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Original Article

Mental health in female breast cancer survivors post-mastectomy: A structural model based on Roy's adaptation model

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ABSTRACT

Objective: Breast cancer survivors experience significant physical and psychosocial changes after mastectomy, making them vulnerable to mental health challenges such as depression, anxiety, and social dysfunction. This study identifies factors influencing the mental health of breast cancer survivors using Roy's Adaptation Model (RAM), which provides a framework for understanding adaptation processes and their impact on health outcomes.

Methods: A cross-sectional structural equation modeling (SEM) study was conducted to develop and validate a hypothetical model based on RAM. Data were collected through an online survey administered from February 1 to 28, 2023, to female breast cancer survivors who had undergone mastectomy at least one year but less than five years before the commencement of the study. A total of 346 participants from an online community of patients with breast cancer were included in the final analysis. Statistical analyses were performed using IBM SPSS 26.0 and AMOS 28.0.

Results: The goodness-of-fit indices for the structural model indicated acceptable fit (goodness-of-fit index [GFI] = 0.82; RMR = 0.05; comparative-fit-index [CFI] = 0.85; root mean square error of approximation [RMSEA] = 0.09). Seven of the eight hypothesized paths were significant. Coping and adaptation processes directly influenced symptom experience, body image, role performance, and social support and indirectly affected mental health. Body image, role performance, and social support collectively explained 88% of the variance in mental health outcomes. Multigroup SEM analysis revealed differences in the structural paths based on breast reconstruction status.

Conclusions: Effective mental health assessment and intervention for breast cancer survivors undergoing mastectomy requires an integrated approach that considers coping processes, body image, role performance, and social support. Nurses should focus on strengthening adaptive coping strategies, fostering a positive body image, managing role-related stress, and enhancing social support systems to improve survivors' overall mental well-being.

Introduction

According to the 2022 Global Cancer Report, breast cancer is the most frequently diagnosed cancer among women, accounting for 23.8% of all female cancers worldwide.[1] In particular, South Korea reports one of the highest breast cancer incidence rates among Asian countries, with the number of cases nearly doubling from 18,575 in 2011 to 34,780 in 2021.[2] This rising trend is closely linked to an increase in established risk factors, including dietary changes, obesity, early menarche, late menopause, declining fertility rates, and reduced breastfeeding, and is expected to persist.[3]

In South Korea, the 5-year relative survival rate for women with breast cancer is 93.3%, indicating a high level of survivorship. Unlike many other cancers that predominantly affect older adults, breast cancer in Korea shows a relatively high incidence among women in their 30s–50s.[3] Consequently, a significant number of women in younger age groups live as long-term survivors following treatment, highlighting the growing importance of addressing their psychosocial adaptation and quality of life.

Mastectomy is a common surgical procedure for treating breast cancer, involving the loss of the breast—a symbol of femininity. Such physical changes can lead to impaired body image, weakened self-

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identity, and decreased self-esteem, thereby exacerbating depression and anxiety.[4] Body image does not merely refer to the aesthetic aspect of appearance but encompasses one's mental representation of one's body and the associated emotional experiences.[5] Loss of a breast or post-operative scars may cause body image disturbance, which can diminish psychological well-being and quality of life.[6]

Recently, psychological approaches based on *body compassion* have been proposed to address body image disturbance.[7] These interventions help breast cancer survivors reconceptualize their changed bodies as objects of healing and care, reconstruct a positive body image, and ultimately enhance psychological well-being and self-integration. In addition to these psychological approaches, breast reconstruction as a compensatory medical intervention has been increasingly used among women who have undergone mastectomy. However, research findings on its psychological benefits remain inconsistent, and breast reconstruction does not guarantee positive outcomes for all patients.[8] Accordingly, a growing need exists to systematically examine how breast reconstruction affects the mental health of breast cancer survivors who have undergone mastectomy.

The diagnosis and treatment of breast cancer represent profoundly stressful experiences for individuals, and many survivors struggle to return to their pre-diagnosis psychological state even after completing treatment. According to previous studies, breast cancer survivors frequently experience anxiety, cognitive decline, and depression.[9] Assessing the mental health of breast cancer survivors is an essential process for understanding their needs and improving their overall health and quality of life. However, few studies have comprehensively analyzed these factors or examined their interrelationships within a theoretical framework.

Therefore, this study adopted Roy's Adaptation Model (RAM)[10] as the conceptual framework to examine the mental health of breast cancer survivors (Supplementary File 1). RAM is a nursing theory that emphasizes achieving physiological and psychological balance through adaptive behaviors. This study aimed to develop and test a structural equation model (SEM) of the mental health of breast cancer survivors based on RAM and to explore its differential impact on mental health using a multi-group SEM analysis according to breast reconstruction status. Furthermore, it addressed the conceptual ambiguity surrounding coping mechanisms in previous research, by reliably measuring the coping construct using the short form of the Coping and Adaptation Processing Scale (CAPS) and incorporating it into the structural model. This approach enhances both the theoretical coherence and practical applicability of RAM. Given the cross-sectional design of this study, the analysis focused on exploring the associations among key variables rather than asserting causal relationships.

Methods

Study design

This study employed a cross-sectional SEM approach to examine the relationships between coping processes, adaptation modes, and mental health in female breast cancer survivors who underwent mastectomy. The SEM was built based on RAM and a literature review.

Participants and data collection

The participants were female breast cancer survivors who had undergone mastectomy and were active members of online breast cancer survivor communities. Eligible participants were those who had undergone a mastectomy between 1 and 5 years after their breast cancer diagnosis, fully understood the study purpose, and voluntarily agreed to participate. Individuals with a psychiatric diagnosis, secondary cancer, or recurrence of breast cancer were excluded.

While there is no absolute requirement regarding SEM sample size, typical recommendations range from 10 to 20 observations per measurement variable, and an ideal sample size between 200 and 400.[11] Given 31 measured variables, a minimum of 310 participants were required, considering a 15% dropout rate, leading to a final sample size of 356 participants.

Data were collected from February 1 to 28, 2023, through online recruitment in nationwide breast cancer survivor communities (e.g., Naver Café and Naver Band). The study announcement, posted with administrator approval, included details about the study purpose, eligibility criteria, voluntary participation, anonymity, and right to withdraw at any time. Interested participants accessed a secure online survey link, reviewed the informed consent form, and proceeded to the questionnaire after selecting "I agree."

A self-administered online survey was conducted using Google Forms. A total of 356 responses were received. After excluding one incomplete response, eight that did not meet the inclusion criteria, and one that met the exclusion criteria, data from 346 participants were included in the final analysis. Among them, 236 participants had undergone breast reconstruction, and 110 had not. To examine group differences, a multi-group SEM was performed.

To encourage participation, respondents who completed the survey received a mobile gift card. Recruitment through online communities enabled access to a nationwide sample but may have introduced selection bias, as individuals active in digital communities could be over-represented. To ensure transparency, a STrengthening the Reporting of OBservational studies in Epidemiology (STROBE)-compliant participant flowchart (Fig. 1) was developed to depict the inclusion, exclusion, and final sample selection process.

Measures

Mental health

The Korean General Health Questionnaire-12 (KGHQ-12), a short-form version of the General Health Questionnaire (GHQ) developed in

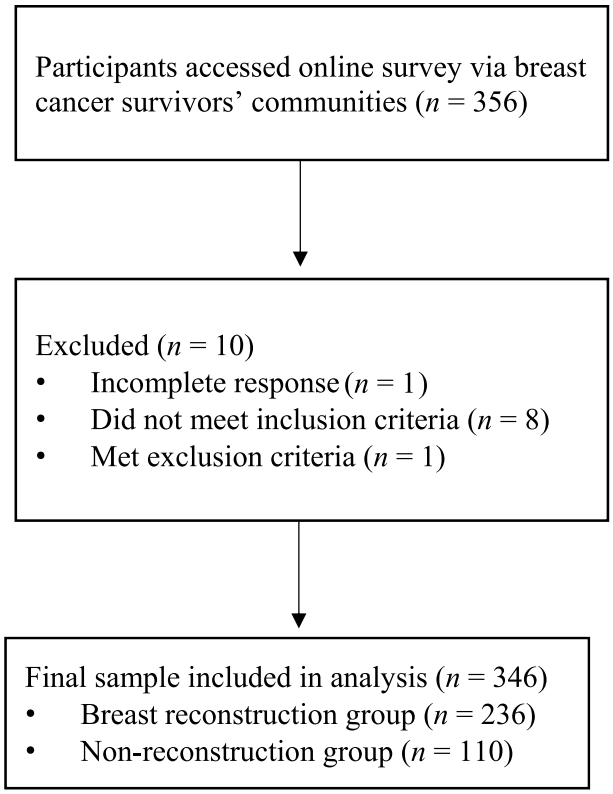


Fig. 1. *Participant recruitment and selection process according to the STROBE guidelines.* STROBE, STrengthening the Reporting of OBservational studies in Epidemiology.

1979 by Goldberg and Hillier[12] and validated in 2012 by Park et al.[13] was used to evaluate the participants' mental health status. This self-report instrument was designed to evaluate an individual's psychological state over the previous two to three weeks, allowing for an assessment of baseline mental health and current psychological distress. It comprises two subdomains: "Depression and Anxiety" and "Social Dysfunction." The questionnaire includes 12 items rated on a Likert scale ranging from 0 to 3 points, with higher scores indicating poorer mental health. Positive items (1, 3, 4, 7, and 12) were reverse coded to ensure scoring accuracy. In the validation study by Park et al., Cronbach's alpha for the KGHQ-12 was 0.79;[13] in this study, reliability was confirmed with a Cronbach's alpha score of 0.90.

Coping and adaptation process

The coping and adaptation process was assessed using the Korean Coping and Adaptation Processing Scale–Short Form (KCAPS-SF), developed in 2016 by Roy et al.[14] and validated in 2018 for patients with cancer by Song et al.[15] This tool evaluates how individuals manage illness-related challenges through cognitive and behavioral coping strategies. It comprises 15 items scored on a four-point Likert scale, with higher scores indicating effective adaptation to environmental changes. Negative items (5, 13, and 14) were reverse coded for accuracy. In the study by Song et al., the reliability of the Korean version was demonstrated, with a Cronbach's alpha score of 0.83;[15] in this study, Cronbach's alpha was 0.80.

Symptom experience

The symptom experiences of breast cancer survivors were measured using the MD Anderson Symptom Inventory (MDASI) developed in 2000 by Cleeland et al.[16] to assess the severity and impact of cancer-related symptoms. The Korean version was obtained with permission from the original developers. This tool comprises 19 items that assess symptom severity and the degree of interference with daily life activities, rated on an eleven-point scale ranging from 0 (no symptoms) to 10 (worst imaginable severity). Higher scores indicate greater physical impairment. Cleeland et al. reported a Cronbach's alpha score of 0.91 for this tool,[16] and reliability in this study was confirmed, with a Cronbach's alpha score of 0.97.

Body image

The Korean Body Image after Breast Cancer Questionnaire (K-BIBCQ) was adapted from the original Body Image after Breast Cancer Questionnaire (BIBCQ) designed in 2006 by Baxter et al.[17] and validated in Korean in 2010 by Yoo and Lee.[18] This instrument examines breast cancer survivors' perceptions of their bodies across six subdomains: body stigma, arm concerns, dissatisfaction with physical appearance, vulnerability, transparency, and activity limitations. It includes 33 items rated on a five-point scale, with higher scores indicating greater distress related to body image. Positive items (6, 12, 14, 16, 17, 18, 19, 20, and 21) were reverse coded for analysis. The original validation study by Yoo and Lee reported Cronbach's alpha score of 0.93;[18] in this study, reliability was confirmed, with a Cronbach's alpha score of 0.95.

Role function

Role function was measured using the modified and supplemented version of the social competence domain of the Enforced Social Dependency Scale (ESDS), originally developed by McCorkle et al., in 1980.[19] and adapted by Kim and Ryu in 2024.[20] This instrument consists of three items assessing "activities at home," "activities at work (or in an affiliated organization for those without a job)," and "leisure or social activities." Each item is rated on a four-point scale, with higher scores indicating lower levels of role function. Kim and Ryu reported a Cronbach's alpha score of 0.79 for the social competence domain of the ESDS;[20] in this study, reliability was confirmed, with a Cronbach's alpha score of 0.79.

Social support

Social support was assessed using the Korean Multidimensional Scale of Perceived Social Support (MSPSS), originally developed by Zimet et al., in 1988[21] and adapted by Park et al., in 2012.[22] This tool evaluates the level of perceived social support from three sources—family, friends, and significant others—with health care providers included as a meaningful category in this study. It comprises 12 items scored on a seven-point scale, with higher scores indicating stronger perceived support. Park et al. reported high reliability for the Korean version, with a Cronbach's alpha score of 0.90;[22] in this study, the Cronbach's alpha score was 0.93.

Data analysis

The data were analyzed using SPSS 26.0 and AMOS 28.0 (Armonk, NY, IBM Corp) to verify the research model and test the hypotheses. Descriptive statistics were used to examine participant demographics and disease-related characteristics. Normality was evaluated using skewness and kurtosis values. Pearson's correlation analysis was conducted to assess the relationships between the variables. Confirmatory factor analysis (CFA) was performed to validate the latent constructs, ensuring convergent and discriminant validity by analyzing standardized factor loadings, average variance extracted (AVE), and construct reliability (CR). The internal consistency of each measurement tool was evaluated using Cronbach's alpha.

SEM was employed to estimate the hypothesized model using maximum likelihood estimation (MLE). In appraising the fit of the hypothesized and emerging models, the following parameters were used: CMIN/$df \leq 3.00$, root mean square error of approximation (RMSEA) $\leq$ 0.08, comparative-fit-index (CFI) ≥ 0.90, goodness-of-fit index (GFI) $\geq$ 0.90.[11] The statistical significance of indirect and total effects was verified through bootstrapping methods. Additionally, multi-group SEM was conducted to analyze the differences between breast reconstruction and non-reconstruction groups, with chi-square difference tests applied to assess pathway variances across the groups.

Results

Participant characteristics

The demographic and clinical characteristics of the study participants are shown in Table 1. A total of 346 breast cancer survivors were included in the final analysis, with a mean age of 45.51 years. Most participants had at least a college degree, and 39.9% were employed, while 60.1% did not have a job at the time of the study. Regarding marital status, 84.7% were married, and 90.5% lived in multi-person households. Economically, 48.3% identified themselves as belonging to the lower-middle class, and 50.3% reported a monthly household income between KRW 2 million and KRW 5 million.

The mean time since breast cancer diagnosis was 34 months (2 years and 10 months), and the mean duration since mastectomy was 30 months (2 years and 6 months). Among the participants, 43.6% underwent immediate breast reconstruction at the time of mastectomy. Ongoing treatments included hormonal therapy (39.3%), whereas completed treatments included chemotherapy (43.1%), radiotherapy (36.4%), hormonal therapy (21.4%), and targeted therapy (8.7%). Since some participants received multiple treatment modalities simultaneously, the total percentages for each treatment type may exceed or fall short of 100%. Detailed information on treatment combinations is presented in Supplementary Table S1. Furthermore, 6.6% had comorbid conditions, 10.1% had received mental health counseling over the previous year, and 6.6% had experienced suicidal ideation in the previous year. Overall, 51.0% of the participants rated their subjective health status as moderate.

Table 1
Participant characteristics ($N = 346$).

Characteristics		*n* (%)	Mean ± SD
Age, years	20–29	4 (1.2)	45.51 ± 7.14
	30–39	62 (17.9)	
	40–49	189 (54.6)	
	50–59	77 (22.3)	
	60–69	14 (4.0)	
Education	Middle school	1 (0.3)	
	High school	106 (30.6)	
	≥ College	239 (69.1)	
Employment	Employed	138 (39.9)	
	Unemployed (before mastectomy)	94 (27.2)	
	Unemployed (because of mastectomy)	114 (32.9)	
Marital status	Unmarried	36 (10.4)	
	Married	293 (84.7)	
	Divorce	9 (2.6)	
	Bereavement	8 (2.3)	
Living with	Alone	33 (9.5)	
	Family	313 (90.5)	
House income	Low	23 (6.7)	
	Lower-middle	167 (48.3)	
	Middle-high	151 (43.6)	
	High	5 (1.4)	
Monthly family income (KRW 10,000)	< 200	30 (8.7)	
	200–499	174 (50.3)	
	500–799	118 (34.1)	
	≥ 800	24 (6.9)	
Time since breast cancer diagnosis, years	1–< 2	85 (24.6)	33.87 ± 11.91
	2–< 3	107 (30.9)	
	3–< 4	107 (30.9)	
	4–< 5	42 (12.1)	
	≥ 5	5 (1.5)	
Time since mastectomy, years	1–< 2	119 (34.4)	29.69 ± 11.51
	2–< 3	114 (33.0)	
	3–< 4	87 (25.1)	
	4–< 5	26 (7.5)	
Breast reconstruction	No	110 (31.8)	
	Yes (immediate)	151 (43.6)	
	Yes (delayed)	85 (24.6)	
Ongoing treatment[a]	Chemotherapy	49 (14.2)	
	Radiotherapy	45 (13.0)	
	Hormonal therapy	136 (39.3)	
	Targeted therapy	14 (4.0)	
Completed treatment[a]	Chemotherapy	149 (43.1)	
	Radiotherapy	126 (36.4)	
	Hormonal therapy	74 (21.4)	
	Targeted therapy	30 (8.7)	
Comorbidity	Yes	22 (6.4)	
	No	324 (93.6)	
Comorbidity disease[a]	Hypertension	6 (1.7)	
	Diabetes	6 (1.7)	
	Hyperlipidemia	6 (1.7)	
	Musculoskeletal disease	5 (1.4)	
	Thyroid disease	3 (0.9)	
Self-rated health	Very good	16 (4.6)	
	Good	98 (28.3)	
	Moderate	177 (51.2)	
	Bad	53 (15.3)	
	Very bad	2 (0.6)	
Mental health Counseling experience	Yes	35 (10.1)	
	No	311 (89.9)	
Suicidal thoughts	Yes	23 (6.6)	
	No	323 (93.4)	

[a] Multiple responses were allowed; therefore, the total percentage may exceed 100%. SD, Standard deviation.

Descriptive statistics for study variables

Table 2 presents descriptive statistics of the variables measured in the proposed structural model. The mean scores were 2.68 (SD = 0.36) for coping and adaptation processes (scale range: 1–4), 4.80 (SD = 2.25) for symptom experience (scale range: 0–10), 3.20 (SD = 0.69) for body image (scale range: 1–5), 1.79 (SD = 0.64) for role performance (scale range: 1–4), 5.24 (SD = 1.12) for social support (scale range: 1–7), and 1.27 (SD = 0.55) for mental health (scale range: 0–3).

Table 2
Descriptive statistics of the measured variables ($N = 346$).

Latent Variables	Measured variables	Mean	SD	Range	Skewness	Kurtosis
Coping & adaptation process	CA1	2.55	0.64	1–4	−0.50	−0.08
	CA2	2.94	0.63		−0.24	0.32
	CA3	3.01	0.67		−0.36	0.27
	CA4	2.90	0.62		−0.24	0.41
	CA5	2.71	0.69		−0.25	0.03
	CA6	2.95	0.58		−0.17	0.46
	CA7	2.43	0.69		0.04	−0.21
	CA8	1.96	0.79		0.54	−0.08
	CA9	2.59	0.84		−0.17	−0.53
	CA10	2.88	0.64		−0.51	0.95
	CA11	2.81	0.64		−0.15	0.03
	CA12	2.97	0.66		−0.09	−0.35
	CA13	2.89	0.70		−0.21	−0.14
	CA14	2.84	0.68		−0.35	0.29
	CA15	2.85	0.65		−0.36	0.46
	Total	2.68	0.36			
Symptom experience	Severity scale	5.05	2.37	0–10	−0.14	−0.91
	Interference scale	4.24	2.40		−0.15	−0.91
	Total	4.80	2.25			
Body image	Body stigma	3.41	0.86	1–5	−0.48	−0.19
	Arm concerns	2.97	0.82		−0.54	0.01
	Body concerns	3.20	0.91		−0.05	−0.60
	Vulnerability	3.46	0.78		−0.34	−0.25
	Transparency	2.93	1.10		−0.02	−0.98
	Limitation	2.76	0.90		−0.03	−0.75
	Total	3.20	0.69			
Role Performance	Home	1.67	0.70	1–4	0.61	−0.56
	Workplace	1.85	0.85		0.63	−0.48
	Society	1.84	0.73		0.49	−0.25
	Total	1.79	0.64			
Social support	Significant other	5.00	1.37	1–7	−0.69	0.18
	Family	5.71	1.22		−1.15	1.17
	Friends	5.01	1.33		−0.97	0.76
	Total	5.24	1.12			
Mental health	Social dysfunction	1.30	0.56	0–3	0.11	0.34
	Depression & anxiety	1.25	0.63		0.34	0.17
	Total	1.27	0.55			

CA, Coping & adaptation process; SD, Standard deviation.

To assess normality, skewness and kurtosis values were examined, with absolute values below 2 indicating acceptable normality assumptions.[23] The skewness values ranged from −1.15 to 0.63, and kurtosis values ranged from −0.98 to 1.17—all measured variables met the normality assumptions for inclusion in the structural model.

Validation of the hypothetical model

To validate the hypothesized model, a two-step approach was adopted.[23] CFA was conducted to assess construct validity. SEM was used to test the proposed relationships among the variables. To ensure convergent validity, standard factor loadings (FL) > 0.50, AVE > 0.50, and CR > 0.70 were examined. Several items in the coping and adaptation process measurement (CA4, CA6, CA7, CA8, CA9, CA10) had standard factor loadings below the acceptable threshold (β values: 0.37, 0.41, 0.44, 0.08, 0.23, 0.46) and were subsequently removed. After modification, all the remaining observed variables had significant standardized factor loadings, meeting the convergent validity criteria. Six items were eliminated, leaving 25 measurement variables for analysis.

Discriminant validity, which ensures that latent variables maintain distinct constructs, was verified using two approaches. The first method

required AVE values to be greater than the squared correlation coefficients between latent variables.[23] The highest correlation coefficient was found between body image and mental health ($r = 0.87$, $r^2 = 0.75$), and the AVE for body image was 0.59, failing this criterion. The second method examined confidence intervals for correlation coefficients, ensuring they did not include 1 within ± 2 standard errors.[23] As all confidence intervals met this condition, discriminant validity was established.

Reliability analysis was conducted using Cronbach's alpha to ensure consistency across the measurement items. The CFA model fit indices were $\chi^2 = 968.24$, $\chi^2/df = 3.72$, GFI = 0.80, RMR = 0.05, CFI = 0.84, and RMSEA = 0.09. Although some fit indices were slightly below the ideal levels, the minimal loss of observed variables and theoretical grounding supported an acceptable model fit.

Path analysis and model fit for the revised structural model

The final SEM estimates were obtained using MLE. The coping and adaptation process significantly influenced symptom experience ($\beta = -0.22$, $P < 0.001$), body image ($\beta = -0.48$, $P < 0.001$), role performance ($\beta = -0.25$, $P < 0.001$), and social support ($\beta = 0.60$, $P < 0.001$). Body image ($\beta = 1.11$, $P < 0.001$), role performance ($\beta = -0.20$, $P = 0.011$), and social support ($\beta = -0.16$, $P = 0.006$) had significant effects on mental health, while symptom experience ($\beta = -0.14$, $P = 0.182$) did not show a significant direct impact (Fig. 2).

The coping and adaptation processes accounted for 5.0% of the variance in symptom experiences, 24.0% of that in body image, 6.0% of that in role performance, and 36.0% of that in social support variance. Additionally, body image, role performance, and social support accounted for 88.0% of the variance in mental health status.

Direct, indirect, and total effects in the modified model

The direct and indirect effects of variables in the final model were analyzed using bootstrapping methods.[23] The coping and adaptation process significantly influenced symptom experience ($\beta = -0.22$, $P = 0.005$), body image ($\beta = -0.48$, $P = 0.001$), role performance ($\beta = -0.25$, $P = 0.003$), and social support ($\beta = 0.60$, $P = 0.001$) as direct effects. A significant indirect effect on mental health ($\beta = -0.55$, $P = 0.001$) was observed. Among adaptation modes, body image ($\beta = 1.11$, $P = 0.004$) and role performance ($\beta = -0.20$, $P = 0.023$) directly affected mental health.

Multi-group structural equation modeling

A multigroup analysis was conducted to compare the breast reconstruction and non-reconstruction groups. Chi-square difference tests revealed distinct pathways, as summarized in Table 3. The effects of coping and adaptation processes on role performance were stronger in the breast reconstruction group. Furthermore, the effect of symptom experience on mental health was more pronounced in the breast reconstruction group. The effect of body image on mental health was stronger in the non-reconstruction group.

Discussion

This study developed a hypothesized model based on RAM to comprehensively identify factors influencing the mental health of breast cancer survivors who underwent mastectomy. The study's significance lies in its multi-group analysis, which revealed that the structural pathways of adaptation differed depending on whether participants had undergone breast reconstruction. This finding highlights the differential effects of reconstruction status on psychological adjustment processes.

Furthermore, by incorporating the cultural background and psychosocial context of Korean women, the study sheds light on the unique adaptation characteristics of East Asian female cancer survivors. Notably, while previous studies have often omitted or only superficially addressed coping mechanisms because of conceptual ambiguity and measurement limitations, this study employed a validated adaptation scale to assess coping more rigorously. As a result, the proposed structural model demonstrated high explanatory power for mental health outcomes, accounting for 88% of the variance.

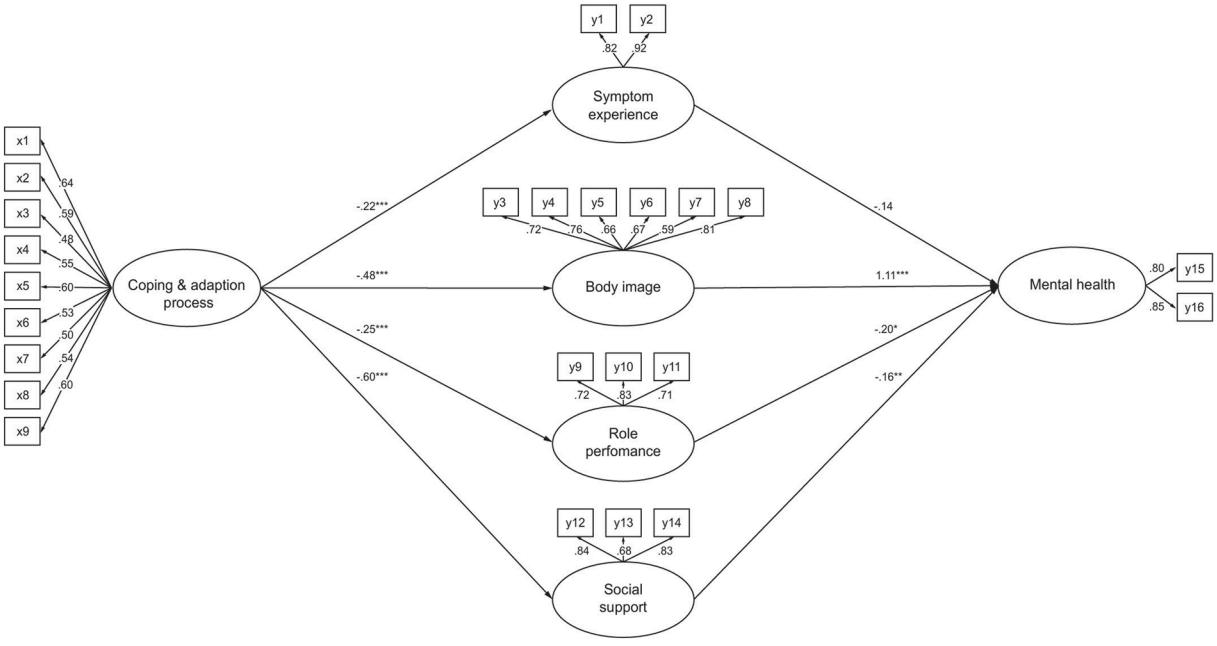


Fig. 2. *The final modified mental health model in breast cancer survivors with mastectomy.*
x1-x9: Coping & adaptation process; y1-y2: Symptom experience (y1: Severity scale; y2: Interference scale); y3-y8: Body image (y3: Body stigma; y4: Arm concerns; y5: Body concerns; y6: Vulnerability; y7: Transparency; y8: Limitation); y9-y11 (y9: Home; y10: Workplace; y11: Society); y12-y14: Social support (y12: Significant other; y13: Family; y14: Friends); y15-y16: Mental health (y15: Social dysfunction; y16: Depression & anxiety). *$P < 0.05$, **$P < 0.01$, ***$P < 0.001$.

Table 3
Differences in path estimates of multi-group SEM ($N = 346$).

Path	Difference between two models			χ^2 (P)
CA → SE	Mastectomy only	=	Mastectomy & reconstruction	1.26 (0.262)
CA → BI	Mastectomy only	=	Mastectomy & reconstruction	1.28 (0.257)
CA → RP	Mastectomy only	<	Mastectomy & reconstruction	7.58 (0.006)
CA → SS	Mastectomy only	=	Mastectomy & reconstruction	1.05 (0.305)
SE → MH	Mastectomy only	<	Mastectomy & reconstruction	17.19 (< 0.001)
BI → MH	Mastectomy only	>	Mastectomy & reconstruction	13.29 (< 0.001)
RP → MH	Mastectomy only	=	Mastectomy & reconstruction	0.24 (0.625)
SS → MH	Mastectomy only	=	Mastectomy & reconstruction	2.45 (0.118)

SEM, structural equation modelling; CA, coping & adaptation process; SE, symptom experience; BI, body image; RP, role performance; SS, social support; MH, mental health.

Factors influencing mental health

The results of this study demonstrated that breast cancer survivors with effective coping mechanisms reported a lower symptom burden. Previous studies using the same adaptation scale have also identified a positive association between coping strategies and physical well-being.[24] Survivors frequently experience ongoing symptoms such as pain, fatigue, and sensory disturbances following mastectomy, which may interfere with daily functioning and psychological adjustment. Stress management and relaxation techniques have been shown to be effective in enhancing both psychological and physical health among breast cancer survivors.[25] These findings highlight the need for personalized coping interventions that reflect each survivor's unique symptom profile and contextual challenges following mastectomy.

In addition to symptom burden, coping mechanisms were also found to have a positive influence on body image. Survivors who actively engaged in coping tended to maintain a more positive perception of their bodies. Prior studies have reported that breast cancer survivors adopt various coping strategies to come to terms with changes in their physical appearance.[26] Women who undergo mastectomy often experience not only the physical loss of the breast—a symbol of femininity—but also the psychological burden associated with bodily disfigurement, which can significantly affect both physical and mental health. Effective coping strategies are essential for alleviating the negative emotions and avoidance responses that may arise in response to these changes.

Research examining the relationship between coping and body image has shown that the use of avoidance strategies is associated with poorer body image, whereas problem-focused and acceptance-based strategies are linked to improvements in both body image and quality of life.[27] Therefore, enhancing constructive coping approaches—such as positive acceptance—may serve as an effective strategy for helping survivors adapt to postmastectomy bodily changes and facilitate the restoration of a more positive body image.

Similarly, survivors who demonstrated effective coping after mastectomy were more likely to exhibit smoother role performance. Coping strategies facilitated reintegration into occupational, familial, and social roles. A study on functional well-being among cancer survivors reported that positive reframing and planned behaviors helped individuals maintain their work and social responsibilities.[28] Accordingly, problem-focused strategies—such as maintaining an optimistic attitude toward life, planning daily routines, and prioritizing tasks—may enhance survivors' ability to fulfill everyday roles and promote adaptive functioning.

This study also found that coping mechanisms enhanced perceived social support, aligning with previous findings that positive coping efforts can strengthen interpersonal networks.[29] Survivors who openly express their emotions and actively engage in the recovery process tend to experience greater levels of social support, which in turn contributes to improved mental health. Encouraging participation in support groups, emotional expression, and the seeking of empathetic responses may serve to enhance the psychological resilience of breast cancer survivors.

Importantly, the structural model in this study revealed that the coping and adaptation process of breast cancer survivors who underwent mastectomy influenced mental health indirectly through symptom experience, body image, role performance, and perceived social support. Survivors with higher levels of coping demonstrated better mental health, consistent with previous research suggesting that adaptive coping plays a significant role in promoting psychological well-being. Prior studies across various populations have similarly reported a strong association between improved coping capacity and enhanced mental health outcomes.[3,26] However, contrary to earlier findings that higher educational attainment is associated with better coping skills, the present study found that despite 69.1% of participants holding a university degree or higher, their average coping score was lower than that reported in a study of women living with HIV/AIDS.[30] This suggests that breast cancer survivors may have relatively underdeveloped coping resources, highlighting the need for supplemental intervention programs aimed at strengthening their coping abilities.

Moreover, coping responses may differ substantially across individuals, even among those with similar disease experiences. Nurses must assess each patient's coping style and implement tailored interventions that reinforce effective strategies or introduce alternative approaches.[28] Additionally, given that coping strategies are shaped by sociocultural contexts,[27] developing culturally sensitive nursing interventions that reflect Korea's family-centered and relationship-oriented societal values is essential.[31]

Interestingly, this study found that symptom experience did not have a statistically significant direct effect on the mental health of breast cancer survivors. This finding contrasts with previous research, which has typically suggested that physical symptoms are major contributors to psychological distress, and indicates that symptom burden may not necessarily serve as a core determinant of mental health. Recent studies have similarly highlighted the complexity of the relationship between physical symptoms and mental health, suggesting that this association cannot be explained through a simple linear or causal framework. For instance, the psychological impact of symptoms may vary depending on the location or nature of the pain,[32] and may also be influenced by illness perceptions and the individual's sense of control.[33] Furthermore, internal psychological resources such as perceived social support have been found to mediate the relationship between physical symptoms and quality of life.[34] These results are consistent with the perspective of RAM, which conceptualizes physical symptoms as focal stimuli. According to RAM, adaptive outcomes are not solely determined by the stimulus itself but are shaped by how individuals interpret and respond to it through the cognator subsystem.[10] This implies that psychological responses to the same physical condition may vary depending on cognitive appraisal and coping capacity. Future studies should therefore adopt a more nuanced and integrative approach to understanding how symptom experience affects mental health. This includes differentiating between types of physical symptoms and incorporating key psychological variables such as illness perception, resilience, and cognitive coping strategies into the analysis.

Furthermore, the relatively low average symptom severity in this study sample may have influenced the nonsignificant association between symptom experience and mental health. Although physical symptoms may lessen over time following surgery, survivors continue to face enduring psychological challenges. These findings underscore the

need for psychosocial interventions in survivorship care beyond medical symptom management.

This study found that body image had a significant positive effect on the mental health of breast cancer survivors who underwent mastectomy and was the most influential predictor among all variables examined. Changes in body image following mastectomy often lead to a perceived loss of femininity and decreased self-esteem, with some survivors even reporting a sense of being physically disabled. Psychological conflict stemming from such changes has been reported to cause greater distress than concerns about disease progression itself.[35] These findings underscore the critical importance of addressing negative body image as an essential component of psychosocial nursing care for breast cancer survivors. Notably, body image continued to have a significant impact on mental health even among participants who were, on average, more than two to three years post-surgery and over the age of 45. This suggests that the psychological consequences of altered body image may persist regardless of time elapsed since treatment or the survivor's age. As such, long-term effects of body image disturbance on mental health should not be overlooked, and sustained nursing attention and intervention are needed to support survivors' psychological recovery.

Contrary to expectations, higher role performance was associated with poorer mental health in this study. The pressure of reintegrating into everyday responsibilities may increase psychological stress for survivors. This is particularly true for younger female survivors, who often face the dual burden of caregiving, occupational responsibilities, and familial expectations. These overlapping demands can create a mismatch between societal role expectations and the individual's physical and emotional capacity.[36] While role performance is generally regarded as a positive indicator of recovery following illness, attempting to fulfill all expected roles despite lingering physical or emotional limitations may lead to psychological strain among breast cancer survivors.[36] Therefore, role performance should not be interpreted solely as a sign of functional restoration. Rather, it must be understood within the broader context of survivors' lived experiences. An integrated nursing approach is needed to help survivors recalibrate role expectations and manage the emotional challenges associated with role overload.

This study reaffirmed previous findings that strong family and peer support enhances the mental health of breast cancer survivors. Prior research has reported that breast cancer patients seek emotional stability through family support and expect greater psychological understanding and encouragement throughout the course of their illness. Furthermore, the level of family support varies depending on the stage of illness and duration of treatment and tends to decline during prolonged treatment.[37] Such a decline may result from the combined effects of social and familial expectations for survivors to resume their pre-illness roles and a decrease in attention and support from family members, which can lead to psychological and social loss. In addition, this phenomenon may be influenced by cultural norms in Korea, where some women regard the provision of care—rather than its receipt—as an inherent part of their identity and role within the family.[38] Therefore, nursing interventions aimed at promoting the mental health of breast cancer survivors should incorporate family members and broader support systems, and ensure the provision of consistent emotional support even after the completion of medical treatment.

Additionally, the measure of social support in this study included support from health care professionals. This highlights the role of nurses and clinicians in providing emotional reassurance and informational guidance, which can have a positive impact on survivors' mental health. However, some survivors reported experiencing unempathetic attitudes or lack of kindness from health care providers.[39] This underscores the importance of empathetic communication and relational competence in delivering high-quality, emotionally supportive cancer care. Finally, this study identified distinct adaptation pathways according to whether survivors had undergone breast reconstruction.

Among those who received reconstruction, the stronger effect of symptom experience on mental health reflects difficulties in the physiological mode of adaptation. This finding can be interpreted as indicating that physical stimuli—such as pain, sensory changes, or a sense of foreignness—during the reconstruction process interfere with physiological integration and delay the adaptation process of accepting the reconstructed breast as part of one's body.[8,31] Furthermore, even as time passes after surgery, if physical symptoms are not adequately managed, they may hinder the formation of a positive body image and adversely affect psychosocial health and quality of life.[31] Therefore, nursing interventions for the reconstruction group should not be limited to symptom management alone but should also include education- and counseling-based adaptive nursing that promotes body integration and physiological recovery. As breast reconstruction is an elective surgery, it is essential to provide shared decision-making and adequate information through a multidisciplinary support system rather than leaving the entire decision-making burden solely on the patient.[40]

In contrast, among survivors who did not undergo breast reconstruction, the greater influence of body image on mental health reflects vulnerability in the self-concept mode. This suggests that when physical appearance changes after mastectomy are not properly addressed, survivors may experience heightened psychological distress. Alternatively, breast reconstruction may serve as a psychosocial resource, promoting a sense of bodily wholeness as well as emotional stability and psychological recovery.[41] However, reconstruction is not essential for all survivors. Some women, even without reconstruction, achieve a renewed sense of self and restored body image through personal acceptance of bodily changes and redefinition of personal identity.[31] These findings underscore the importance of self-acceptance and identity reconstruction in the psychological recovery process, aligning with the self-integration process emphasized in the self-concept mode. Accordingly, the use of acceptance-based nursing interventions to facilitate recovery of body image and psychological well-being is supported. In particular, survivors who have not undergone reconstruction have been reported to have lower social support and higher levels of avoidant coping; thus, nursing approaches that strengthen emotional support from family and peers and foster the interdependence mode are warranted.[42]

In conclusion, the pathways through which symptom experience and body image affect mental health differed depending on breast reconstruction status. These findings highlight the necessity of individualized nursing interventions that consider survivors' surgical choices and coping tendencies. Theoretical approaches grounded in RAM can facilitate holistic adaptation and provide a practical foundation for promoting the mental health of breast cancer survivors.

Implications for nursing practice and research

This study identified key factors influencing the mental health of breast cancer survivors who underwent mastectomy and highlighted differences in adaptation pathways based on whether breast reconstruction was performed. The following implications are suggested for nursing practice: First, body image was identified as the most influential factor affecting mental health. Therefore, nurses should provide continuous interventions to support body image recovery even after surgery. Survivors with negative body image perceptions should be identified early, and interventions such as self-acceptance counseling, expressive therapy programs, and peer support groups should be offered. Second, given that role performance burden can negatively affect mental health, nurses should help survivors adjust their expectations regarding social roles. Counseling and support services should be provided to facilitate workplace reintegration and family role redistribution. Tailored strategies are especially necessary for younger survivors who often face dual responsibilities in both family and occupational domains. Third, social support was found to be a protective factor for mental health. In particular, the support of family members and health care professionals plays a critical role in survivors' psychological recovery. Nurses should consider family members as care recipients and

emphasize the importance of emotional support. Educational and counseling programs for families should be developed, and health care professionals should strengthen their empathetic communication and emotional care competencies. Fourth, the coping mechanism was identified as a key mediating factor influencing mental health. Nurses should assess survivors' coping styles and implement interventions that reduce avoidant behaviors while enhancing acceptance- and problem-focused strategies. Psychological education, emotional expression training, stress management, and relaxation techniques may serve as effective nursing interventions.

Finally, since adaptation pathways differ based on whether breast reconstruction is performed, nurses should develop individualized care plans that consider the survivor's surgical decisions, level of body image acceptance, and recovery status. For those who underwent reconstruction, interventions should emphasize recovery-focused symptom management and comprehensive surgical education. For those without reconstruction, nursing care should focus on promoting body image acceptance and reinforcing self-identity through supportive, acceptance-based interventions.

Limitations

This study has the following limitations. First, the SEM used in this study yielded the following fit indices: $\chi^2 = 968.24$, $\chi^2/df = 3.72$, GFI = 0.80, RMR = 0.05, CFI = 0.84, and RMSEA = 0.09. Some of these indices fall short of commonly recommended thresholds (GFI and CFI $\geq$ 0.90; RMSEA $\leq$ 0.08). However, Stone emphasized that in theory-driven models, theoretical consistency and interpretability of the pathways should be prioritized over strict adherence to fit indices.[43] Similarly, Hooper et al. reported that RMSEA values between 0.08 and 0.10 and CFI values in the mid-0.80s may still be acceptable in empirical research.[44] Based on RAM, this study systematically aligned key variables with the four adaptive modes, thereby maintaining theoretical coherence. Despite some fit indices not meeting ideal thresholds, the model demonstrated an overall acceptable level of fit and interpretable causal pathways. Nevertheless, future studies should consider increasing the sample size or simplifying the model structure to enhance model fit. Second, RAM conceptualizes individuals as open systems interacting within four adaptive modes, where adaptation is understood as a dynamic process involving continuous feedback rather than a fixed state. However, this study employed a cross-sectional research design, which limits the ability to capture the dynamic and temporal nature of adaptation over time. Third, during the assessment of convergent validity, six items from the coping and adaptation process scale with low standardized factor loadings were removed. This limited the exploration of sub-dimensions of coping adaptation. Future research should aim to retain coping-related items as much as possible while refining the measurement structure. Fourth, in comparing the reconstruction and non-reconstruction groups, the sample size of the non-reconstruction group did not reach the ideal threshold required for multigroup SEM. As a result, the generalizability of findings regarding differences in adaptation pathways between the two groups may be limited. Fifth, since participants were recruited through several online communities, a potential risk of selection bias exists, which may limit the generalizability of the findings. Future studies should employ more diverse recruitment strategies to enhance sample representativeness.

Conclusions

This study constructed a RAM-based structural model to identify factors influencing mental health among breast cancer survivors after mastectomy. Coping indirectly affected mental health through body image, role performance, and social support, with body image showing the strongest effect. Multi-group analysis revealed that symptom experience had a greater impact among women with breast reconstruction, whereas body image was more influential among those without reconstruction. These findings highlight the importance of developing individualized nursing interventions tailored to surgical type and adaptation needs. Future studies should test this model longitudinally and include cultural and psychological factors to further validate and refine the adaptation pathways.

CRediT authorship contribution statement

Hyeng Sook Yoon: Conceptualization, Investigation, Study design, Data Curation, Formal Analysis, Visualization, Writing – Original Draft, Writing – Review & Editing. **Eunjung Ryu:** Conceptualization, Methodology, Formal analysis, Writing – Review & Editing. All authors have read and approved the final manuscript.

Ethics statement

This study was approved by the Institutional Review Board of Chung-Ang University (Approval No. 1041078-202206-HR-158) and was conducted in accordance with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. All participants provided written informed consent electronically before participation.

Data availability statement

The data that support the findings of this study are available from the corresponding author, Ryu, upon request.

Declaration of generative AI and AI-assisted technologies in the writing process

No AI tools/services were used during the preparation of this work.

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Declaration of competing interest

The authors declare no conflict of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.apjon.2025.100820.

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