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Longitudinal analysis of factors influencing return to work after breast cancer treatment among public employees in São Paulo

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ABSTRACT

Introduction: Breast cancer (BC) is the most common disease among women worldwide. Improvements in screening and treatment have increased survival rates, making survivorship issues such as return to work (RTW) increasingly relevant. RTW is associated with better quality of life (QoL), psychological well-being, and social reintegration. However, factors influencing RTW among breast cancer survivors vary according to clinical, sociodemographic, and occupational conditions. This study aimed to evaluate the RTW rate among public employees in São Paulo, Brazil, diagnosed with non-metastatic BC and treated surgically. **Methods:** A longitudinal study was conducted among female public employees diagnosed with non-metastatic BC who underwent surgical treatment between October 2021 and December 2022. Sociodemographic, clinical, and work-related variables were collected at baseline and during follow-up. QoL was assessed using validated questionnaires, and logistic regression analyses were performed to evaluate associations between clinical, sociodemographic, and temporal factors influencing RTW. **Results:** The RTW rate was high, with most participants returning to work within six months. Age, tumor stage, chemotherapy, and education level were not significantly associated with RTW over time. However, improved QoL was correlated with successful RTW across several domains, including body image and functionality. **Conclusions:** RTW among public employees was primarily influenced by QoL rather than clinical or sociodemographic factors. The longitudinal design highlights the dynamic relationship between QoL improvements and RTW outcomes. Policymakers and healthcare providers should integrate QoL assessments into survivorship care plans and promote flexible work policies to improve occupational reintegration.

KEYWORDS: breast cancer, return to work, quality of life, surgery, chemotherapy.

INTRODUCTION

Breast cancer (BC) is the most common disease among women worldwide. Each year, approximately 73,610 women are diagnosed with BC in Brazil[1], of whom approximately 65% are of working age — between 18 and 67 years old[2,3]. Fortunately, improvements in BC screening, such as mammography techniques and treatments, including less aggressive surgery, adjuvant chemotherapy, and hormonal therapy, have reduced the recurrence and mortality rates and increased survival rates in all patients with BC[4].

Employment has become a major concern for breast cancer survivors (BCS)[5]. BCS face several challenges, such as the physical side effects of treatment; issues related to quality of life (QoL); and psychological, social, and financial issues[6-9]. Since the peak

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BC incidence occurs in the working population at mid-working age, this disease causes the largest productivity loss in the female population among all malignancies[3,10]. Most BCS continue to work while they address cancer-related disabilities.

Public employees represent a unique population within cancer survivors owing to the stability and specific regulations of their employment. In Brazil, public employees often benefit from more structured employment conditions, such as job security, paid sick leave, and retirement plans, which may influence their return-to-work (RTW) process. However, these advantages also come with challenges, such as rigid organizational structures and potential delays in workplace accommodations. Understanding how these dynamics impact RTW among breast cancer survivors is essential for tailoring interventions and policies for this group[11].

RTW after cancer treatment is important for women's recovery and is associated with better survival rates[12]. Work is a fundamental part of BCS' "rebirth" process[13]; it can contribute to a new normality and reduce BC consequences in a survivor's life. A better QoL has been demonstrated in BCS who resume work than in those who quit their jobs[14]. RTW after BC is associated with physical, functional, social, and emotional well-being[10]. However, BC is associated with high rates of employment loss and early retirement.

Previous Brazilian studies evaluating RTW after breast cancer have been conducted exclusively in public hospitals and within Sistema Único de Saúde (SUS) populations[15,16]. Additionally, Zomkowski et al. reported important RTW challenges among manual labor workers in southern Brazil[17]. The study by Michels et al., often cited in this context, is a validation of the EORTC questionnaires and does not evaluate RTW outcomes. Importantly, no published studies have examined RTW patterns among privately insured public employees in Brazil, which highlights the originality and relevance of the present study[18]. A systematic review showed that the prevalence of RTW within one year of diagnosis varied from 43% in the Netherlands to 93% in the USA[19]. In Central and South America, there are very few reports on the frequency or pattern of work resumption among patients with cancer. In Brazil, a study demonstrated an RTW rate that was 30.3% lower than that in other studies[16]. Unlike other countries, in Brazil, approximately 60% of patients with BC are diagnosed at a later stage of the disease[15], which increases sequelae risk after treatment. Despite the relevance of the topic, few studies analyze this issue with a focus on Brazil[18], and those that exist have small sample sizes and limited variables related to non-RTW, whose QoL have been minimally evaluated.

This study aimed to evaluate the RTW rate among public employees in the state of São Paulo who have been diagnosed and treated for BC and compare this rate with the type of oncologic treatment they received and their QoL.

METHODS

Study design

This observational, analytical cohort study was designed to assess RTW rates and associated factors among BCS. A cross-sectional design was chosen because the design is feasible to capture a snapshot of RTW rates and associated variables within a defined timeframe. While a longitudinal approach might better capture the dynamics of RTW over time, the cross-sectional design provides valuable insights into the immediate factors that influence RTW shortly after treatment. This study was conducted at the Hospital do Servidor Público Estadual São Paulo (HSPE) between October 2021 and December 2022.

Participants, Inclusion and exclusion criterion

Female patients aged 18 to 70 years, diagnosed with non-metastatic BC and employed as public servants at the time of diagnosis, who underwent surgical treatment at the HSPE-SP between October 2021 and December 2022, were eligible for inclusion.

Participants were required to have completed the main locoregional oncologic treatment at least six months prior to survey administration, a period considered sufficient for early functional recovery and initial occupational reintegration. For patients treated with upfront surgery, completion of treatment was defined as surgery with or without adjuvant chemotherapy and/or radiotherapy. For patients treated with a neoadjuvant approach, completion of treatment was defined as the end of neoadjuvant chemotherapy followed by surgery and adjuvant radiotherapy, when indicated.

Patients with metastatic disease at diagnosis, those who developed distant metastases within six months after completion of the main locoregional treatment, and those who did not respond to the questionnaire were excluded from the study. This six-month interval was chosen to ensure clinical stability and to minimize the influence of acute treatment-related effects on RTW outcomes.

Data collection

Data collection was conducted between May 2023 and September 2023. Eligible participants were identified through the HSPE-SP mastology database. Cleaning and manual labor personnel were not included, as these positions are outsourced and do not correspond to statutory public employment.

Potential participants were initially contacted by telephone and informed about the objectives of the study. Subsequently, an electronic questionnaire addressing employment status, RTW characteristics, and QoL was sent to eligible patients. A total of 420 questionnaires were distributed, of which 355 were returned, yielding a response rate of 84.5%. Sixteen questionnaires (3.8%) were excluded because they were answered by dependents of state employees. Of the 339 eligible respondents, 300 patients

(88.2%) were actively employed at the time of BC diagnosis and constituted the final study population.

All questionnaires were administered at least six months after completion of locoregional treatment, ensuring a homogeneous temporal window for early survivorship assessment. Continuation of endocrine therapy and anti-HER2 therapy was allowed, as these treatments are part of standard long-term adjuvant care. No direct clinical evaluation was performed at the time of questionnaire completion; therefore, treatment-related sequelae, disease status, and functional impairments were assessed exclusively through patient self-report. A flowchart summarizing patient selection and inclusion is presented in Figure 1.

Study variables

The main study outcome was the participants' self-reported employment status after BC treatment. The primary outcome was full-time employment, which was defined as ≥20 hours of work per week. RTW was selected as the primary outcome because it is a key measure of recovery in BCS. The evaluated variables included the following: type of occupation; education, which was classified as complete elementary and incomplete middle school, complete middle school, incomplete graduation, and graduation; family structure, which was evaluated using three parameters, marital status (whether the participants were married, single, divorced, or in a stable union), the number of children (none, one, two, or more than three), and children aged <18 years living at home. Race was self-reported as White, Asian, or Black. For analytical purposes, individuals identifying as Brown were grouped together with Black participants, following standard epidemiological practice in Brazilian population studies. Comorbidities included self-reported hypertension, diabetes, dyslipidemia, obesity, thyroid disorders, and other chronic medical conditions. Mastectomy with prosthesis was not available for this cohort due to institutional resource limitations, which explains the absence of this category in the surgical distribution. The participants' clinicopathological characteristics were obtained from the HSPE mastology database.

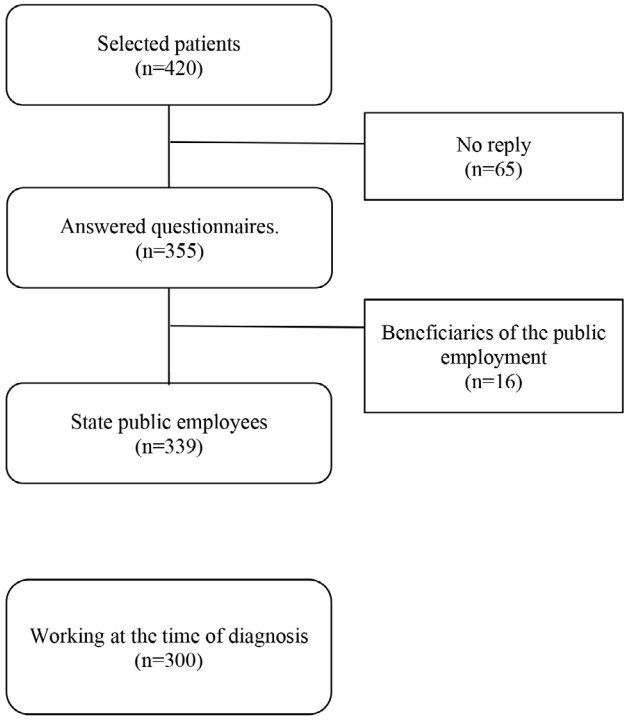

Figure 1. Flowchart with included participants.

Questionnaire development

Questions related to RTW were adapted from selected items of the EORTC QLQ-C30 and EORTC QLQ-BR23 questionnaires, as well as from previously published studies evaluating RTW after BC. Additional items were created based on aspects considered relevant to the clinical and occupational context of our institution, including work adjustments, job satisfaction, perceived discrimination, and functional limitations. The resulting instrument was designed to explore RTW motivations, barriers, and work-related challenges. It was not intended to represent a psychometrically validated questionnaire.

Questionnaires on quality of life

Questionnaires validated for use among Brazilian Portuguese were used to evaluate health-related QoL. The following questionnaires were used: the EORTC QLQ-C30 questionnaire with 30 questions on QoL, and its subscale for breast cancer with 23 questions (EORTC QLQ-BR23). The EORTC QLQ-C30 is a general questionnaire for patients with cancer which consists of 30 questions divided into three dimensions: five functional scales (physical, role performance, emotional, cognitive, and social), three symptom scales (fatigue, nausea/vomiting, and pain), six single-item scales (dyspnea, insomnia, loss of appetite, constipation, diarrhea, and financial difficulties), and overall QoL. Functional and symptom scales were rated on a scale ranging from 1 (no) to 4 (very much), and questions related to overall QoL were rated on a scale ranging from 1 (very poor) to 7 (excellent). The scores were converted to a scale of 0–100 points. High overall QoL scores indicate good QoL, whereas high scores on the symptom scale indicate increased symptomatology. The EORTC QLQ-B23 is a specific QoL questionnaire for patients with BC. It has 23 questions divided into two dimensions: functional scales (body image, perspective on the future, sexual function, and sexual satisfaction) and symptoms (chemotherapy effect, concerns about hair loss, and breast and arm symptoms). For scoring, a four-point scale (not at all, a little, quite a bit, and very much) was used. Similar to the QLQ C-30, the score was converted to a scale of 0–100 points[18,20].

Return to work questionnaire

The participants answered the following questions characterizing RTW and its associated difficulties. What motivated me to return to work? (financial needs/personal satisfaction/denied retirement). Is functional rehabilitation needed? (yes/no). Was there a need to reduce working hours? (yes/no). Was there also a decrease in work performance? (yes/no). Why did you not return to work? (retirement based on contribution time/psychiatric disorder after BC diagnosis/sequelae of surgical treatment/sequelae of systemic treatment/sequelae of radiotherapy). Time to RTW (0–6 months/6–12 months/12–18 months).

Statistical analysis

Descriptive statistics were used to summarize the study variables. Categorical variables are presented as absolute and relative frequencies. Continuous variables are expressed as means and standard deviations.

Continuous variables were initially assessed for distribution characteristics. Comparisons between groups were performed using Student's t-test for normally distributed continuous variables and the Mann-Whitney U test for non-normally distributed variables. Categorical variables were compared using the chi-square test or Fisher's exact test, as appropriate. Statistical significance was defined as a two-sided $p<0.05$.

Univariate logistic regression analyses were conducted to evaluate associations between RTW and sociodemographic variables (age, marital status, education level, comorbidities), clinical and pathological characteristics (clinical stage, tumor size, lymph node status, molecular subtype), treatment-related variables (type of breast surgery, axillary surgery, chemotherapy, radiotherapy, hormone therapy, anti-HER2 therapy), and occupational factors (type of activity, previous income, main source of family income, job satisfaction, employer support, functional readaptation, and perceived discrimination).

Variables presenting $p<0.10$ in the univariate analyses were considered for inclusion in the multivariate logistic regression model. The multivariate model was constructed using a stepwise forward selection method, with variable selection performed by the statistical software, based on predefined inclusion criteria. Adjusted and unadjusted odds ratios (ORs) and their respective 95% confidence intervals (95% CI) were calculated.

Variables collected exclusively among participants who returned to work — such as reasons for returning, time to RTW, perceived changes in work performance, and workload modifications — were analyzed descriptively only, as no corresponding data were available for participants who did not return to work, precluding inferential statistical comparisons.

All statistical analyses were performed using appropriate statistical software, and model assumptions were verified prior to interpretation.

Ethics

The study was approved by the Research Ethics Committee of HSPE-SP (Certificate of Presentation for Ethical Appreciation — CAAE 68337823.4.0000.5463), and all participants signed an informed consent form.

RESULTS

Sociodemographic characteristics

The participants' mean age at diagnosis was 51.3 years; 216 participants (72.0%) self-reported as White, 189 (63.0%) were married, 62 (20.7%) did not have any children, 244 (81.4%) completed higher education, and 119 (39.7%) worked as teachers. The data presentation was streamlined by grouping certain variables for clarity and conciseness. For example, education levels and marital status were grouped to provide a more coherent analysis of sociodemographic patterns influencing RTW. Hypertension was the most frequent comorbidity, affecting 115 (38.5%) participants, and 60 (19.6%) participants had more than one comorbidity. Table 1 summarizes the participants' sociodemographic characteristics.

Return to work and patient-related conditions

In the cohort of BCS, 223 (74.3%) individuals returned to work within 18 months post-surgery, while 77 (25.7%) did not resume work in the same period. Among those who returned, 180 (80.6%) did so within the first six months, 34 (15.2%) between six and 12 months later, and nine (4.0%) after 12 months. The mean time between completion of locoregional treatment and questionnaire administration was 9.4 months (standard deviation: 4.2 months), ensuring that all participants were assessed within a comparable early survivorship period.

The data indicated that younger BCS, aged 18–49 years, had a higher RTW rate of 85.7% (n=120), in contrast to their older counterparts aged between 50 and 69 years, where only 64% (n=89) resumed work, showing a statistically significant difference ($p<0.0001$). Although marital status did not significantly influence RTW rates, married patients had a significantly lower likelihood of returning to work. Professional activity was regrouped according to functional and physical job demands into administrative, educational, and practical/clinical (nursing) categories. Administrative occupations showed the highest RTW rate (119/140; 85.0%), followed by educational roles (84/119; 70.6%). In contrast, practical/clinical (nursing) occupations demonstrated the lowest RTW rate (20/41; 48.8%). The overall difference among the three occupational groups was statistically significant ($p<0.0001$), indicating a gradient in RTW likelihood according to increasing physical and functional job demands. Other sociodemographic factors, such as ethnicity, number of children, and education level, did not have a statistically-significant association with RTW rates, as detailed in Table 1.

Tumor-related characteristics were significantly associated with RTW. Patients with early-stage disease (stages 0–I) and smaller tumors (Tis–T1) demonstrated higher RTW rates compared with those with more advanced tumors (T2–T4). Likewise, individuals with no lymph node involvement (N0) were more likely to return to work than those with nodal involvement (N1–N2) (overall p<0.0001). These tumor features were directly reflected in surgical management: early-stage, smaller, and node-negative tumors were more frequently treated with breast-conserving surgery and sentinel lymph node biopsy, whereas advanced disease more often required mastectomy and axillary lymph node dissection, which were associated with lower RTW rates. Molecular subtype was not significantly associated with RTW.

Surgical intervention types had a statistically significant impact on RTW rates; 71.4% of the participants undergoing oncoplastic techniques did not return to work, and those undergoing mastectomy without reconstruction were also less likely to RTW (71.4%) than those undergoing breast-conserving surgery (3.5%), with statistically-significant differences (p<0.0001). Neoadjuvant or adjuvant chemotherapy were associated with lower RTW rates (33.3 and 50%), while those undergoing radiotherapy showed higher RTW rates (85.3%), each with a statistically significant impact (p<0.0001). The use of anti-HER-2 therapy and hormone therapies did not result in statistically significant differences in RTW rates. The relationships among BC characteristics, treatment modalities, and RTW rates are shown in Table 1.

Confounding factors, such as treatment type and clinical stage, were adjusted for in the regression analysis to clearly understand their influence on RTW. The analysis showed that none of the variables had a statistically significant association with RTW. For instance, age (OR 0.99, 95%CI 0.95–1.03, p=0.56), tumor stage (OR 1.05, 95%CI 0.90–1.22, p=0.43), chemotherapy (OR 0.90, 95%CI 0.60–1.35, p=0.60), and education level (OR 1.02, 95%CI 0.80–1.31, p=0.70) were not significantly associated with RTW. This finding suggests that these factors did not independently influence the likelihood of RTW in this cohort. The regression model incorporated sociodemographic variables and clinical characteristics to consider potential confounding effects, ensuring robust estimates of their associations.

Return to work and work-related conditions

The participants answered a questionnaire on RTW, its direct relationship with work factors, and difficulties in RTW. First, there was a statistically-significant difference in RTW rates based on previous income levels, with 50% of individuals who did not RTW having a previous income of less than two minimum wages. Conversely, individuals with a previous income between two and four minimum wages had a higher RTW rate (80.9%). Statistical significance (p=0.024) indicated that previous income levels notably impacted the likelihood of RTW after cancer treatment.

Job satisfaction before the diagnosis was also significantly associated with RTW rates. The participants who liked their job before the diagnosis had a higher RTW rate (77.4%) than those who did not enjoy their job (33.3%), which is a statistically-significant result (p<0.0001). The study did not find a statistically-significant difference in RTW rates based on the number of working hours per week (p=0.233), indicating that the length of the workweek before diagnosis did not significantly affect the participants' RTW decision.

However, support from employers or supervisors following a diagnosis had a statistically significant association with RTW, with 73.9% of those returning to work reporting their employers' support, compared with 60% of those who did not return (p=0.0002). This finding suggests that the employers' support was crucial for RTW. Furthermore, the offer of functional readaptation had a statistically significant association with higher RTW rates, where 93.8% of returnees were offered readaptation compared to only 62.8% of non-returnees (p<0.0001). Finally, the experience of discrimination from employers had a statistically significant association with a lower likelihood of RTW, with 44.7% of non-returnees reporting discrimination compared with 22.9% of returnees (p=0.0007). Table 2 shows relationships between BCS and RTW.

Among the 223 breast cancer survivors who returned to work, several work-related characteristics were identified (Table 3). Personal satisfaction was the most frequent reason for resuming work (74%), followed by financial need (13%) and denial of retirement (13%). Most participants (61%) returned to work within the first six months after treatment, while 12.1% returned between six and 12 months later, and 26.9% between 12 and 18 months later.

The majority of survivors (93.8%) resumed the same job role they held prior to diagnosis. Regarding perceived work performance, 62.4% reported no decline after treatment, whereas 37.6% perceived reduced performance. Most participants maintained the same workload upon returning (81.2%), while 15.6% reduced their working hours and 3.1% increased them.

These data highlight that, among those who returned to work, early reintegration, maintenance of the same professional role, and stability in workload were common patterns. This is detailed in Table 3.

Further reasons for BCS not returning to work were explored. The development of depression and anxiety after treatment was found to be the most significant barrier, with 54.5% of those who did not RTW citing this as the reason. Physical sequelae from oncological treatment were reported by 36.4% of the participants as a hindrance to RTW. Furthermore, 9.1% of the participants did not RTW because of retirement based on time of contribution (p<0.0001).

In the univariate logistic regression, variables associated with RTW at p<0.10 included previous income, main source of family income, job satisfaction before diagnosis, employer support after

Table 1. Sociodemographic, clinical staging, and treatment-related characteristics of breast cancer survivors according to return to work.

Variable/Category	Return to work		Total n (%) 300 (100)	p-value χ^2
	No n (%) 77 (25.70)	Yes n (%) 223 (74.3)		
Age group (years)				
18–49	20 (14.3)	120 (85.7)	140 (46.7)	<0.0001
50–69	50 (36.0)	89 (64.0)	139 (46.3)	
>70	7 (33.3)	14 (66.7)	21 (7.0)	
Ethnicity				
Asians	0	7 (100.0)	7 (2.4)	0.210
White	63 (29.2)	153 (70.8)	216 (72.0)	
Black/Brown	14 (18.2)	63 (81.8)	77 (25.6)	
Marital status				
Married	49 (25.9)	129 (74.1)	188 (63.0)	<0.001
Divorced	7 (14.3)	42 (85.7)	49 (16.3)	
Single	21 (33.4)	42 (66.6)	63 (20.7)	
Number of children				
None	14 (22.5)	48 (77.5)	62 (20,7)	0.141
One	28 (33.3)	56 (66.4)	84 (28,0)	
Two	28 (26.6)	77 (73.4)	105 (35,0)	
Three or more	7 (14.2)	42 (85.7)	49 (16,3)	
Do you have any children under the age of 18?				
No	56 (25.6)	174 (74.4)	230 (76.6)	0.420
Yes	21 (30.0)	49 (70.0)	70 (23.4)	
Schooling				
Illiterate	0	7 (100.0)	7 (2.4)	0.105
Elementary school	0	7 (100.0)	7 (2.4)	
High school	14 (33.3)	28 (66.7)	42 (14,0)	
Higher education	63 (25.8)	181 (74.2)	244 (81,2)	
Comorbidities				
No	49 (38.9)	77 (61.1)	126 (41.9)	<0.0001
Yes	28 (16.1)	146 (83.9)	174 (58.1)	
Public employment and profession				
Administrative	21 (15.0)	119 (85.0)	140 (46,7)	<0.0001
Educational	35 (29.4)	84 (70.6)	119 (39,7)	
Sector				
Practical/Clinical (Nursing)	21 (51.2)	20 (48.8)	41 (13,6)	
Clinical stage (TNM)				
0	0	7 (100.0)	7 (2.3)	<0.0001
I	14 (9.5)	132 (90.5)	146 (48.8)	
II	42 (37.5)	70 (62.5)	112 (37.2)	
III	21 (60.0)	14 (40.0)	35 (11.6)	

It continues...

Table 1. Continuation.

Variable/Category	Return to work		Total n (%) 300 (100)	p-value χ^2
	No n (%) 77 (25.70)	Yes n (%) 223 (74.3)		
Tumor size (T)				
Tis	0	7 (100)	7 (2.3)	<0.0001
T1	14 (9.5)	132 (90.5)	146 (48.8)	
T2	31 (50.8)	30 (49.2)	61 (20.3)	
T3	30 (35.7)	54 (64.3)	84 (28.0)	
T4	2 (100.0)	0	2 (0.6)	
Lymph nodes				
0	14 (9.1)	139 (90.9)	153 (51.0)	<0.0001
N1	42 (37.5)	70 (62.5)	112 (37.3)	
N2	21 (60.0)	14 (40.0)	35 (11.7)	
N3	0	0	0	
Molecular subtype				
Luminal A	35 (24.5)	108 (75.5)	143 (47.6)	0.062
Lumina B	21 (24.4)	65 (75.6)	86 (28.6)	
Luminal HER-2	0	14 (100.0)	14 (4.8)	
HER-2	7 (33.3)	14 (66.7)	21 (7.1)	
TNBC	14 (38.9)	22 (61.1)	36 (11.9)	
Type of breast surgery				
Breast-conserving surgery	7 (3.5)	195 (96.5)	202 (67.4)	<0.0001
Breast-conserving surgery with oncoplastic techniques	35 (71.4)	14 (38.6)	49 (16.3)	
Mastectomy without prosthesis	35 (71.4)	14 (38.6)	49 (16.3)	
Type of axillary surgery				
SLN	39 (18.9)	167 (81.1)	206 (68.7)	<0.0001
SLN+axillary lymphadenectomy	8 (53.4)	7 (46.6)	15 (5.0)	
Axillary lymphadenectomy	30 (37.9)	49 (62.1)	79 (26.3)	
Chemotherapy				
Neoadjuvant	21 (33.3)	42 (66.7)	63 (20.9)	<0.0001
Adjuvant	49 (50.0)	49 (50.0)	98 (32.6)	
None	7 (5.0)	132 (95.0)	139 (46.7)	
Anti-HER-2 therapy				
Yes	7 (20.0)	28 (80.0)	35 (11.6)	0.541
No	70 (26.4)	195 (73.3)	265 (88.4)	
Radiotherapy				
Yes	35 (14.7)	202 (85.3)	237 (79.1)	<0.0001
No	42 (66.7)	21 (33.3)	63 (20.9)	
Hormone therapy				
Adjuvant	56 (22.9)	188 (77.1)	244 (81.4)	0.076
Neoadjuvant	7 (35.0)	13 (65.0)	20 (6.6)	
None	14 (38.9)	22 (61.1)	36 (12.0)	

HSPE does not employ in-house manual labor workers; these roles are outsourced.
TNM: Clinical Stage; TNBC: Triple Negative Breast Cancer; SLN: Sentinel lymph node.

diagnosis, functional readaptation, and perceived discrimination. These variables were subsequently entered into the multivariate logistic regression model.

After adjustment for sociodemographic, clinical, pathological, treatment-related, and occupational variables, only employer support (adjusted OR ≈ 2.10) and functional readaptation (adjusted OR ≈ 3.00) remained independently associated with RTW. Job satisfaction showed a borderline association, whereas previous income and perceived discrimination did not retain statistical significance after adjustment (Table 4).

Assessment of quality of life and relationship with return to work in breast cancer survivors

Analysis of the EORTC QLQ-C30 and QLQ-BR23 questionnaires revealed several factors that positively impacted BCS and RTW. Specifically, individuals who returned to work reported a better overall health status (p<0.001). Additionally, higher role-functioning scores suggest that individuals' ability to fulfill daily roles and responsibilities is vital for RTW (p=0.008). Higher social functioning scores were associated with successful RTW (p=0.006).

Higher QoL scores were significantly associated with successful RTW. Participants who returned to work reported better scores in domains such as body image (p<0.001) and future outlook (p=0.032). Conversely, those who did not RTW reported higher fatigue levels and pain scores. These findings emphasize the role of functional and emotional recovery in facilitating occupational reintegration.

Conversely, several factors negatively impacted the likelihood of RTW among BCS. The data indicated that participants who did not RTW reported higher levels of fatigue (p=0.041), pain (p=0.048), and financial difficulties (p=0.023). Additionally, severe arm symptoms, as shown in the QLQ-BR23 results, significantly affected survivors, impacting their physical capability and comfort in performing job-related tasks, particularly for those with roles

Table 2. Income-related and occupational factors associated with return to work among breast cancer survivors.

Variable/Category	Return to work		Total n (%) 300 (100)	p-value χ^2
	No n (%) 77 (25.70)	Yes n (%) 223 (74.3)		
Previous income (MW)				
Less than 2x	7 (50.0)	7 (50.0)	14 (4.7)	0.024
Between 2–4x	28 (19.1)	118 (80.9)	146 (48.8)	
Between 5–10x	35 (31.2)	77 (68.8)	112 (37.2)	
Between 11–20x	7 (25.0)	21 (75.0)	28 (9.3)	
Are you the main source of family income?				
No	14 (16.6)	70 (83.4)	84 (27.9)	0.037
Yes	63 (29.2)	153 (70.8)	216 (71.1)	
Do you like your job?				
No	14 (66.7)	7 (33.3)	21 (7.0)	<0.0001
Yes	63 (22.6)	216 (77.4)	279 (93.0)	
How many hours a week did you work?				
Greater than or equal to 40 h	49 (23.4)	160 (76.6)	209 (69.8)	0.233
Less than 40 h	28 (30.7)	63 (69.3)	91 (30.2)	
Did you receive support from your employer/boss after your diagnosis?				
No	28 (40.0)	42 (60.0)	70 (23.3)	0.0002
Yes	49 (26.1)	181 (73,9)	188 (62.8)	
Functional readaptation offered				
No	70 (37.2)	118 (62.8)	188 (62.8)	<0.0001
Yes	7 (6.2)	105 (93.8)	112 (37.2)	
Have you felt any type of discrimination from your employer?				
No	60 (22.9)	202 (77.1)	262 (87.3)	0.0007
Yes	17 (44.7)	21 (55.3)	38 (12.6)	

MW: minimum wage; h: hours.
2024 MW = R$1,427.00 = US$583.00;

requiring manual dexterity or strength. Table 5 shows the average QoL questionnaire scores and their relationship with RTW.

Logistic regression analyses were performed to evaluate the association between QoL domains and RTW. In unadjusted analyses, higher scores in physical functioning, lower pain intensity, reduced fatigue, and better social functioning were significantly associated with higher RTW rates.

After adjustment for clinical stage and type of professional activity, physical functioning, pain, and social functioning remained independently associated with RTW, whereas associations with role limitations due to physical problems and fatigue did not retain statistical significance. Emotional well-being was not significantly associated with RTW in either unadjusted or adjusted models (Table 6).

Table 3. Characteristics of breast cancer survivors who returned to work.

Variable/Category	Patients who returned to work
	n (%) 223 (100)
Reason for returning to work	
Personal satisfaction	165 (74.2)
Financial need	29 (12.9)
Retirement denied	29 (12.9)
Time to return to work (months)	
Between 0–6	136 (61.0)
Between 6–12	27 (12.1)
Between 12–18	60 (26.9)
Did you return to work in the same role?	
No	14 (6.3)
Yes	209 (93.8)
After treatment, did you notice a drop in performance at work?	
No	139 (62.5)
Yes	84 (37.5)
After returning, did you continue working with the same workload?	
I increased the workload	7 (3.1)
I reduced the workload	35 (15.6)
Yes	181 (81.3)

DISCUSSION

This study conducted the most comprehensive investigation in Brazil on individuals' RTW after their BC treatment. Previous studies have identified multiple variables that influence RTW, including educational attainment, ethnicity, chemotherapy, intense physical labor, health status, fatigue, depression, and emotional turmoil[18-21]. Previous Brazilian research[16,18] identified education and age as significant predictors of RTW among public health system patients. Conversely, our findings did not corroborate the link between education level and RTW but indicated that younger BCS, particularly those who are divorced, are more predisposed to re-enter the workforce. Professionals in the educational field, particularly teachers, face amplified obstacles to resuming their professional roles.

The population analyzed in this study consists of public-sector employees, predominantly working in the health and education sectors, under a statutory employment regime that provides job stability and access to occupational health services. Within this context, participants performed either administrative functions or direct patient- or student-facing activities, which entail markedly different physical, functional, and organizational demands. These characteristics are particularly relevant when interpreting RTW outcomes, as job stability may reduce the risk of unemployment, while occupational demands may differentially affect functional capacity and reintegration after cancer treatment.

Table 4. Univariate and multivariate logistic regression models for return to work.

Variable	Category	Univariate OR (95%CI)	p-value	Multivariate OR (95%CI)	p-value
Previous income	5–10 × MW	0.70 (0.35–1.40)	0.09	0.82 (0.38–1.75)	0.60
Previous income	11–20 × MW	0.78 (0.34–1.80)	0.08	0.95 (0.38–2.40)	0.90
Main source of income	Yes	1.85 (0.96–3.55)	0.037	1.58 (0.78–3.20)	0.21
Job satisfaction	Yes	3.80 (1.60–9.00)	<0.0001	2.40 (0.95–6.20)	0.065
Employer support	Yes	2.75 (1.42–5.35)	0.0002	2.10 (1.02–4.25)	0.043
Functional readaptation	Yes	3.95 (1.85–8.42)	<0.0001	3.00 (1.28–7.05)	0.011
Perceived discrimination	Yes	0.52 (0.27–1.03)	0.0007	0.60 (0.28–1.26)	0.18

Univariate logistic regression analyses were performed for all sociodemographic, clinical, treatment-related, and occupational variables. Variables with p<0.10 in the univariate analysis were entered into the multivariate logistic regression model. The table presents both unadjusted and adjusted odds ratios with 95% confidence intervals. The final adjusted model retained variables that remained independently associated with return to work after adjustment. Variables presented in the adjusted model were selected using a stepwise forward approach.
OR: odds ratios; CI: confidence intervals; MW: minimum wage.

Regarding the analytical strategy, clinical stage and treatment-related variables were carefully considered as adjustment factors due to their central role in the therapeutic pathway of BC. Clinical stage directly influenced treatment intensity, including the need for chemotherapy, radiotherapy, and more extensive surgical procedures, which are known to impact physical recovery

Table 5. Average quality of life questionnaire scores and their relation to return to work.

Questionnaire	Total n=300		Return to work				p-value
			No n=77		Yes n=223		
	Mean	SD	Mean	SD	Mean	SD	
EORTC QLQ-C30							
1. Global health status	62.3	15.7	51.5	15.7	73.2	15.7	<0.001
2. Physical functioning	73.6	17.3	68.5	16.4	78.8	18.3	0.107
3. Role functioning	69.4	22.9	57.6	20.2	81.3	25.7	0.008
4. Cognitive functioning	67.8	24.6	60.6	22.7	75	26.6	0.119
5. Emotional functioning	61.0	19.9	58.3	16.2	63.8	23.6	0.482
6. Social functioning	79.1	19.6	68.7	17.4	89.6	21.9	0.006
7. Fatigue	30.7	26.1	33.3	29.8	28.1	22.4	0.041
8. Nausea and vomiting	7.4	13.0	9.1	13.7	5.7	12.4	0.455
9. Pain	34.4	28.5	43.9	32.7	25	24.3	0.048
10. Dyspnea	8.6	15.8	12.1	16.8	5.2	14.9	0.207
11. Insomnia	33.3	29.5	33.3	29.8	33.3	29.3	0.999
12. Appetite loss	10.8	17.9	9.1	15.6	12.5	20.3	0.615
13. Constipation	18	29.4	15.2	31.1	20.8	27.8	0.573
14. Diarrhea	7.7	18.6	9.1	21.6	6.3	15.7	0.641
15. Financial difficulties	22.9	25.4	33.3	25.8	12.5	25	0.023
EORTC QLQBR-23							
1. Body image	64.1	28.5	52.3	29.6	76	27.4	0.023
2. Sexual functioning	43.2	17.9	78.8	18.4	7.6	17.4	0.850
3. Sexual enjoyment	55.8	27.0	52.4	32.5	59.3	21.6	0.541
4. Future perspective	34.0	29.4	21.2	24	46.9	34.8	0.032
5. Systemic therapy side effects	22.5	14.5	26	12.5	19	16.5	0.212
6. Breast symptoms	24.6	24.7	27.3	28.3	21.9	21.2	0.501
7. Arm symptoms	35.5	26.4	49.5	32.9	21.5	19.9	0.002
8. Upset by hair loss	35.5	33.9	33.3	34.9	37.8	33	0.726

Comparisons between groups were performed using Student's t-test for normally distributed variables and the Mann-Whitney U test for non-normally distributed variables, according to data distribution.

Table 6. Association between quality-of-life domains and return to work.

Quality-of-life domain	Unadjusted OR (95%CI)	p-value	Adjusted OR (95%CI)	p-value
Physical functioning	1.85 (1.30–2.64)	0.001	1.62 (1.10–2.38)	0.014
Role limitations-physical	1.47 (1.09–1.98)	0.011	1.29 (0.93–1.79)	0.121
Pain	1.92 (1.34–2.76)	<0.001	1.71 (1.16–2.52)	0.007
Fatigue	1.56 (1.12–2.18)	0.009	1.33 (0.94–1.90)	0.108
Emotional well-being	1.21 (0.89–1.64)	0.224	1.08 (0.78–1.51)	0.642
Social functioning	1.68 (1.20–2.36)	0.003	1.45 (1.01–2.08)	0.045

Odds ratios greater than 1 indicate higher likelihood of return to work per unit increase in quality-of-life domain score. The adjusted model was controlled for clinical stage and type of professional activity.
OR: odds ratios; CI: confidence intervals.

and work capacity. Adjusting for these variables allowed us to account for baseline disease severity while isolating the independent contribution of occupational and organizational factors to RTW outcomes. This approach is particularly appropriate in a population of public-sector employees, in whom workplace conditions and institutional support may mitigate the effects of clinical severity on occupational reintegration.

Although our study collected information regarding treatment timelines and RTW periods, the analytical approach adopted was cross-sectional. This design choice was primarily driven by feasibility, the objective of achieving a high participation rate, and the need to capture a representative snapshot of RTW outcomes within the early survivorship window. Cross-sectional designs are frequently used in RTW research because they allow accurate evaluation of short-term reintegration outcomes and their correlates within a defined period after treatment completion. While a longitudinal design would allow a more detailed evaluation of dynamic changes in work ability, fluctuations in QoL, and long-term vocational trajectories, such an approach requires repeated in-person evaluations and sustained participant retention, which were not feasible within the structure of this institutional program. Therefore, our cross-sectional strategy provides robust and meaningful insights into early RTW determinants, while also highlighting the need for future longitudinal studies to better explore the evolution of functional recovery and work capacity over time.

RTW rates in our study align with those in previous findings on developed nations, such as Canada and Sweden, where universal healthcare systems support occupational reintegration. These findings also surpass those reported in underdeveloped countries and other Brazilian studies[22-27]. The findings of Blinder et al.[21], who analyzed RTW rates among socioeconomically disadvantaged American women from diverse ethnic backgrounds, mirror our observations, particularly because most participants in our study also had lower incomes[23]. This suggests that low-income women, irrespective of their nationality, may experience prolonged delays in RTW.

Workplace interventions, such as accommodations and flexible work arrangements, are critical for overcoming barriers to RTW. Evidence suggests that tailored strategies, including phased returns and job modifications, significantly improve RTW outcomes. Public sector employers in Brazil may benefit from implementing such strategies to support cancer survivors in resuming their professional activities. In both Brazil and the United States, legislation mandates employers' obligations to safeguard employees' rights and job retention. This often requires modifications in the workplace[21]. The feasibility of adapting workplace responsibilities to accommodate medical needs significantly influences patients' RTW capacity, echoing findings from prior research and underscoring the necessity for workplace adjustments during cancer treatment[28].

In addition, the multivariate analysis reinforced that occupational and organizational factors play a more significant role in RTW than clinical or treatment-related characteristics. Among all variables with $p<0.10$ in the univariate analysis, only employer support and functional readaptation remained independently associated with RTW after adjustment, underscoring the decisive influence of workplace conditions on the reintegration process of BCS. This finding is consistent with international literature showing that institutional support, communication with supervisors, and temporary adaptations in workload or job tasks are fundamental facilitators of sustainable RTW. The absence of significant associations for clinical variables after adjustment suggests that, in settings with greater employment stability and reduced socioeconomic vulnerability, psychosocial and organizational factors may exert a more prominent influence on RTW outcomes.

The multivariate analysis demonstrated that occupational and organizational factors outweighed clinical and treatment-related variables in determining RTW. Although tumor stage and treatment intensity influenced RTW in univariate analyses, these variables did not remain independently associated after adjustment, suggesting that workplace conditions may act as upstream determinants capable of mitigating the impact of clinical severity in this population of public-sector employees.

Our institution has specific structural characteristics that distinguish our population from the broader public SUS setting in Brazil. All participants in this study are public-sector employees working under a statutory employment regime, which guarantees job stability, regulated working conditions, and access to a dedicated occupational health system. These employees also maintain a state-supported health insurance plan, facilitating timely access to oncological treatment and rehabilitation services. Additionally, concerns regarding pension eligibility, career progression, and the potential loss of income-related benefits often discourage prolonged medical leave, motivating an earlier RTW. These institutional protections reduce socioeconomic vulnerability and may partially explain the higher RTW rates observed in our cohort compared with SUS-based studies. However, these same characteristics limit the generalizability of our findings, as they may not reflect the experience of workers in informal or unstable employment conditions.

Other studies have observed links between advanced disease stages, comorbidities, and non-RTW[19,24]. Our study established a correlation between the clinical stage of the tumor and RTW, with women presenting with larger tumors and undergoing more intensive treatments being likely to face greater post-treatment challenges.

Surgical approaches affect RTW, with more extensive procedures, such as mastectomies[16] and axillary lymph node dissections[18], posing significant RTW barriers owing to associated morbidities, such as nerve damage and lymphedema, which can be debilitating. Such extensive surgical interventions are prevalent in Brazil's public healthcare system, where late-stage diagnoses are common[18]. The participants in our study, however, did not use the public healthcare system, which may have influenced the outcomes.

Previous Brazilian studies investigating RTW among BCS used different methodological strategies, including in-person interviews[15,17], and telephone-based questionnaires[16]. One of these studies also performed structured clinical assessments of functional sequelae, particularly upper-limb and shoulder impairments, in a subset of patients[15].

In our study, although with a substantial number of patients, we did not perform a direct clinical evaluation of physical sequelae. This is an important limitation, as functional impairments such as pain, reduced range of motion, fatigue, and lymphedema are recognized predictors of delayed RTW. Differences in methodological design — particularly the absence of clinical functional assessment — may partially explain discrepancies between our findings and those reported in SUS-based cohorts.

Chemotherapy has been identified as a significant RTW barrier in various studies[15,16,18], which is attributable to its immediate and enduring adverse effects[19]. In our study, chemotherapy emerged as a significant barrier to RTW and was potentially associated with advanced disease stages. Consistent with other studies[18,29], hormone therapy was not correlated with RTW, although consensus is lacking[18]. Side effects of hormone therapy include arthralgia, fatigue, and hot flashes. Although radiation therapy[29] is considered a potential impediment to RTW owing to arm morbidities, our findings showed no significant relationship between radiation therapy and RTW.

Research on the relationship between QoL and RTW is scarce. A South Korean prospective study evaluating RTW's impact on QoL using EORTC QLQ-C30, BR23, and the Brief Fatigue Inventory found that appetite loss and fatigue adversely affected RTW, with non-returning patients reporting higher arm symptom scores[16,18]. A Brazilian study utilizing the FACT-B questionnaire noted the detrimental effect of post-treatment depression on RTW[16]. RTW was correlated with various domains exhibiting improved functional scores, whereas negative RTW outcomes were linked to the symptoms of depression, anxiety, disability, and pain, which suggests that employment positively influences QoL and underscores the association between non-RTW and psychological symptoms. Improvements in fatigue and depressive symptoms were noted over time[16]. In our study, RTW was significantly associated with improved QoL across multiple domains, including body image and functionality. Conversely, patients who did not RTW exhibited higher levels of fatigue and poorer social perceptions, which reinforces the critical link between employment and psychological well-being. However, the reliance on self-reported data introduces the possibility of recall bias, particularly in the measurement of QoL. Survivors may have over- or underestimated their functional and emotional recovery, which could impact the interpretation of RTW-related factors. Future research should consider longitudinal designs with validated tools to provide a more accurate and dynamic understanding of RTW determinants.

It is important to note that, at the time of data collection, some participants were still undergoing ongoing adjuvant oncologic treatment, particularly endocrine therapy and anti-HER2 therapy, which are typically administered over prolonged periods and may coexist with return to work. Unlike cytotoxic chemotherapy, these treatments are commonly associated with a more favorable functional profile, allowing occupational reintegration while treatment is ongoing.

The presence of ongoing systemic therapy therefore reflects real-world survivorship conditions rather than active disease severity. Accordingly, the reference to disease progression at the time of data collection was removed to avoid misinterpretation, as the study population consisted of clinically stable patients without evidence of metastatic disease at diagnosis. This clarification strengthens the internal validity of our findings and aligns the analysis with contemporary survivorship care models.

This study has several limitations that should be acknowledged. First, because of the cross-sectional design, the patients' clinical and functional status at the six-month mark was not directly evaluated. Some participants may still have been undergoing active oncologic treatment or experiencing disease progression at the time of data collection, which may influence their ability or decision to RTW. Second, we did not perform objective clinical assessments of treatment-related sequelae, such as pain, reduced shoulder mobility, lymphedema, fatigue, or neuropathy — which are recognized predictors of delayed work reintegration. Third, functional capacity was self-reported, and no standardized or validated functional scale was applied, which may introduce information bias. Fourth, although the questionnaire was based on relevant RTW-related items extracted from the EORTC QLQ-C30 and QLQ-BR23, we did not use the updated EORTC BR42 module, which includes additional domains related to long-term functional outcomes and survivorship issues. Fifth, the study was conducted in a specific population of public-sector employees with stable statutory employment, predictable income, and access to a structured occupational health system, which may limit generalizability to workers in informal or unstable employment contexts. Finally, as with all questionnaire-based studies, the possibility of recall bias and social desirability bias cannot be excluded.

Despite these limitations, the study provides robust evidence on organizational factors influencing RTW and contributes novel data from a population rarely explored in Brazilian literature.

CONCLUSIONS

In conclusion, RTW among BCS in our institution was primarily influenced by occupational and organizational factors rather than clinical characteristics. Employer support and the availability of functional readaptation were the strongest independent determinants of successful reintegration. These findings highlight the importance of structured workplace support programs and tailored accommodations to facilitate RTW. Further longitudinal

studies incorporating functional assessment and validated QoL measures are needed to better understand long-term work outcomes in this population.

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AUTHORS' CONTRIBUTIONS

MA: Conceptualization, Methodology, Writing – original draft. AM: Conceptualization, Methodology, Writing – original draft. AGDP: Methodology, Writing – original draft. MSB: Methodology, Writing – original draft. FPC: Writing – review and editing. FZ: Writing – review & editing. ECM: Writing – review & editing. FPB: Writing – review & editing. ALF: Writing – review & editing.

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