IMPACT OF ADJUVANT CHEMOTHERAPY ON QUALITY OF LIFE IN BREAST CANCER SURVIVORS

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Abstract

The study aimed to assess the quality of life in breast cancer patients who had undergone adjuvant chemotherapy. Data from a registry were used to recruit a sample of breast cancer patients (N = 61, average age = 51.6 years) who had completed adjuvant chemotherapy 3 to 36 months prior (average = 15.87 months). An age-matched comparison group of women without a history of cancer (N = 59, average age = 51.5 years) was also recruited using a peer nomination procedure. Both groups were asked to complete surveys that included the Medical Outcomes Study Short Form 36 (SF-36) and the Center for Epidemiologic Studies Depression Scale (CES-D). The goal was to examine whether breast cancer patients previously treated with chemotherapy had reduced quality of life compared to their peers and to explore demographic and medical factors that may contribute to variations in their quality of life. As hypothesized, the post-chemotherapy group scored lower than the non-cancer comparison group on the CES-D and six of the eight subscales of the SF-36, including the physical component summary scale ($p < 0.05$). Younger age and unmarried status were linked to poorer mental well-being and higher levels of depressive symptoms ($p < 0.05$). The time since cancer diagnosis and completion of chemotherapy was also associated with greater depressive symptoms ($p < 0.05$). However, none of the demographic or medical variables had a significant relationship with physical well-being ($p > 0.05$). Breast cancer survivors treated with adjuvant chemotherapy face challenges in various aspects of life, particularly in mental health, following their treatment. Demographic and medical factors can explain variations in mental but not physical quality of life outcomes. These results underscore the importance of developing interventions to enhance the quality of life for breast cancer patients who have undergone adjuvant chemotherapy.

Keywords: Effects of chemotherapy, Sleep, anxiety, Depression, Quality of life

Introduction

In 2021, around 175,000 women in the India were diagnosed with breast cancer [1]. A significant portion of these women underwent adjuvant chemotherapy, as studies have shown that this treatment improves both disease-free and overall survival rates [2]. With the increasing number of women receiving this treatment, researchers have become more interested in its effects on health-related quality of life. Most studies so far have focused on the period during active treatment, revealing that breast cancer patients often face challenges across multiple quality of life domains while undergoing chemotherapy [3-6]. However, less is known about the quality of life after completing adjuvant chemotherapy. Although various studies have examined quality of life in breast cancer survivors [7-10], only a few have specifically addressed those who had adjuvant chemotherapy.

One of the earliest studies on this topic, conducted by Knobf [11], surveyed 28 women who had completed different adjuvant chemotherapy regimens an average of 28 months earlier (ranging from 2 to 60 months). These findings have provided insight into the impact of chemotherapy beyond the treatment phase, focusing on the physical, psychological, and social domains of survivors' quality of life.

Additional studies have explored the differences in quality of life between

women who received adjuvant chemotherapy and those who received other breast cancer treatments. For instance, Berglund et al. [14] and van Dam et al. [15] found no significant differences in quality of life between chemotherapy and radiotherapy groups. However, Schagen et al. [18] discovered that former chemotherapy patients experienced more problems related to physical and cognitive functioning and higher levels of depression compared to those who underwent radiotherapy.

Two additional studies have examined the quality of life after adjuvant chemotherapy compared to other breast cancer treatments. In one study, Lindley et al. [19] evaluated the quality of life among women treated with adjuvant chemotherapy alone (N = 22, specific regimens not reported), tamoxifen alone (N = 31), or a combination of adjuvant chemotherapy and tamoxifen (N = 33) between 2 to 5 years prior. All participants completed the Functional Living Index-Cancer [20] (FLIC) and the Medical Outcomes Study Short Form 36 [21] (SF-36). The results showed no significant differences in quality of life based on the treatment received.

In a larger study, Ganz et al. [10] assessed the quality of life in women who were 1 to 5 years post-diagnosis and had completed one of the following treatments at least four months earlier: adjuvant chemotherapy only (N = 180, specific regimens not mentioned), tamoxifen alone (N = 356), a combination of chemotherapy and tamoxifen (N = 295), or no adjuvant therapy (N = 265, surgery with or without radiotherapy). Participants were evaluated using the SF-36, the Center for Epidemiologic Studies Depression Scale (CES-D), and additional measures addressing sexual functioning and common physical and psychological symptoms. Results indicated that women who received no adjuvant therapy reported better physical and sexual functioning compared to those in the adjuvant therapy groups. Among the adjuvant therapy groups, women treated with chemotherapy showed poorer sexual functioning compared to those treated with tamoxifen alone. However, no significant treatment-related differences were observed in terms of depressive symptoms or emotional functioning.

In summary, the literature presents mixed findings on the extent to which quality of life is affected after adjuvant chemotherapy for breast cancer. Some studies suggest that women treated with chemotherapy experience worse quality of life compared to those treated with postoperative radiotherapy or hormonal therapy, while other studies do not find such differences. A key question that previous research has not addressed is whether the quality of life of women treated with adjuvant chemotherapy differs from that of women with similar sociodemographic characteristics who have no history of breast cancer. This study aims to explore this issue by comparing the quality of life of women who have undergone adjuvant chemotherapy with an age-matched group of women without a cancer history. The data collected from both groups were used to test the hypothesis that former chemotherapy patients would have a lower quality of life. Additionally, the study examined whether certain demographic and medical factors (e.g., age and time since treatment completion) were associated with variations in quality of life among former chemotherapy patients.

Methods

This study included two groups: women who had undergone adjuvant chemotherapy for breast cancer (referred to as the post-chemotherapy group) and women with no history of breast cancer (non-cancer comparison group).

To qualify for the post-chemotherapy group, participants had to have completed their adjuvant chemotherapy for breast cancer between 3 and 36 months before the study and show no signs of disease recurrence at their most recent follow-up. They were also required to be at least 18 years old, have no untreated or unstable medical conditions, no known neurological disorders, and be fluent in English. A total of 79 patients from the Known Cancer Center met the criteria, with complete data collected from 61 patients (77%).

For the non-cancer comparison group, women were nominated by peers and had to meet similar criteria, including no history of cancer, being within six years of age of the patient who nominated them, and having no major medical conditions. From 65 eligible women, data were obtained from 59 participants (91%).

This study aimed to test the hypothesis that former chemotherapy patients would have a lower quality of life compared to the non-cancer comparison group. It also examined how demographic and medical factors, such as age and time since treatment, influenced individual quality of life outcomes in the post-chemotherapy group.

Procedures

Women who had completed adjuvant chemotherapy between 3 and 36 months before data collection were identified through a centralized tumor registry. Eligibility was confirmed by reviewing their medical records and consulting with the breast cancer treatment team. Those who met all the eligibility criteria were initially contacted by mail, receiving an introductory letter from their oncologist. Following this, they were contacted by telephone to obtain verbal informed consent. Women who agreed to participate were then sent a consent form, a questionnaire packet, and a pre-stamped envelope for returning the materials. About a week after sending the packet, a second phone call was made by a member of the research team to conduct a brief interview, answer any study-related questions, and request the prompt return of the completed questionnaires.

During the first phone call, each former chemotherapy patient was also asked to nominate one or more female friends, within six years of her age, who had no history of cancer and might be willing to join the study. The nominated women were first sent an introductory letter explaining the study and their nomination. They were then contacted by phone to confirm their eligibility and obtain verbal consent. Those who agreed to participate followed the same procedures for providing written consent and completing the self-report data collection.

Measures

A self-report questionnaire was used to gather demographic data on both former chemotherapy patients and the non-cancer comparison group, including age, menopausal status, marital status, employment status, ethnicity, and education level. The medical charts of the former chemotherapy patients were also reviewed to collect additional information about their disease stage, type of breast surgery, duration of adjuvant chemotherapy, chemotherapy agents used,

radiation therapy, and adjuvant hormonal treatments.

The primary measure of health-related quality of life used in the study was the SF-36 [21, 24], which includes eight subscales addressing different aspects of general health: physical functioning, role-physical (impact of physical health on work or daily activities), role-emotional (impact of emotional problems on work or daily activities), mental health, bodily pain, general health, vitality, and social functioning. The SF-36 also includes two summary scales: the physical component summary scale and the mental component summary scale. The SF-36 has well-established reliability and validity as a measure of health-related quality of life [21, 24].

In addition, participants completed the CES-D [22], a 20-item questionnaire designed to measure the severity of depressive symptoms over the past week. The CES-D has demonstrated reliability and validity in various populations, including cancer patients [25].

Other measures administered to participants, which are not the focus of this report, are described in detail elsewhere [26].

Results

Demographic and Medical Characteristics

The demographic and medical profiles of the post-chemotherapy group and the non-cancer comparison group are summarized in Table 1.

Table 1. Demographic characteristics of study samples

Variable	Former chemotherapy patients ($n = 61$)	Noncancer comparison subjects ($n = 59$)
Age (years)*	51.58 ± 11.10	51.47 ± 11.25
Income ($)		
≥ 40,000	31	36
< 40,000	30	23
Marital status		
Married	40	41
Unmarried	21	18
Education		
College graduates	21	26
Other	40	23
Employment		
Outside home	41	45
Other	20	14
Ethnic group		
White	56	56
Nonwhite	5	3
Menopausal status		
Postmenopausal	45	33
Pre- or perimenopausal	16	26

*Value expressed as mean ± SD.

The ages of women in the post-chemotherapy group ranged from 29 to 75 years (mean = 51.58, SD = 11.1). Most of these women were white (92%), married (66%), and working outside the home (67%). More than half (51%) reported a household income of $40,000 or more annually, and 34% were college graduates. At follow-up, 74% were postmenopausal, while 26% were pre- or perimenopausal. The comparison group's ages ranged from 29 to 77 years (mean = 51.47, SD = 11.25), with 95% being white, 69% married, and 76% working outside the home. A larger proportion of the comparison group (61%) reported an annual income of $40,000 or more, and 44% were college graduates. Menopausal status differed between the groups, with 56% of the comparison group being postmenopausal compared to 74% of the post-chemotherapy group. However, except for menopausal status, no other significant differences were found between

the groups on any demographic variables ($p \geq 0.35$). A marginal trend toward more post-chemotherapy women being postmenopausal was observed ($p = 0.06$).

The average time since breast cancer diagnosis in the post-chemotherapy group was 673 days (SD = 221.44), with 61% having undergone a mastectomy and 38% a lumpectomy. Regarding additional treatments, 48% received radiotherapy and 61% were on hormonal therapy (e.g., tamoxifen). Disease stages at diagnosis included stage I (25%), stage II (64%), stage III (8%), and unstaged (3%). Chemotherapy regimens varied, with the most common being doxorubicin and cyclophosphamide (39%). The average duration of chemotherapy was 111 days (SD = 49.6), and the average time since completing chemotherapy was 476 days (SD = 216.06). About 38% of patients had completed chemotherapy within the last year, while 62% had finished over a year ago.

Group Differences in Quality of Life

Table 2. Group comparisons on quality of life outcome

	Former chemotherapy patients ($n = 61$) M ± SD	Noncancer comparison subjects ($n = 59$) M ± SD	*F* value
CES-D	11.75 ± 10.97	7.59 ± 8.86	5.29*
SF-36 Scale			
Physical functioning	70.33 ± 24.32	85.85 ± 18.53	15.39***
Role-physical	54.51 ± 40.18	86.44 ± 27.20	25.82***
Role-emotional	70.49 ± 38.54	80.23 ± 35.62	2.06
Mental health	75.28 ± 18.24	79.19 ± 16.57	1.51
Bodily pain	70.79 ± 22.83	80.93 ± 18.77	7.04**
General health	68.70 ± 19.86	78.78 ± 16.64	9.04**
Vitality	52.30 ± 24.25	63.22 ± 17.85	7.86**
Social functioning	80.12 ± 23.65	90.68 ± 18.22	7.47**
Physical component summary scale	43.99 ± 10.67	51.87 ± 7.47	21.82***
Mental component summary scale	49.91 ± 11.48	51.53 ± 9.30	0.71

CES-D: Center for Epidemiologic Studies Depression Scale.
*$p \leq 0.05$.
**$p \leq 0.01$.
***$p \leq 0.001$.

Table 2 presents the mean scores and standard deviations for each group on the SF-36 measures of quality of life. The post-chemotherapy group reported significantly lower physical functioning ($p \leq 0.01$), more difficulties with daily activities due to physical problems ($p \leq 0.01$), increased bodily pain ($p \leq 0.01$), and poorer general health ($p \leq 0.01$). In terms of general health, 11% of former chemotherapy patients rated their health as "fair" or "poor," compared to just 2% in the comparison group, with the difference approaching significance ($p = 0.08$).

The post-chemotherapy group also reported lower vitality ($p \leq 0.01$) and poorer social functioning ($p \leq 0.01$) compared to the comparison group. However, no significant differences were found in mental health or daily activity limitations due to emotional problems between the groups.

Physical component summary scores indicated that former chemotherapy patients had worse overall physical well-being ($p \leq 0.001$) compared to the comparison group, while no significant differences were observed in overall mental well-being ($p > 0.05$).

On the CES-D measure of depressive symptoms, former chemotherapy patients reported significantly higher levels of depressive symptoms ($p \leq 0.05$). Using a cutoff score of 16 to indicate clinically significant distress, 26% of the post-chemotherapy group and 14% of the comparison group scored above this threshold, though the difference was not statistically significant ($p = 0.13$).

Relationship of Demographic and Medical Variables to Physical Well-Being

The analysis explored how demographic and medical variables were associated with differences in physical well-being among former chemotherapy patients. As

presented in Table 3, overall physical well-being, as measured by the SF-36 physical component summary scale, did not show any significant ($p \leq 0.05$) relationships with demographic factors such as age, marital status, income level, years of education, or employment status. A similar trend was observed for medical characteristics. Specifically, there were no significant ($p \leq 0.05$) associations between overall physical well-being and factors such as time since diagnosis, duration of chemotherapy treatment, time elapsed since chemotherapy ended, disease stage at diagnosis, type of surgery, receipt of radiotherapy, current use of hormonal therapy (e.g., tamoxifen), or menopausal status.

Table 3. Correlation of demographic and medical variables with quality of life outcomes among former chemotherapy patients

	PCSS	MCSS	CES-D
Demographic variables			
Age (years)	−0.20	0.29*	−0.25*
Marital status (married/unmarried)	0.09	0.29*	0.26*
Income level (≥$40,000/<$40,000)	0.18	0.00	−0.14
Education level (college graduates/other)	0.00	−0.17	0.08
Employment (outside home/other)	−0.15	0.09	0.05
Medical variables			
Time since diagnosis (days)	−0.17	−0.17	0.28*
Time since chemotherapy ended (days)	−0.19	−0.14	0.30*
Length of chemotherapy treatment (days)	0.04	−0.16	0.07
Stage of disease at diagnosis (stage I/other)	−0.02	0.21	−0.09
Type of surgery (mastectomy/lumpectomy)	0.01	0.18	0.07
Receipt of adjuvant radiotherapy (yes/no)	−0.01	−0.09	0.00
Current use of hormonal therapy (yes/no)	−0.15	−0.02	0.10
Menopausal status (post/pre or peri)	0.20	−0.11	0.00

PCSS: physical component summary scale; MCSS: mental component summary scale; CES-D: Center for Epidemiologic Studies Depression Scale.
*$p \leq 0.05$.

Relationship of Demographic and Medical Variables to Mental Well-Being

The analysis also examined the relationship between demographic and medical variables and differences in overall mental well-being among former chemotherapy patients. As previously mentioned, there were no significant differences in overall mental well-being, as measured by the SF-36 mental component summary scale, between former chemotherapy patients and non-cancer comparison subjects. However, considerable variability in mental well-being was observed among former chemotherapy patients, with scores ranging from 22.83 (2.4 standard deviations below the group mean) to 65.62 (1.4 standard deviations above the group mean). As shown in Table 3, mental well-being was significantly ($p \leq 0.05$) related to demographic characteristics such as age and marital status. Specifically, older women and married women reported better mental well-being. None of the medical variables assessed were significantly ($p \leq 0.05$) related to mental well-being. A multiple regression analysis was conducted to further explore the relative contributions of age and marital status to mental well-being. Using a forward selection method, the results indicated that age accounted for 8% of the variability in mental well-being ($p \leq 0.05$), while marital status explained 9% of the remaining variability ($p \leq 0.05$). No significant interaction effect was found between age and marital status ($p = 0.81$).

Relationship of Demographic and Medical Variables to Depressive Symptomatology

Lastly, the analysis investigated how demographic and medical variables were associated with differences in depressive symptomatology among former chemotherapy patients. As shown in Table 3, depressive symptomatology, as measured by the CES-D, was significantly ($p \leq 0.05$) related to demographic factors such as age and marital status. Specifically, younger women and unmarried women reported higher levels of depressive symptomatology. In terms of medical characteristics, depressive symptomatology was significantly ($p \leq 0.05$) associated with

time since diagnosis and time elapsed since chemotherapy ended, with women who had more time pass since diagnosis or the end of chemotherapy reporting higher levels of depressive symptomatology. A multiple regression analysis was conducted to examine the relative contributions of age, marital status, time since diagnosis, and time since chemotherapy to depressive symptomatology. Using a forward selection method, the results indicated that time since chemotherapy ended accounted for 9% of the variability in depressive symptomatology ($p \leq 0.05$), while age explained 6% of the remaining variability ($p \leq 0.05$). Marital status and time since diagnosis did not account for additional significant variability ($p > 0.05$), and no significant interaction effect was observed between age and time since chemotherapy ended ($p = 0.97$).

Discussion

The hypothesis that quality of life would be poorer in women who had undergone adjuvant chemotherapy compared to those without a cancer history was largely supported by the study's findings. Physical aspects of quality of life, such as limitations in physical functioning and daily activities, were more affected than mental aspects. While mental health differences were not significant overall, the post-chemotherapy group exhibited poorer social functioning, vitality, and higher levels of depressive symptoms, suggesting that mental health is also impacted to some extent.

In terms of clinical significance, the physical health of former chemotherapy patients was comparable to individuals suffering from chronic illnesses like lung disease or arthritis. Although depressive symptoms were higher among the post-chemotherapy group, they did not exceed clinical thresholds, but the results suggest that more in-depth assessments of mental health in former chemotherapy patients may be warranted.

These findings emphasize the need for ongoing support for women recovering from chemotherapy, particularly in addressing both physical and mental aspects of quality of life.

The findings presented in this study differ from two previous studies [10, 19] that compared SF-36 scores of breast cancer survivors with published norms [21, 24]. Unlike the current research, both of these studies showed that the SF-36 scores of breast cancer survivors were similar to the age-matched norms for U.S. women. The difference between these results and those of the present study might be due to variations in the patient selection criteria. This study focused on women who had undergone adjuvant chemotherapy, while the earlier studies included women treated with combinations of surgery, radiotherapy, hormonal therapy, and/or chemotherapy. However, it is important to note that this study also contradicts the findings of another study [23], which showed that women who had been treated with adjuvant chemotherapy had physical component summary scores comparable to the U.S. mean.

The reason for the lower physical well-being of former chemotherapy patients in this study is unclear. One possible explanation is that physical well-being may improve over time after treatment. In support of this idea, patients in this study were assessed an average of 1.8 years after diagnosis, compared to 2.7 years and 3.1 years in the earlier study [23]. Another explanation could be differences in the chemotherapy regimens (such as the type of

drugs, doses, and number of cycles) used in each study, though this cannot be confirmed without further data from the previous study.

This study's design does not rule out the possibility that the quality-of-life differences between women treated with adjuvant chemotherapy and those without breast cancer could be influenced by factors other than chemotherapy. For instance, the observed differences might be related to breast surgery or radiotherapy, which often accompany chemotherapy. One piece of evidence supporting this comes from a prior study we conducted comparing women who received only surgery and radiotherapy with women without cancer, where no significant quality-of-life differences were found [27].

The current study provides limited insight into factors affecting individual differences in the quality of life among former chemotherapy patients. The finding that age was linked to mental well-being and depressive symptoms aligns with previous research showing better psychosocial adjustment in older women [28–32]. Additionally, this study found that married survivors had better mental well-being and fewer depressive symptoms than their unmarried counterparts, a finding not widely reported before.

Other findings indicate that the risk of mental health problems may increase over time after treatment, contradicting the assumption that mental health improves with time. However, the cross-sectional nature of this study limits the conclusions that can be made about changes in depression or quality of life over time.

The results point to four key areas for future research. First, more research is needed to explore factors influencing physical well-being among women treated with adjuvant chemotherapy. Given the lack of relationships observed between physical well-being and demographic or medical characteristics in this study, future research could examine the role of psychosocial factors. For instance, past research has linked greater use of avoidance coping strategies to poorer physical well-being. Future research should also assess the impact of ongoing side effects (e.g., fatigue) on physical well-being. Second, longitudinal studies are necessary to track quality of life over time, which could provide clearer insights into how it changes after chemotherapy. Such studies could also identify factors that help or hinder recovery. Third, further research should investigate how quality-of-life considerations affect treatment decisions, such as whether informing patients about post-treatment quality of life influences their choice to undergo chemotherapy. Finally, the need for effective interventions to improve the quality of life for women treated with chemotherapy is evident. Future efforts should aim to address physical and social functioning, pain, fatigue, and depressive symptoms, requiring comprehensive interventions targeting both physical and mental well-being.

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