universal cytological diagnosis and limited access to histopathology and molecular

characterization. This gap substantially constrained treatment selection and the implementation of guideline-concordant breast cancer care [1, 3].

**Clinical presentation and delayed diagnosis**

Seventy percent of women presented with AJCC Stage III or IV disease after a median consultation delay of seven months. Late presentation is common throughout Sub-Saharan Africa and remains a major determinant of poor breast cancer survival [2, 3, 5, 19, 21, 22]. In contrast, fewer than 15-20% of women in most high-income settings are diagnosed with stage III or IV disease, reflecting greater awareness, established referral pathways, organized screening programs, and timely access to diagnostic services [1, 22-26].

Our findings are comparable to those reported in Nigeria, where 60-80% of patients present with locally advanced or metastatic disease [27,28], and to studies from Ghana, Ethiopia, Uganda, Tanzania, and Rwanda documenting persistent delays and advanced-stage presentation [6,8,9,13]. Although the present study was not designed to identify determinants of delay, rural residence and limited formal education may have contributed by reducing geographical access to specialized care and awareness of early breast cancer symptoms. Similar associations have been reported elsewhere in Africa [3,8,27,28].

Financial barriers may also have delayed diagnostic evaluation. During the study period, patients generally paid out of pocket for FNAC, core needle biopsy, and histopathological examination, even though staging investigations and selected oncological treatments were publicly funded [16]. Comparable financing barriers have been associated with delayed diagnosis and treatment in other low-income settings [3,6,8,13,27,28]. Traditional medicine and self-medication may represent additional contributors, but these factors were not systematically documented in our cohort and require prospective investigation [3].

The WHO Global Breast Cancer Initiative emphasizes early diagnosis through community awareness, rapid referral, and timely diagnostic assessment rather than reliance on population-based mammographic screening alone in resource-limited settings [5]. These findings support strengthening public awareness, training frontline healthcare professionals, decentralizing diagnostic services, and reducing patient-level financial barriers in Niger.

**Diagnostic pathway: cytology, histopathology, and immunohistochemistry**

The most important diagnostic finding was the gap between universal FNAC and limited, comprehensive pathological evaluation. Only 25.5% of women had histopathological confirmation, and none underwent immunohistochemistry. FNAC remains valuable in low-resource settings because it is inexpensive, minimally invasive, and rapidly provides diagnostic information [5,26,29]. Its diagnostic accuracy can be high when specimens are obtained and interpreted by experienced professionals [29,30]. Nevertheless, cytology alone cannot reliably determine histological subtype, tumor grade, lymphovascular invasion, or predictive biomarkers required for contemporary treatment planning [25, 31].

The WHO recommends core needle biopsy, followed by histopathological examination, before definitive treatment whenever feasible [5]. Immunohistochemical assessment of estrogen receptor, progesterone receptor, HER2, and, where appropriate, Ki-67, is also central to tumor classification and individualized systemic therapy [5, 14, 25, 32, 33].

Limited access to histopathology in our cohort reflected several structural constraints. Diagnostic procedures were generally financed through out-of-pocket payments, while pathology laboratories were concentrated in a small number of locations, limiting accessibility for women referred from rural regions. In addition, many surgical specimens were not submitted for examination because of financial constraints or local practices, whereby families requested the return of excised tissues for burial. Because the frequency and individual reasons for this practice were not systematically recorded, its contribution cannot be quantified. Nevertheless, failure to examine surgical specimens prevents definitive diagnosis, pathological staging, and biomarker assessment. Similar barriers involving affordability, laboratory capacity, and specimen management have been described in other African settings [2,3,21,26,27].

The absence of immunohistochemistry precluded molecular subtype classification and biomarker-guided use of endocrine and HER2-targeted therapies [24,32,33]. Strengthening breast cancer care therefore requires investment in the complete diagnostic pathway, including affordable core needle biopsy, routine examination of surgical specimens, expanded pathology capacity, reliable specimen transport, and access to immunohistochemistry. Public financing of these essential procedures would be consistent with the objectives of the WHO Global Breast Cancer Initiative [5].

**Treatment patterns**

Approximately three-quarters of women underwent surgery, and a similar proportion received chemotherapy. Modified radical mastectomy was the predominant surgical procedure, consistent with the high prevalence of locally advanced disease and limited access to radiotherapy. Comparable surgical patterns have been reported in Nigeria, Ethiopia, Uganda, and Tanzania [6,8,9,12]. Breast-conserving surgery is more common in high-income settings, where cancers are generally detected earlier and postoperative radiotherapy is routinely available [5,22,23].

Chemotherapy was the principal systemic treatment, with the fluorouracil-doxorubicin-cyclophosphamide regimen most frequently administered. Anthracycline-based regimens remain widely used in sub-Saharan Africa because of their availability and affordability [8,12,34]. However, the absence of routine pathological and molecular characterization prevented treatment selection according to tumor biology, as recommended by international guidelines [5,32,35].

Only one-third of women received radiotherapy, probably reflecting limited availability, referral difficulties, and the logistical and financial burden of accessing treatment. Insufficient radiotherapy capacity remains a major barrier to cancer care across Sub-Saharan Africa [3,6,8,12,24]. Endocrine therapy was also administered to approximately one-third of patients despite the absence of documented hormone receptor testing. Treatment was therefore based on local clinical practice rather than confirmed receptor status. Current ESMO and NCCN recommendations restrict endocrine and HER2-targeted therapies to patients with appropriately confirmed biomarkers [25,35]. The lack of immunohistochemistry may consequently have exposed some women to undertreatment and others to empiric treatment without documented biological indication.

Chemotherapy discontinuation was documented in 17.9% of treated women. The retrospective records did not allow the relative contributions of toxicity, financial hardship, disease progression, or disengagement from care to be determined. Treatment abandonment and incomplete therapy remain important concerns in resource-constrained settings, where socioeconomic barriers and limited supportive care frequently affect adherence [24]. Improving outcomes will therefore require coordinated investment in pathology, radiotherapy, multidisciplinary care, treatment monitoring, and patient-support systems rather than expansion of surgery and chemotherapy alone [1,5,25,35].

**Clinical outcomes**

At the last documented contact, more than 60% of women were alive, but this finding must be interpreted cautiously because 28.5% were lost to follow-up. Such attrition may lead to underestimation of mortality and limit reliable assessment of long-term outcomes [2,21].
Kaplan-Meier analysis indicated poorer survival among women with advanced-stage disease, consistent with extensive evidence identifying stage at diagnosis as a major prognostic factor [2,23,24]. Studies from the ABC-DO cohort and other African settings have similarly associated advanced-stage diagnosis, limited access to pathology and radiotherapy, incomplete treatment, and socioeconomic disadvantage with reduced survival [8,10,24,27,36].
Loss to follow-up may reflect long travel distances, transportation costs, financial hardship, treatment discontinuation, deaths outside hospitals, and inadequate patient-tracking systems. Similar challenges have been reported across sub-Saharan Africa, where cancer registries and survivorship services remain underdeveloped [2,13]. The documented recurrence proportion of 1.6% should therefore not be interpreted as a reliable recurrence rate because surveillance was not standardized and events occurring outside the participating hospitals may not have been captured. Prospective cohorts with active follow-up are needed to generate more accurate estimates of recurrence and survival.

**Implications for clinical practice and health policy**

The findings support a health-system approach addressing the entire breast cancer care continuum. Earlier diagnosis should be promoted through community education, training of primary healthcare professionals in clinical breast assessment, and expedited referral of suspicious lesions. These measures are consistent with the early-diagnosis pillar of the WHO Global Breast Cancer Initiative [5].
Pathology services require parallel strengthening through increased laboratory capacity, training of pathologists and technicians, improved specimen transport, routine examination of surgical specimens, and introduction of immunohistochemistry. These interventions would enable more accurate diagnosis and evidence-based use of endocrine and targeted therapies in accordance with international recommendations [25, 35].
Reducing financial barriers is equally important. Extending public financing to FNAC, core needle biopsy, histopathology, and essential biomarker testing could improve completion of the diagnostic pathway and reduce inequalities in access to care [5]. Culturally sensitive engagement with patients, families, community leaders, and religious leaders may also improve

acceptance of pathological examination, although qualitative research is needed to understand local practices and develop acceptable interventions.
Finally, structured patient-tracking systems, electronic cancer registries, and survivorship programs are needed to improve continuity of care and the reliability of outcome data [5,25]. Integrating early diagnosis, affordable pathology, biomarker-guided treatment, multidisciplinary management, and long-term follow-up is essential for reducing avoidable breast cancer mortality in Niger and comparable, resource-constrained settings.

**Strengths and limitations**

This study has several important strengths. To our knowledge, it represents the largest multicenter study describing the clinical presentation, diagnostic pathway, treatment patterns, and survival status of women with breast cancer in Niger. By including the country's two national referral institutions over a five-year period, the study provides a comprehensive overview of routine breast cancer care delivered within the Nigerien public health system. Furthermore, the relatively large sample size enabled a detailed description of patient characteristics, diagnostic practices, treatment strategies, and clinical outcomes in a setting where published data remain scarce. The multicenter design also enhances the representativeness of the findings for women managed in tertiary referral hospitals across the country.
Another major strength is the detailed characterization of the diagnostic pathway. Unlike most previous studies from Sub-Saharan Africa, our study documents not only the clinical presentation of breast cancer but also the successive steps from cytological diagnosis to histopathological confirmation, surgical management, and systemic treatment. In addition, it identifies structural, financial, and sociocultural barriers that influence access to comprehensive pathological diagnosis, providing evidence that may inform future health policy and breast cancer control strategies in low-resource settings.

Several limitations should nevertheless be acknowledged. First, the retrospective design relied on routinely collected medical records, resulting in missing data for some clinical and pathological variables. Second, although all patients had cytological evidence of malignancy, histopathological confirmation was available for only one-quarter of the cohort, and no patients underwent immunohistochemical characterization. Consequently, histological subtype, tumor grade, and molecular subtype could not be determined for the majority of women, limiting comparison with studies from settings where comprehensive pathological evaluation is routinely available.
Third, 28.5% of patients were lost to follow-up, which may have introduced attrition bias and resulted in underestimation of mortality, recurrence, and other long-term outcomes. Similarly, the low recurrence rate observed in this study should be interpreted cautiously because recurrent events occurring outside the participating hospitals may not have been captured.

Finally, some potentially important determinants of delayed presentation and treatment outcomes including socioeconomic status, household income, health insurance coverage, consultation with traditional healers, transportation barriers, and patient knowledge of breast cancer, were not systematically recorded in the medical files and could therefore not be

evaluated. Prospective multicenter studies incorporating these variables are needed to provide a more comprehensive understanding of the determinants of breast cancer outcomes in Niger.

Despite these limitations, our study provides robust and clinically relevant evidence on breast cancer care in Niger and highlights critical gaps in the diagnostic pathway that warrant urgent attention. The findings constitute an important baseline for future prospective studies and for evaluating the impact of national initiatives aimed at strengthening breast cancer diagnosis, pathology services, and comprehensive cancer care.

## CONCLUSION

This multicenter study provides the most comprehensive contemporary overview of breast cancer care in Niger and highlights critical gaps across the entire continuum of care. Women were predominantly diagnosed after prolonged consultation delays and presented with advanced-stage disease. Although fine-needle aspiration cytology enabled timely initial diagnosis, access to histopathological confirmation remained limited, and immunohistochemistry was unavailable for all patients, substantially restricting accurate tumor characterization and evidence-based treatment selection.

Despite these diagnostic constraints, most women received surgery and chemotherapy, demonstrating the commitment of the national referral hospitals to provide breast cancer care under challenging circumstances. However, limited access to comprehensive pathology services, radiotherapy, biomarker-guided therapy, and long-term follow-up continues to compromise optimal management and may adversely affect survival.

Our findings indicate that improving breast cancer outcomes in Niger will require a coordinated health-system response extending beyond treatment availability alone. Expanding access to affordable pathological diagnosis, ensuring routine examination of surgical specimens, introducing immunohistochemistry into routine practice, strengthening referral pathways, reducing financial barriers to diagnosis, and promoting earlier presentation should become national priorities.

Future prospective, multicenter studies integrating comprehensive pathological evaluation, molecular characterization, and standardized long-term follow-up are warranted.

## AUTHOR CONTRIBUTIONS

M.O., A.O.S., H.S.D., I.I.D., and M.N : Study's conception and design, data collection, manuscript drafting, draft review, and manuscript finalization.

A.A., Z.S.L., A.A.I., and R.S : Data collection, formal analysis, interpretation and review.

All authors read and approved the final manuscript.

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## CONFLICT OF INTERESTS STATEMENT

The authors declare no competing interests.

## CONSENT FOR PUBLICATION

Not applicable.

## ETHICS APPROVAL

Ethical approval for this study was obtained from the Institutional Review Board (IRB) of the Faculty of Health Sciences of Abdou Moumouni University, Niamey, Niger (Approval No. 000978/2AUA/FSS/SS).

## CONSENT TO PARTICIPATE

Given the retrospective design of the study and the use of routinely collected, fully anonymized hospital data, the need for consent to participate was waived by the Institutional Review Board (IRB) of the Faculty of Health Sciences of Abdou Moumouni University (Approval No. 000978/2AUA/FSS/SS).

## DATA AVAILABILITY STATEMENT

The datasets used and analyzed during the current study are available from the corresponding author upon reasonable request.

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