

Social Determinants of Health and Their Impact on Quality of Life in Young Female Breast Cancer Survivors, the Mediating Role of Treatment Regret: A Path Analysis

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Purpose: This study focused on developing and testing a comprehensive model that explores the social determinants of health influencing the quality of life of young breast cancer survivors, particularly highlighting the impact of treatment regret.

Methods: This descriptive-analytical study with a cross-sectional design was conducted on 462 young female breast cancer survivors referred to the Yazd Radiation Therapy Center. Data were collected using a demographic questionnaire, the standard decision regret scale, the perceived social support scale, the reproductive concern inventory, and the quality-of-life questionnaire for breast cancer survivors. Then, using path analysis test, the relationship between social determinants of health and quality of life in breast cancer survivors was examined. Data were analyzed by SPSS-26 and LISREL-8 software.

Results: According to the results of path analysis, among the structural determinants of health examined, socioeconomic status ($\beta=0.279$) had the most positive effect on the quality of life. Also, among the intermediate determinants, treatment regret ($\beta=-0.26$) and fertility concerns ($\beta=-0.36$) had the most direct and negative effect on the quality of life of breast cancer survivors. The fertility concerns had the most indirect and negative effect on the quality of life of young female survivors with the mediation of treatment regret ($\beta=-0.039$). The results also indicated an acceptable goodness of fit for the model.

Conclusion: Socioeconomic status had the strongest influence on the quality of life of young breast cancer survivors, partly through social support. Fertility concerns also affected quality of life directly and indirectly via treatment regret. Addressing fertility-related distress should be a key component of supportive care. Although fertility preservation options such as egg or embryo freezing exist in Iran, limited access and awareness highlight the need for early fertility counseling and integrated psychosocial support to improve survivors' well-being.

Implications for Cancer Survivors: To improve their quality of life, it is essential to implement strategies such as creating support groups in treatment centers, offering counseling on fertility options, and providing regular follow-up programs for their physical and mental health.

Keywords: social determinants of health, quality of life, breast cancer survivor

Introduction

Breast cancer is the most common cancer among women, responsible for the death of 666,000 women worldwide in 2022.¹ Breast cancer represented around 11.6% of all new cancer cases and 6.9% of all cancer deaths in 2022.² Evidence shows that while breast cancer is more common in women aged 50 and above, its incidence among younger women is also increasing, making it the second leading cause of cancer-related deaths in women aged 39 years and younger worldwide.³ The survival rate of breast cancer patients has increased significantly in recent years due to early diagnosis

and advances in cancer treatment.⁴ Evidence suggests that, even in cases where the disease is metastatic, up to 70% of individuals survive and enter a post-disease phase.⁵ After the initial treatment of breast cancer, survivors may experience various medical, physical, and psychosocial outcomes that can impact their overall health and well-being.⁶ Longer survival rates and the growing number of cancer survivors underscore the importance of developing specific strategies to address the long-term effects of breast cancer treatments and improve the quality of life for survivors.⁵

Studies suggest that non-biological factors, such as social determinants of health, significantly affect breast cancer survival.^{7,8} Social determinants of health (SDH) refer to the conditions under which people are born, grow up, work, live, and age. These determinants include social, economic, cultural, behavioral, biological, and psychological factors that contribute to health inequalities among individuals. According to the World Health Organization's conceptual model, these factors fall into two categories: structural factors, such as socioeconomic status, social class, occupation, and culture; and intervening factors, including behavioral, biological, and psychosocial factors.⁹ Socioeconomic status and social isolation are associated with poorer quality of life among breast cancer patients.¹⁰ Social support and social networks are key social determinants that affect the quality of life of these individuals.^{11,12} The results of a review study showed that social determinants of health play an important role in breast cancer diagnosis, treatment, and survival.^{13–15}

Treatment regret is a psychological component of social determinants of health that affects the quality of life of breast cancer survivors. Studies show that breast cancer survivors who regret their treatment choices tend to have poorer quality of life and experience psychological problems, such as anxiety and depression. This regret may be due to treatment side effects, changes in physical and social identity, dissatisfaction with treatment results, and the adverse effects of treatment on fertility.^{16–18} In fact, facing difficult treatment choices may cause breast cancer survivors to regret their treatment choices in the future.¹⁹ This experience negatively impacts the psychological well-being and quality of life of these women.²⁰

Despite the studies conducted on this issue, we could not find one that examined the effect of social determinants of health on the quality of life of young breast cancer survivors. Accordingly, this study was conducted to design and test a model of social determinants of health related to the quality of life of young female breast cancer survivors, with a particular focus on treatment regret (Figure 1).

Methods

This descriptive, analytical, cross-sectional study was conducted from June to October 2023. The study aimed to determine the social determinants of health associated with the quality of life among 462 young female breast cancer survivors living in Yazd City. The sample size calculation formula was used to determine the sample size, considering the 90% test power, 95% confidence interval, and 5% error rate reported by Li et al (mean = 58.79, standard deviation = 21.05).²¹ Accordingly, the sample size was calculated to be 420 subjects. After adjusting for an anticipated 10% attrition rate, the calculated sample

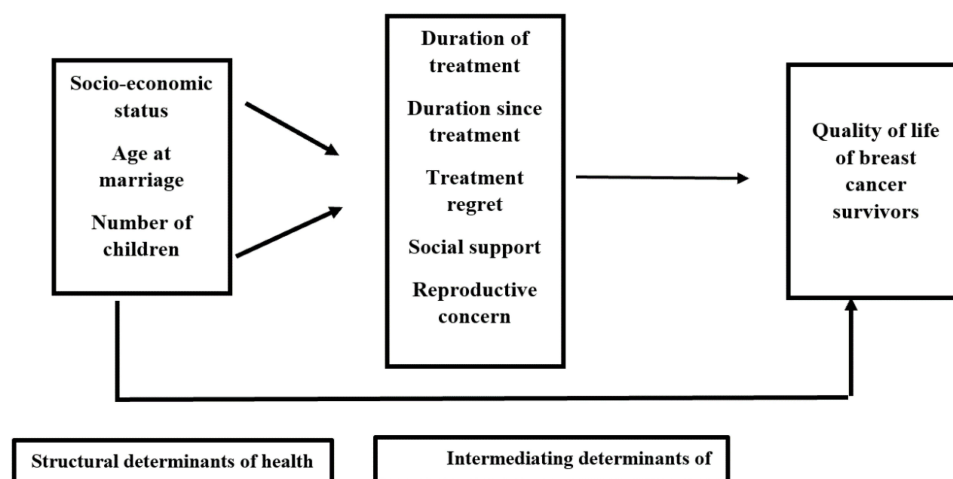


Figure 1 Conceptual model designed based on the World Health Organization's social determinants of health model.



size was 462 participants. In the sample size formula, d represents the acceptable margin of error (precision) between the sample mean and the population mean, which was set at 5% in this study.

$$n = (Z_{1-\alpha/2})^2 \times s^2 / d^2$$

Inclusion Criteria

The inclusion criteria included; having Iranian nationality, being a breast cancer survivor aged 20–45 years, having completed chemotherapy at least two years prior, having a history of stage 1–3 breast cancer, and having no chronic diseases or mental illnesses according to patient statement and hospital record.

Exclusion Criteria

Women who were unwilling to continue the study, experienced a relapse, or developed metastases were excluded.

After obtaining the necessary permits, convenience and accessible sampling method was conducted at the Yazd Radiation Therapy Center.

To this end, a list of breast cancer survivors who were referred to the center was first prepared. Eligible individuals were contacted by the researcher, who explained the study objectives and obtained their consent to participate. Prior to questionnaire administration, participants were advised that responding to the items might take some time and were given adequate preparation and reassurance. Then, after the study objectives were explained to them, those who met the inclusion criteria were invited to participate in the study.

Then, the researcher carefully completed all the questionnaires over the phone interviewing.

Data Collection Instruments

Data was collected by the following instruments:

1. Demographic information questionnaire: This tool was used to collect demographic, obstetric, disease, and treatment information. The demographic information included the woman's and her spouse's age, education level, ethnicity, age at marriage, and duration of marriage. The obstetric information included the number of pregnancies, deliveries, children, and details of the menstrual cycle. The treatment information included the stage of the cancer, the type of treatment received, the duration of the treatment, and the time elapsed since the last treatment.
2. Socio-economic status questionnaire (SES): This questionnaire was prepared by Ghodrathnama in 2013. It has 4 components, including income, economic class, education, and housing status, with a total of 6 demographic questions and 5 main questions. This questionnaire uses a five-point Likert scale to score the questions. The scale ranges from "very low" (score 1) to "very high" (score 5). This questionnaire is widely used to measure the socioeconomic status of individuals.
3. Multidimensional Scale of Perceived Social Support (MSPSS): Zimet et al (1988) developed this scale to measure an individual's perceived social support from family, friends, and significant others. This scale contains 12 questions scored based on a 7-point Likert scale ranging from "strongly disagree" (score 1) to "strongly agree" (score 7).^{22,23} This scale has a minimum score of 12 and a maximum score of 84. A score of 13–48 indicates low social support, a score of 49–68 indicates moderate social support, and a score of 69–84 indicates high social support.^{22–24}
4. Treatment regret questionnaire: This five-item tool assesses how people feel about their treatment decisions. This tool uses a 5-point Likert scale for scoring, ranging from "strongly agree" (score 1) to "strongly disagree" (score 5). Barhut et al have evaluated and confirmed the validity and reliability of this tool.²⁵
5. Reproductive Concerns After Cancer (RCAC): The RCAC scale is a multidimensional tool that measures women's potential fertility concerns following a cancer diagnosis and treatment. This tool includes six subscales, including fertility potential, disclosure of fertility status to partner, child health, personal health, acceptance of potential infertility, and pregnancy. Each subscale score is calculated by averaging the responses to its three corresponding items. Responses are based on a five-point Likert scale, ranging from "strongly disagree" (score 1) to "strongly

agree” (score 5). Items 5, 10, and 15 (the acceptance-related items) are scored in reverse. Subscale scores range from 1 to 5, with higher scores indicating greater concerns in each relevant area (eg, greater concerns about fertility potential) or lower acceptance of infertility.²⁶

6. Cancer Survivors’ Quality of Life: This 41-item ordinal scale tool measures the quality of life of cancer patients by examining four aspects of quality of life, including physical, mental, social, and spiritual health. Ferrell et al have confirmed the validity and reliability of this tool.

Data Analysis

The normality of the quantitative variables was first examined using the Kolmogorov–Smirnov test in the present study. The path analysis method is a type of ordinary regression that expresses direct and indirect effects, as well as the effect of each variable on dependent variables. This method can be used to logically interpret observed relationships and correlations based on the results. Data analysis was performed by SPSS-26²⁷ and LISREL-8.8²⁸ software. The results were expressed as the Pearson correlation coefficient for the relationships ($p\text{-value} < 0.05$ * $p\text{-value} < 0.01$ **) and as the beta value for the path analysis, considering the significance level of $T\text{-value} \geq 1.96$.

Results

According to the results, the mean age of breast cancer survivors was 40.29 years, with a standard deviation of 3.82 years. The mean age of their spouses was 44 years, with a standard deviation of 5.6 years. Most of the women (1.57%) were between 41 and 45 years old, and 59.1% of their spouses were between 36 and 45 years old. The mean age of women at the time of marriage was 21.45 years (standard deviation: 4.50). The level of education was a high school diploma for 221 (47.8%) of the women and 179 (38.7%) of their spouses. Most of the women (94.4%) and their spouses (94.6%) were of Persian ethnicity. The women’s mean (standard deviation) number of pregnancies was 2.4 (1.4), their number of births was 1.9 (0.9), and their number of children was 1.9 (0.9). It should be noted that 100% of the samples answered the questions, and there was no dropout.

The results of the Kolmogorov–Smirnov test showed that the data are normally distributed. Based on the results of the correlation test, a significant correlation was observed between the variables and the main outcome (quality of life). The highest inverse relationship with the quality of life of young female survivors of breast cancer was found with fertility concerns ($r = -0.41$) and treatment regret ($r = -0.36$) (Table 1).

After examining the paths that were significant based on a $t\text{-value}$ of at least 1.96 (Figure 2), the results of the path analysis revealed that, among the structural determinants of health examined, socioeconomic status ($\beta = 0.279$) had the greatest positive effect on the quality of life of breast cancer survivors and also the relationship between quality of life

Table 1 Description and Correlation Between the Main Variables of the Research

Variables	Mean SD	1	2	3	4	5	6	7	8	9
1. Age at marriage	21.45(4.50)	1	−0.358**	0.003	−0.062	0.203**	0.144**	0.055	0.157**	0.041
2. Number of children	1.94(0.95)		1	0.024	0.009	−0.029	0.011	0.004	−0.256**	0.102*
3. Duration of treatment	12.19(8.25)			1	−0.187**	0.009	−0.033	0.050	0.015	−0.135**
4. Duration since treatment	32.01(13.53)				1	−0.004	0.090	0.124**	−0.117*	−0.001
5. Socio-economic status	14.5(1.89)					1	0.334**	−0.168**	−0.061	0.277**
6. Social support	60.85(14.26)						1	−0.115**	−0.082	0.289**
7. Treatment regret	30.66(13.46)							1	0.150**	−0.364**
8. Reproductive concern	37.61(11.76)								1	−0.417**
9. Quality of life	53.36(12.61)									1

Note: $p < 0.01$ ** $p < 0.05$ *.

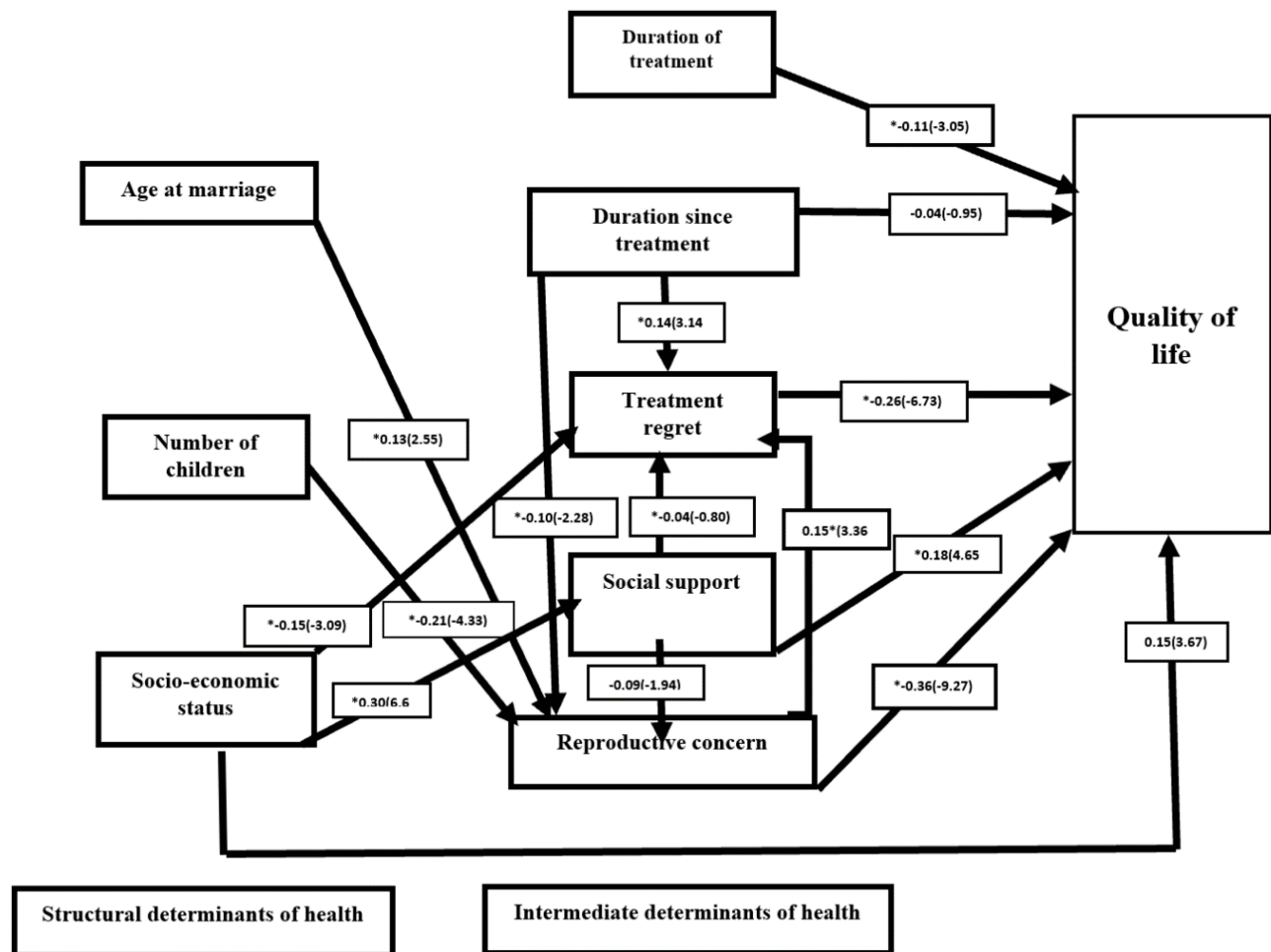


Figure 2 Path analysis diagram of the relationship between quality of life in breast cancer survivors and the structural and mediating social determinants of health: β coefficient (t-value).

and socioeconomic status is mediated by two variables: treatment regret and social support. The highest indirect and positive effect of socioeconomic status was mediated by social support ($\beta=0.054$). Of the examined intervening determinants, fertility concerns ($\beta=-0.36$) had the highest direct and negative effect on the quality of life of young female breast cancer survivors. This variable, through treatment regret ($\beta=-0.039$), also had an indirect and negative effect on women's quality of life and fertility concerns, mediated by treatment regret, have a significant impact on the quality of life of breast cancer survivor. Of the examined intervening determinants, social support had the highest direct and positive effect ($\beta=0.18$) (Table 2).

Table 2 Direct and Indirect Effects of Social Determinants of Health (Structural and Intermediary Factors Determining Social Health) on the Quality of Life of Women Surviving Breast Cancer

Variable	β Standard Coefficients			T-value (Straight Path)
	Direct Effect	Indirect Effect	Total Effect	
Age at marriage		-0.051	-0.051	-
Number of children		-0.067	-0.067	-

(Continued)

Table 2 (Continued).

Variable	β Standard Coefficients			T-value (Straight Path)
	Direct Effect	Indirect Effect	Total Effect	
Socio-economic status	0.15	0.129	0.279	3.67
Duration since treatment	0.04	−0.028	−0.068	−0.95
Duration of treatment	−0.11	-	−0.11	−3.05
Treatment regret	−0.26	-	−0.26	−6.73
Social support	0.18	0.045	0.225	4.65
Reproductive concern	−0.36	−0/039	−0.399	9.27

The results of model fit indices indicated the desirability and high adequacy of the model (Chi-square/df =2.488, RMSEA = 0.057, NFI = 0.96, CFI= 0.97, IFI= 0.97). The results also showed the rationality of adjusted relationships between the variables based on the conceptual model. Accordingly, the fitted model did not differ significantly from the conceptual model (Figure 2).

Discussion

The main objective of this study was to design and test a comprehensive conceptual model related to the social determinants of health and quality of life of breast cancer survivors, with an emphasis on treatment regret. The selection of structural determinants (eg, age at marriage, number of children, and socioeconomic status) and intervening determinants (eg, duration of treatment, length of time elapse since treatment, perceived social support, treatment regret, and fertility concerns) was based on a literature review and the findings of previous studies. The designed conceptual model was tested using path analysis, and the results showed an acceptable fit between the model and the data, thus supporting the research hypothesis.

This study found that socioeconomic status was positively and significantly related to the quality of life of breast cancer survivors, both directly and indirectly. This finding has also been observed in other studies.^{29–31} This confirms that breast cancer survivors, especially those in the later stages of treatment, are influenced by socioeconomic factors such as income, education level, and social support, which can affect their quality of life. Similar to our results, another study conducted in South Florida, USA, found that the quality of life of breast cancer survivors was strongly and positively associated with socioeconomic status.²⁹ The study that was conducted in Iran showed that Patients with higher socioeconomic status demonstrated greater coping abilities. In other words, they engaged more effectively in intellectual, emotional, and behavioral strategies when facing stressful situations. This finding highlights the importance of providing psychological support and counseling for breast cancer patients with lower socioeconomic status. The other study in Iran showed that socioeconomic status is significantly related to quality of life.³² In fact, survivors with poorer financial status may have more difficulty accessing health care services, which in turn negatively impacts their quality of life.³³

According to the results of the path analysis, the number of children was indirectly related to the quality of life of breast cancer survivors through the mediation of fertility concerns, indicating a negative relationship between these two variables. In other words, breast cancer survivors with fewer children have higher fertility concerns and a lower quality of life. Some studies have shown that female cancer survivors who have had more children tend to receive more emotional and social support, which can improve their quality of life.³⁴ On the other hand, survivors who are unable to have the number of children they desire during or after treatment may experience a sense of loss and psychological problems. A desire for children often persists or emerges after treatment, particularly among younger, childless survivors, and that an unfulfilled desire for children is linked to poorer mental health.^{35,36} This can lead to a decrease in quality of life.³⁷ In contrast to the results of the present study, Bo Lan et al found that women with breast cancer who had more than one child experienced greater concerns and had lower quality of life scores.³⁸ One explanation for this discrepancy is that



the research population in the present study consisted of breast cancer survivors who had completed their treatment, while the study by Bo Lan et al included women who were undergoing active treatment for breast cancer, which causes psychological stress and anxiety.^{39,40}

The path analysis revealed a negative association between treatment duration and the quality of life of breast cancer survivors. In line with the results of our study, research has shown that the length of treatment, such as chemotherapy, radiotherapy and other medical procedures, can negatively impact the quality of life of patients.⁴¹

The quality of life of breast cancer survivors was positively associated with perceived social support through both direct and indirect paths. These findings align with the results of other studies,^{42–44} which confirmed the important role of perceived social support in the quality of life of breast cancer survivors. Young mothers diagnosed with cancer encounter substantial emotional strain and psychological distress, further exacerbated by the challenges of maintaining their maternal responsibilities. Healthcare systems can strengthen social support for this population by developing and implementing proactive, individualized, and comprehensive interventions that specifically address issues related to fertility, mental health, and parenting demands.⁴⁵ In fact, social support can affect the adjustment process and quality of life in various ways. Patients may recover physically in a shorter time if they receive emotional support from family, friends, and health care providers. It also improves the physical aspect of quality of life and overall quality of life by increasing patients' ability to cope with the challenges of treatment and disease.⁴⁶

In the present study, fertility concerns were also among the determinants that were negatively associated with the quality of life of breast cancer survivors, both directly and indirectly, and among the six dimensions of fertility concerns, child health was the highest concern of women. These findings are consistent with those of another study by Wenjing Xu et al, which indicated the importance of fertility concerns in young female breast cancer survivors.⁴⁷ This study also showed that fertility concerns affect the quality of life of breast cancer survivors in various ways, including concerns about reproductive risks, parenting difficulties, and the need for support from family, peers, and professionals.⁴⁷ Additionally, a study in Mexico revealed that fertility concerns are among the most significant health concerns that require attention.⁴⁸ For many cancer survivors of reproductive age, the possibility of having biological children is important. However, cancer treatment can threaten fertility and negatively impact quality of life.⁴⁹

In this study, we found that treatment regret was directly and negatively associated with a lower quality of life among breast cancer survivors. Additionally, we discovered that treatment regret indirectly influenced the relationship between quality of life and fertility concerns. In line with the results of the present study, a study by Angela G. et al showed that treatment regret and fertility concerns negatively affect the quality of life of breast cancer survivors. However, receiving fertility counseling before and after treatment reduces treatment regret and fertility concerns in cancer survivors.⁵⁰ Regretting treatment choices can have a profoundly negative effect on the quality of life of cancer survivors, especially if the regret involves fertility concerns.⁵¹ In addition, women who undergo aggressive treatments, such as chemotherapy, may experience greater regret. This can exacerbate their dissatisfaction with life and concerns about fertility, especially if the treatment negatively affects their ability to have children.⁵²

In fact, studies show that negative experiences related to treatment, such as medication side effects and fertility concerns, can lead to feelings of regret and dissatisfaction with treatment decisions. This regret affects not only patients' mental health, but also their quality of life. Depression, anxiety, and decreased social relations are common among breast cancer survivors who regret their treatment choices.^{53,54} Studies have shown that interventions such as fertility counseling can reduce fertility concerns and post-treatment regret in breast cancer survivors, thereby improving their overall well-being.⁵⁵

Strengths and Limitations

The study developed and tested a comprehensive conceptual model integrating multiple social determinants of health to explain quality of life among young breast cancer survivors. The use of validated and standardized instruments (eg, Decision Regret Scale, Perceived Social Support Scale, Reproductive Concern Inventory, and QoL questionnaire) enhanced the reliability and comparability of findings. A relatively large sample size (n=462) increased the statistical power and robustness of the path analysis. The use of advanced statistical modeling (path analysis) allowed for the

examination of both direct and indirect relationships among key variables, providing a deeper understanding of complex psychosocial interactions.

This study also has certain limitations. It does not consider the impact of treatment type on the quality of life of survivors. This is because different treatments, such as surgery, chemotherapy, and radiation therapy, can have different effects on quality of life, treatment regret, and fertility concerns. It is recommended that future studies address this issue. The cross-sectional design limits the ability to infer causal relationships between social determinants, treatment regret, and quality of life. The study was conducted in a single geographic and cultural context (Yazd, Iran), which may restrict the generalizability of findings to other populations.

Conclusion

Among the structural determinants of health examined, socioeconomic status showed the strongest direct effect on the quality of life of young breast cancer survivors, and this effect was partly mediated by perceived social support. Among the psychosocial mediators, fertility concerns exerted both direct and indirect influences on quality of life. In the indirect pathway, treatment regret partially mediated the association between fertility concerns and quality of life, suggesting that women who experience greater worry about their fertility may also feel more regret regarding treatment decisions that affected their reproductive potential.

These findings highlight the importance of addressing the psychological and emotional dimensions of fertility concerns as part of comprehensive survivorship care. In the Iranian context, although fertility preservation options such as oocyte or embryo freezing are available, their use remains limited due to low awareness, financial barriers, and insufficient referral systems. Incorporating structured fertility counseling before treatment initiation, improving collaboration between oncology and fertility specialists, and establishing support groups and follow-up programs could reduce fertility-related distress and treatment regret. Strengthening these interventions may ultimately enhance both the reproductive and psychosocial well-being of young breast cancer survivors and improve their overall quality of life.

Data Sharing Statement

No datasets were generated or analyzed during the current study.

Ethical Approval

This research is approved by Faculty of Pharmacy, Nursing, and Midwifery - Shahid Beheshti University of Medical Sciences (IR.SBMU.PHARMACY.REC.1402.014). We state that our study complies with the Declaration of Helsinki.

Consent to Participate

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

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors declare no potential conflicts of interest in this work.

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