

Factors associated with Low Physical Activity Levels among Breast Cancer Survivors

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Abstract

Purpose

Physical activity improves quality of life and reduces recurrence and mortality among breast cancer survivors; however, real-world activity levels remain poorly characterized, particularly in Japan. This study aimed to describe physical activity levels and identify clinical factors associated with insufficient activity.

Methods

In this cross-sectional study, breast cancer survivors (stage 0–III) who had completed primary treatments were recruited from multiple facilities within a single medical group in 2025. Physical activity was assessed using the Global Physical Activity Questionnaire. The primary outcome was achievement of recommended leisure-time physical activity (≥ 600 MET-min/week). Logistic regression analyses were performed with surgical procedure and cancer stage as main explanatory variables, adjusting for demographic, treatment-related, and psychosocial factors.

Results

Among 295 participants, only 16.6% achieved the recommended activity level, and 64.7% reported no moderate-to-vigorous activity. Mastectomy was significantly associated with lower likelihood of achieving recommended activity (univariate OR, 0.40; 95% CI, 0.20–0.78). This association remained significant after multivariable adjustment (Model 3: OR, 0.26; 95% CI, 0.08–0.76; $p = 0.019$).

Conclusions

Physical activity levels among breast cancer survivors were markedly low. Mastectomy was independently associated with insufficient activity, suggesting a need for surgery-specific interventions to improve physical activity.

Introduction

Breast cancer is the most commonly diagnosed cancer among women worldwide [1], and its prevalence has steadily increased in Japan since 1964 [2]. In recent years, advances in screening for early detection [3, 4] and improvements in treatment outcomes [5] have increased the 5-year survival rate of women with early-stage breast cancer by approximately 90% [6]. The term “breast cancer survivor” refers to an individual from the time of breast cancer diagnosis throughout the remainder of their lives. Although clinical outcomes have improved, breast cancer survivors still experience a range of physical, psychological, and social challenges. Therefore, comprehensive, high-quality care is required to address the long-term effects of breast cancer treatment [7].

Improving physical activity is an important component of survivorship care for breast cancer survivors. Previous studies have shown that physical activity not only improves quality of life (QOL) [8], but also contributes to a reduced risk of breast cancer recurrence [9] and mortality [10]. Based on this evidence, both domestic and international guidelines recommend at least 150 min of moderate-intensity physical activity per week or at least 75 min of vigorous-intensity physical activity per week [11, 12].

However, the proportion of breast cancer survivors who meet the recommended levels of physical activity remains limited, ranging from 34–54%, with substantial variations across cultural backgrounds and regions [13–15]. In Japan, only 21% of breast cancer survivors are aware of physical activity guidelines [16], and lifestyle counseling related to physical activity is provided by only 19% of healthcare professionals [17]. Thus, despite the well-established importance of physical activity, support systems for promoting physical activity in routine clinical practice remain

insufficient, and significant challenges persist in facilitating increased physical activity among breast cancer survivors.

In light of these challenges, the effective delivery of physical activity support services requires the identification of target populations for intervention, which in turn necessitates an understanding of the factors associated with physical activity levels. Previous studies among breast cancer survivors in Japan have reported that self-efficacy, social support, experiences of symptom relief, low income, and urban residence are associated with physical activity [16]. Although psychosocial and socioeconomic factors have been reported, little is known about the relationship between physical activity levels and clinical characteristics, including breast cancer stage, surgical procedures, and systemic treatments.

Therefore, this study aimed to examine the associations between clinical factors, such as breast cancer stage and treatment characteristics, and the attainment of recommended levels of physical activity. We sought to identify target populations that should be prioritized for physical activity support services by clarifying the clinical characteristics of breast cancer survivors who met the recommended physical activity levels.

Methods

Study Design and Participants

This cross-sectional study was conducted at the Kameda General Hospital and its affiliated clinics (Kameda Clinic, Kameda Makuhari Clinic, and Kameda Kyobashi Clinic). The study institutions were geographically diverse: Kameda General Hospital and Kameda Clinic are located in Kamogawa City (population of approximately 30,000), Kameda Makuhari Clinic in Chiba City (population of approximately 1 million), and Kameda Kyobashi Clinic in central Tokyo (population of approximately 200,000) [18]. The geographical locations are shown in Fig. 1. Eligible patients diagnosed with breast cancer who attended the outpatient clinics of the study institutions between June 1 and July 14, 2025, were consecutively enrolled from the clinics of four collaborating physicians. Based on the assumption that the prevalence of achieving the recommended level of physical activity (≥ 600 METs-min/week) was 30%, as reported in the 2023 National Health and Nutrition Survey of Japan [19], the required sample size was set at 350 participants.

Eligibility and Exclusion Criteria

The participant selection process is illustrated in Fig. 1. Eligibility criteria were as follows: a diagnosis of breast cancer (stage 0–III); age ≥ 20 years at the time of questionnaire completion; completion of postoperative treatments other than endocrine therapy; and the ability to complete a self-administered questionnaire.

The exclusion criteria were cognitive impairment, psychiatric disorders, physical or functional impairments limiting exercise, history of metachronous bilateral breast cancer, stage IV disease or recurrent/metastatic breast cancer, and ongoing treatments other than endocrine therapy (e.g., chemotherapy, molecular-targeted therapy, or radiotherapy).

Data Collection and Study Variables

Two types of data were collected in this study: electronic medical records and self-administered questionnaires. Oncological characteristics and treatment-related information (including cancer stage, type of surgery, and receipt of chemotherapy, endocrine therapy, and radiotherapy) were extracted from electronic medical records.

Physical, psychological, behavioral, and social factors were collected using a self-administered questionnaire distributed in the outpatient clinics. The questionnaire was provided to the patients by the outpatient support staff together with an information sheet, and the completed questionnaires were returned via a locked collection box.

Primary Outcome

The primary outcome measure was achievement of the recommended level of leisure-time physical activity, defined as engaging in ≥ 600 METs-min/week of physical activity, based on the Global Physical Activity Questionnaire (GPAQ) [20]. The GPAQ is a self-administered questionnaire developed by the World Health Organization to assess physical activity and consists of 16 items that evaluate moderate-to-vigorous physical activity (MVPA) and sedentary time across three domains: work, transport, and leisure.

Metabolic equivalents (METs) represent the intensity of physical activity as a multiple of the resting energy expenditure; one MET corresponds to resting while seated, and normal walking is equivalent to approximately 3 METs. According to international physical activity guidelines, the recommended level of physical activity is defined as at least 150 min/week of moderate physical activity (MPA) or 75 min/week of vigorous physical activity (VPA). In the GPAQ, MPA and VPA were assigned values of 4 METs and 6 METs, respectively. Participants with a total MVPA of ≥ 600 METs-min/week were therefore classified as having achieved the recommended level of physical activity.

Explanatory Variables

Clinical variables were used as the main explanatory variables and were obtained from electronic medical records. These included the type of surgery, cancer stage, tumor subtype, and history of chemotherapy, endocrine therapy, and radiotherapy. Surgical procedures were categorized as breast surgery (mastectomy or other breast-preserving procedures) or axillary surgery (sentinel lymph node biopsy [SN] or axillary lymph node dissection [Ax]). Other breast-preserving procedures included breast-conserving surgery and cryoablation. Cancer stage was classified into four categories (stage 0, I, II, and III). The history of chemotherapy and radiotherapy was classified as yes or no. Chemotherapy regimens were further categorized into four groups: anthracycline plus taxane (AC-T), taxane-based therapy alone, docetaxel plus cyclophosphamide (TC), and other. Endocrine therapy history was classified into five categories: no endocrine therapy, tamoxifen (TAM), aromatase inhibitors (AIs), switching from TAM to AIs, and switching from AIs to TAM.

Physical factors other than clinical variables, including age at diagnosis, current age, time since diagnosis, and body mass index (BMI), were collected using a self-administered questionnaire. Social factors, including employment status, household composition, household income, availability of support within the household, and residential area, were also obtained from the questionnaire.

Employment status was classified into four categories: unemployed, employed full-time, employed part-time, and self-employed/other. Household composition was categorized as living alone, living with a spouse, living with children, living with parents, or other. Household income was classified into six categories: <2 million yen, 2–4 million yen, 4–6 million yen, 6–8 million yen, ≥ 8 million yen, and prefer not to answer. The availability of household support was categorized as childcare responsibilities, caregiving responsibilities, no specific support needs, or other. Residential areas were collected in a free-text format at the municipal level. Psychological and behavioral factors included fatigue, anxiety, and depression symptoms, and habitual physical activity prior to cancer diagnosis. Fatigue was assessed using the Cancer Fatigue Scale (CFS), which consists of three subscales: physical, mental, and cognitive. The total CFS score is calculated as the sum of all items, with higher scores indicating greater fatigue severity. The

CFS comprises 15 items rated on a 5-point Likert scale ranging from 1 (no) to 5 (very much), yielding a total score ranging from 0 to 60. A cutoff score of 19 has been proposed to indicate clinically significant fatigue that interferes with activities of daily living [21, 22]. In the present study, participants were classified into high- and low-fatigue groups based on this cutoff. Anxiety and depression were assessed using the Japanese version of the Hospital Anxiety and Depression Scale (HADS). The HADS consists of 14 items, including seven items each for anxiety and depression. Scores for each subscale range from 0 to 21 and are categorized as normal (0–7), borderline (8–10), or definite cases (≥ 11). In this study, a total score of ≥ 8 was defined as indicating the presence of anxiety and/or depressive symptoms [23].

Statistical Analyses

Descriptive analyses were initially conducted to calculate the proportion and distribution of participants who achieved the recommended level of physical activity. Cross-tabulations were performed, and chi-squared tests were used to examine univariate associations between achievement of the recommended physical activity level (≥ 600 METs-min/week) and clinical variables, including type of surgery, cancer stage, tumor subtype, history of chemotherapy, endocrine therapy, and radiotherapy. Subsequently, logistic regression analyses were conducted to evaluate the independent associations between these clinical variables and achievement of the recommended physical activity level, with achievement status as the dependent variable and clinical variables as independent variables. To account for potential confounding factors, sequentially adjusted models were constructed by adding physical factors (current age and BMI), psychological and behavioral factors (CFS score, HADS score, and habitual physical activity before diagnosis), and social environmental factors (employment status, household composition, household income, family support, and residential area).

Odds ratios (ORs) and 95% confidence intervals (95% CIs) were calculated for each model. Radiotherapy was excluded from the multivariate models because of its high correlation with breast-conserving surgery and concerns regarding multicollinearity. Model performance and validity were assessed using receiver operating characteristic (ROC) curve analysis, variance inflation factors (VIF) to evaluate multicollinearity, and the Hosmer–Lemeshow goodness-of-fit test. Statistical significance was set at a two-sided $p < 0.05$. All statistical analyses were performed using R software (version 4.3.3).

Results

During the study period, 401 patients diagnosed with breast cancer visited the outpatient clinic. After excluding 87 patients who met the exclusion criteria and 19 with missing GPAQ data, 295 patients were included in the final analysis (Fig. 1). Table 1 summarizes the clinical characteristics of the study population. The mean age at diagnosis was 56.9 years (standard deviation [SD], 11.8), the mean interval from diagnosis to the survey was 5.2 years (SD, 4.1), and the mean body mass index was 22.9 kg/m² (SD, 3.9). Breast-conserving surgery was the most common procedure ($n = 138$, 47%), followed by mastectomy ($n = 129$, 44%), and cryoablation ($n = 28$, 9%). Sentinel lymph node biopsy was performed in 230 patients (83%). More than half of the patients had stage I disease, followed by stage II. Approximately 30% of patients received chemotherapy, nearly 90% underwent hormone therapy, and more than half received radiotherapy.

Table 1
Clinical Characteristics of the Study Population

N = 295		
Age at diagnosis (years), mean $\pm$ SD		56.9 $\pm$ 11.8
Current age (years), mean $\pm$ SD		62.1 $\pm$ 11.5
Time since diagnosis (years), mean $\pm$ SD		5.2 $\pm$ 4.1
BMI, mean $\pm$ SD		22.9 $\pm$ 3.9
Breast surgery, n (%)	Mastectomy	129(44)
	Breast-conserving surgery	138(47)
	Cryoablation	28(9)
Axillary surgery, n (%)	SN	230(83)
	Ax	49(18)
Breast reconstruction, n (%)	Yes	24(8)
Stage, n (%)	0	42(14)
	I	159(54)
	II	82(28)
	III	12(4)
Simultaneous bilateral surgery, n (%)	Yes	13(4)
Chemotherapy, n (%)	Yes	88(30)
	AC-T	38(12)
	Only Taxan	16(5)
	TC	23(8)
	Other	11(4)
Hormone therapy, n (%)	Yes	262(89)
	TAM	90(31)
	TAM→AI	19(6)
	AI	147(49)
	AI→TAM	6(2)
Radiotherapy, n (%)	Yes	166(56)
	No	47(16)
BMI, body mass index; SD, standard deviation; SN, sentinel lymph node biopsy; Ax, axillary lymph node dissection; AC-T, doxorubicin plus cyclophosphamide followed by paclitaxel; TC, docetaxel plus cyclophosphamide; TAM, tamoxifen; AI, aromatase inhibitor.		
TAM→AI indicates switching from tamoxifen to an aromatase inhibitor, and AI→TAM indicates switching from an aromatase inhibitor to tamoxifen.		

N = 295		
Postoperative complications, n (%)	Shoulder joint contracture	16(6)
	Menopausal symptoms	53(21)
	Lymphedema	14(6)
	Joint pain	42(17)
	Peripheral neuropathy	18(7)
	Edema	13(5)
	Other	20(8)
BMI, body mass index; SD, standard deviation; SN, sentinel lymph node biopsy; Ax, axillary lymph node dissection; AC-T, doxorubicin plus cyclophosphamide followed by paclitaxel; TC, docetaxel plus cyclophosphamide; TAM, tamoxifen; AI, aromatase inhibitor.		
TAM→AI indicates switching from tamoxifen to an aromatase inhibitor, and AI→TAM indicates switching from an aromatase inhibitor to tamoxifen.		

Table 2 summarizes the psychological and behavioral characteristics of the study population. The median CFS score was 6 (interquartile range [IQR], 3–10), and 127 patients (43%) were classified as having high fatigue levels (score $\geq$ 19). The median total HADS score was 10 (IQR: 7–15), with 182 patients (62%) showing depressive or anxiety symptoms (score $\geq$ 8). Before diagnosis, 146 patients (50%) reported regular exercise habits, whereas only 45 patients (15%) reported walking for at least 1 h per day. Regarding social factors, 98 patients (33%) were unemployed, and 73 (25%) were employed full-time. Thirty-three patients (11%) lived alone, whereas 243 (82%) lived with family members. The most common annual household income was 2–4 million yen (25%), followed by $\geq$ 8 million yen (19%). More than half of the patients (54%) resided in cities with populations of less than 100, 000.

Table 2
Psychological and Psychosocial Characteristics of the Study Population

N = 295		
CFS,median (IQR)	Physical fatigue	6(3–10)
	Mental fatigue	8 (7–10)
	Cognitive fatigue	4(2–7)
	Total score	18(13–25)
HADS,median (IQR)		10(7–15)
CFS, n (%)	≥ 19	127(43)
HADS, n (%)	8≥	183(62)
Pre-diagnosis exercise habits, n (%)	Yes	146(50)
Employment status, n (%)	Not employed	98(33)
	Full-time	73(25)
	Part-time	68(23)
	Self-employed / Other	35(12)
Household composition, n (%)	Living alone	33(11)
	Other	243(82)
Support status, n (%)	Childcare	19(6)
	Caregiving	27(9)
	Other	17(6)
	No support	191(65)
Annual household income, n (%)	< 2 million yen	40(14)
	2–4 million yen	74(25)
	4–6 million yen	37(13)
	6–8 million yen	33(11)
	≥ 8 million yen	55(19)
Urbanicity, n (%)	Special wards / major metropolitan cities	66(22)
	Population ≥ 100,000	54(18)
	Population < 100,000	160(54)
	Towns and villages	15(5)
IQR, Interquartile range; CFS, Cancer Fatigue Scale; HADS, Hospital Anxiety and Depression Scale.		

Achievement of the Recommended Level of Physical Activity

Table 3 presents the achievement status of the recommended level of physical activity. The median amount of MVPA during leisure time was 0 MET-min/week (IQR, 0–355). When leisure and transportation activities were combined, the median was 240 MET-min/week (IQR, 0–840); and when leisure, transportation, and work-related activities were combined, the median was 460 MET-min/week (IQR, 0–1580). The proportion of patients who achieved the recommended level of physical activity was 16.6% (n = 49) for leisure-time activities, 33.9% (n = 100) for leisure and transportation activities, and 50.5% (n = 149) for leisure, transportation, and work-related activities. Regarding the distribution of physical activity, the proportion of patients reporting no MVPA was 64.7% (n = 191) for leisure only, 45.4% (n = 134) for leisure plus transportation, and 30.5% (n = 90) for leisure, transportation, and work-related activities, indicating that more than half of the non-achievers reported no activity across all domains (Fig. 2).

Table 3
Proportion of participants achieving recommended physical activity levels

N = 295	Leisure	Leisure+Transport	Leisure+Transport+Work
Median (IQR)	0(0-355)	240(0-840)	480(0-1580)
Achieving recommended physical activity (%)	49(16.6)	100(33.9)	146(49.5)
Not achieving recommended physical activity (%)	246(83.4)	195(66.1)	149(50.5)
No MVPA (%)	191(64.7)	134(45.4)	90(30.5)
IQR, Interquartile range; MVPA, Moderate-to-vigorous physical activity.			
Recommended physical activity: ≥600 METs-min/week			

Association Between Clinical Factors and Physical Activity Level

First, cross tabulations were performed to examine the association between the recommended level of physical activity and each clinical factor (Table 4). Patients who underwent mastectomies tended to have lower achievement rates than those who underwent other breast-preserving procedures. In contrast, no clear differences in achievement rates were observed according to the disease stage, type of axillary surgery, presence of breast reconstruction, history of chemotherapy, hormone therapy, radiotherapy, or current treatment status.

Table 4
Association between achievement of recommended physical activity levels and clinical factors

N = 295		Not achieving recommended physical activity (n = 246)	Achieving recommended physical activity (n = 49)	P value
Breast surgery type (n, %)	Total mastectomy	116(47)	13(27)	0.011
	Other breast-preserving procedures	130(52)	36(73)	
Axillary surgery type (n, %)	SN	190(81)	40(89)	0.304
	Ax	44(19)	5(11)	
Breast reconstruction (n, %)	Yes	22(9)	2(4)	0.434
	No	224(91)	47(96)	
Stage (n, %)	0, I	165(67)	36(73)	0.478
	II, III	81(33)	13(27)	
Chemotherapy (n, %)	Yes	78(32)	10(20)	0.159
	No	168(68)	39(80)	
Hormone therapy (n, %)	Yes	217(88)	45(92)	0.626
	No	29(12)	4(8)	
No current treatment (n, %)	Yes	40(16)	7(14)	0.896
	No	209(84)	42(86)	
SN, sentinel lymph node biopsy; Ax, axillary lymph node dissection.				
P values were calculated using the chi-square test.				

The results of the logistic regression analysis are presented in Table 5. In the univariate logistic regression analysis, mastectomy was significantly associated with failure to achieve the recommended level of physical activity, with an OR of 0.40 (95% CI, 0.20–0.78; $p = 0.009$). Patients with a history of chemotherapy tended to be less likely to achieve the recommended level of physical activity; however, this association did not reach statistical significance (OR, 0.55; 95% CI, 0.25–1.12; $p = 0.118$). No significant associations with physical activity achievement were observed for disease stage, type of axillary surgery, breast reconstruction, history of hormone therapy, history of radiotherapy, or current treatment status.

Table 5

Clinical factors associated with achievement of recommended physical activity levels: a logistic regression analysis

		Crude OR (95% CI)	P value	Model 1 (n = 279) Adjusted OR (95% CI) P value		Model 2 (n = 209) Adjusted OR (95% CI) P value		Model 3 (n = 168) Adjusted OR (95% CI) P value	
Stage (ref: 0–I)	II, III	0.74 (0.36–1.43)	0.381	1.00 (0.45–2.13)	0.991	0.87 (0.37–2.14)	0.771	1.03 (0.32–3.25)	0.958
Breast surgery type (ref: other breast-preserving procedures)	Mastectomy	0.40 (0.20–0.78)	0.009	0.45 (0.21–0.93)	0.035	0.39 (0.17–0.83)	0.017	0.26 (0.08–0.76)	0.019
Axillary surgery type (ref: SN)	Ax	0.54 (0.18–1.33)	0.220	0.71 (0.21–2.12)	0.562	1.38 (0.36–4.98)	0.624	1.24 (0.25–5.27)	0.784
Breast reconstruction	Yes	0.43 (0.07–1.54)	0.220	0.71 (0.11–2.82)	0.669	0.67 (0.10–2.98)	0.637	1.49 (0.17–8.95)	0.680
Chemotherapy	Yes	0.55 (0.25–1.12)	0.118	0.16 (0.32–1.87)	0.621	0.85 (0.30–8.87)	0.742	0.95 (0.27–3.10)	0.937
Hormone therapy	Yes	1.50 (0.56–5.25)	0.465	1.58 (0.41–8.47)	0.508	1.50 (0.31–8.87)	0.630	1.44 (0.21–2.53)	0.613
No current treatment	Yes	0.86 (0.33–1.94)	0.730	0.90 (0.27–2.62)	0.849	0.65 (0.15–2.41)	0.531	0.22 (0.03–1.26)	0.111
Model 1: Adjusted for current age and body mass index (BMI).									
Model 2: Additionally adjusted for psychosocial and behavioral factors (Cancer Fatigue Scale [CFS], Hospital Anxiety and Depression Scale [HADS], and pre-diagnosis physical activity).									
Model 3: Additionally adjusted for social environmental factors (employment status, household composition, household income, household support, and residential area).									
OR, odds ratio; CI, confidence interval; SN, sentinel lymph node biopsy; Ax, axillary lymph node dissection.									

Subsequently, three multivariate logistic regression models (Models 1–3) were constructed. Model 1 was adjusted for age and BMI. Model 2 was additionally adjusted for psychological and behavioral factors (CFS score, HADS score, and pre-diagnosis exercise habits). Model 3 was adjusted for social factors (employment status, household composition, household income, family support, and residential area). Across all models, mastectomy was consistently associated with a lower likelihood of achieving the recommended level of physical activity than other breast-preserving procedures. The ORs for mastectomy were 0.45 (95% CI, 0.21–0.93; $p = 0.035$) in Model 1, 0.39 (95% CI, 0.17–0.83; $p = 0.017$) in Model 2, and 0.26 (95% CI, 0.08–0.76; $p = 0.019$) in Model 3 (Table 6). ROC curve analysis of the final

model (Model 3) yielded an area under the curve (AUC) of 0.82, indicating good discriminative ability. All variance inflation factor values were below 5, suggesting no multicollinearity. The Hosmer–Lemeshow goodness-of-fit test was not significant ($p = 0.111$), indicating an adequate model fit.

Discussion

In this study, only 16.6% of the breast cancer survivors achieved the recommended level of physical activity, indicating that few participants were sufficiently active to meet the current physical activity guidelines. Notably, among those who did not achieve the recommended level, many reported no MVPA, suggesting a polarized distribution of physical activity levels. Furthermore, mastectomy was identified as a factor associated with a lower likelihood of achieving the recommended level of physical activity. This association remained consistent even after adjusting for physical factors such as age and BMI, as well as psychological, behavioral, and social factors. In contrast, no significant association was observed between physical activity levels and cancer stage, axillary surgery type, breast reconstruction status, history of chemotherapy or endocrine therapy, or current treatment status.

Few studies have examined the association between breast surgery and physical activity among breast cancer survivors [15]. Therefore, the observation that a similar association was identified in a Japanese population, with distinct body compositions, lifestyles, and psychological backgrounds, is noteworthy.

Prior studies have suggested that mastectomies are more likely to be accompanied by physical complications, such as sensory disturbances [24] and limitations in upper limb elevation [25, 26], which may restrict engagement in daily physical activity. Additionally, psychological resistance to postoperative changes in body image may discourage participation in exercise [27]. In addition, breast-conserving surgery generally requires daily postoperative radiotherapy [28], and patients with pre-existing physical or social vulnerabilities may opt for mastectomy to avoid the burden of frequent hospital visits. Thus, surgical procedures may also reflect baseline differences in physical activity habits, functional capacity, and social circumstances. In contrast, no significant association was observed between physical activity and breast reconstruction. Although reconstruction may improve body image satisfaction, it can also impose postoperative physical constraints [29], suggesting that further research is required to optimize postoperative guidance after reconstructive surgery. Similarly, no associations were found between physical activity and cancer stage or a history of chemotherapy. This may reflect the recovery of physical function after completion of chemotherapy, as well as increased self-efficacy through ongoing follow-up care and information provided by healthcare professionals, which could attenuate differences in physical activity related to treatment history.

Previous studies have reported that 34–54% of breast cancer survivors achieve the recommended level of leisure-time physical activity [13–15]; however, the prevalence observed in the present study was lower than these reports and below the national average among Japanese women (approximately 29%) [19], indicating insufficient physical activity levels in this study population. This low prevalence may reflect the combined effects of psychological, social, and environmental factors.

In our cohort, a substantial proportion of participants experienced high fatigue (43%) and symptoms of anxiety and/or depression (62%), which may have limited their engagement in physical activity. Additionally, one-third of the participants were unemployed, and approximately half resided in small cities with populations of less than 100,000, where access to exercise environments and supportive resources may be restricted. Taken together, these factors may have acted synergistically to contribute to the overall low prevalence of achieving the recommended level of physical activity in this study population. In addition to these cross-sectional influences, temporal factors may play a role. Previous evidence has shown that physical activity levels decline substantially within 12 months of diagnosis [30]. In the present study, the mean time since diagnosis was 5.2 years (SD, 4.1), suggesting that sustained or

cumulative reductions over time may have further contributed to the low prevalence observed. However, given the cross-sectional design of the present study, this interpretation should be made with caution.

Similar to the present study, a Japanese study by Shimizu et al. assessed physical activity among breast cancer survivors using the GPAQ. In that study, the prevalence of achieving the recommended level of physical activity, calculated by combining work-, transport-, and leisure-related activities, was 50.1% [16], which is comparable to the overall achievement rate observed in our study (50.5%). However, physical activity accumulated through work or transport has been suggested to confer fewer health benefits than leisure-time exercise, a phenomenon known as the “physical activity paradox” [31]. Moreover, reductions in breast cancer recurrence and mortality have primarily been demonstrated in studies focusing on leisure-time physical activity [10, 32–35]. Although the present study specifically examined leisure-time physical activity, it remains unclear whether work- or transport-related activity provides health benefits comparable to those in breast cancer survivors, highlighting the need for further investigation.

This study had several limitations. First, approximately half of the respondents resided in areas with populations of less than 100,000, and the participating institutions treated a relatively large proportion of patients with early-stage breast cancer, which may have resulted in selection bias. Second, as the questionnaire was self-administered in outpatient waiting areas, the number of survey items was limited, and some factors potentially associated with physical activity may not have been fully assessed. Third, due to the cross-sectional design, the observed associations did not allow for causal inferences. Therefore, the findings of the present study should be interpreted with caution. Future studies involving larger and more diverse samples across multiple institutions, as well as interventional studies, are warranted to further elucidate the determinants of physical activity among breast cancer survivors.

Implications

Despite several limitations, our study demonstrated that physical activity levels among breast cancer survivors were generally low and polarized, with one subgroup engaging in little to no MVPA, and the other maintaining sufficient levels. The independent association between mastectomy and lower physical activity suggests the need for personalized survivorship strategies based on treatment history and physical background rather than a uniform approach.

Given the challenges of behavioral change, coordinated efforts are required at the individual, population, and societal levels. At the individual level, individualized support and information delivery tailored to each survivor’s treatment history and physical and psychosocial background are important. At the population level, healthcare institutions should establish systems to continuously provide practical physical activity information early after diagnosis. At the societal level, collaboration with community and public health sectors to integrate survivor-specific physical activity support into local resources may contribute to the long-term maintenance of physical activity.

Conclusion

In this study, only 16.6% of the breast cancer survivors achieved the recommended level of physical activity, indicating a substantial subgroup with markedly low activity levels. Mastectomy was associated with lower physical activity, and this association remained consistent after adjusting for age, BMI, and psychosocial factors. These findings underscore the need for physical activity support tailored for breast surgical procedures.

Declarations

Acknowledgments

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Compliance with Ethical Standards

Conflict of interest

The authors declare that they have no conflict of interest.

Ethical approval

This study was conducted in accordance with the Declaration of Helsinki and relevant guidelines, and was approved by the Ethics Review Committee of Kameda General Hospital (approval no. 25-021) and the Teikyo University Ethics Committee (Teirin 25-031).

Informed consent

Informed consent was obtained from all individual participants included in this study.

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Figures

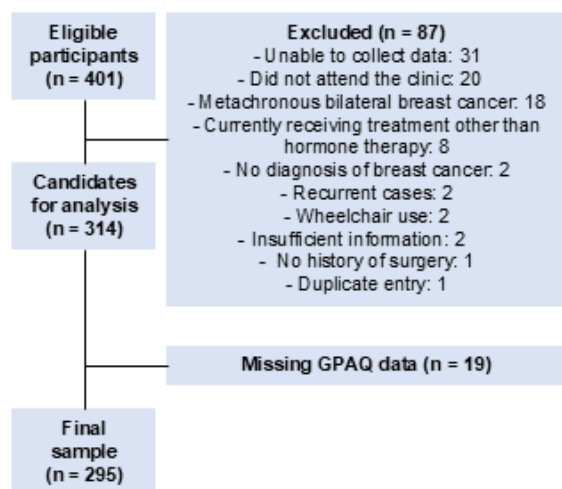


Figure 1

Flow diagram of participant selection

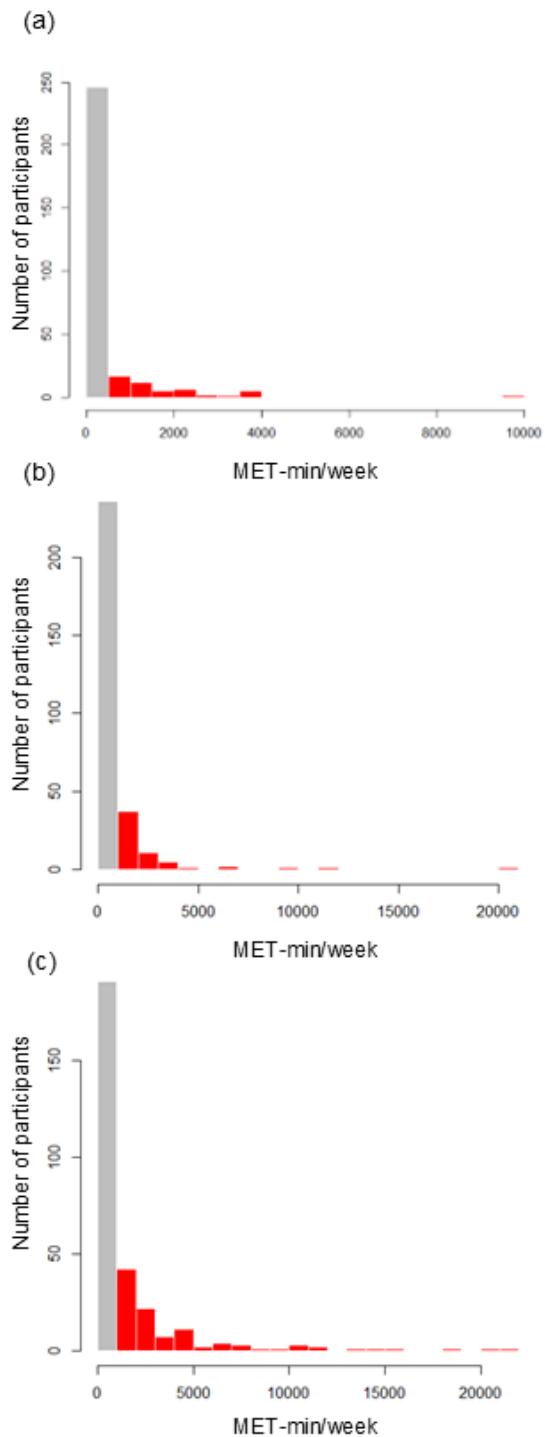


Figure 2

Distribution of moderate-to-vigorous physical activity (MVPA) by domain.

(a) Leisure. (b) Leisure plus transportation. (c) Leisure plus transportation plus work-related activities.

The horizontal axis shows MET-min/week and the vertical axis shows the number of participants. The red bars indicate participants who achieved the recommended physical activity level (≥ 600 MET-min/week). MVPA, moderate-to-vigorous physical activity; MET, metabolic equivalent