

Analysis of quality of life in breast cancer survivors using structural equation modelling: the role of spirituality, social support and psychological well-being

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Background: To explore and characterize the inter-relationship between psychological well-being, spirituality, social support, comorbidity, demographic and lifestyle factors and quality of life (QoL).

Methods: This cross-sectional study was conducted with 305 breast cancer survivors in northern Iran in 2017. The demographic and socio-economic data and physical activity were measured with a standard questionnaire. The standard European Organization for Research and Treatment of Cancer (EORTC) QLQ-C30 QoL scale, a system-of-belief inventory questionnaire, the social support scale, the short form of the Hospital Anxiety and Depression Scale and the fatigue severity scale (FSS) were used in data collection. In structural equation modelling analysis, we used the maximum likelihood procedure to estimate the direct and indirect effects of relevant factors on QoL.

Results: The median age (quartile 1 [Q1], quartile 3 [Q3]) of patients was 50 y (43, 55). The psychological factors designated by anxiety, depression and FSS had a negative significant direct effect on QoL ($\beta=-0.62$). Spirituality has a positive direct effect ($\beta=0.089$) but a negligible indirect effect ($\beta=0.020$) on QoL, while the direct association of social support was almost negligible.

Conclusions: The findings emphasized the unifying structure of the determinants of QoL and the mediating negative association of psychological factors with QoL. Thus the supportive education efforts should focus on improving psychological well-being along with standard treatment in breast cancer survivors.

Keywords: breast cancer survivors, physical activity, psychological factors, quality of life, social support, spirituality

Introduction

Quality of life (QoL) has been recognized as a subjective measurement reported by patients of the health status of cancer survivors.¹ It is influenced by cultural and ethnic factors such as social norms, values, beliefs and shared experiences.² Even though advanced radical therapeutic agents with early diagnosis have increased the survival of cancer patients, especially breast cancer patients, patients are concerned about the side effects of therapeutic agents on their life, including infertility problems, symptoms of menopause, recurrence and the incidence of secondary malignancies.³ Thus evaluation of the QoL of these patients is important from a clinical perspective. The perception of health-related QoL (HRQoL) is influenced by complicated

multiple structural components comprising sociodemographic characteristics, biological determinants, spirituality, social support, psychological state and lifestyle-related factors.^{4–8} Knowing the sophisticated inter-relationship between different constructs that comprise HRQoL plays an important role in the promotion of intervention programmes for cancer patients. The conceptual model suggested by Wilson and Cleary⁴ explained the inter-relationship between the cognitive symptoms and signs and related comorbidities, environmental and social determinants and general health that influences HRQoL.⁵

The Wilson and Cleary model unifies the duality between biological and social determinants.⁴ Ferrell et al.,⁹ in an analysis of constructs related to QoL, summarized the details of physical functioning, psychological conditions and social and spiritual acts

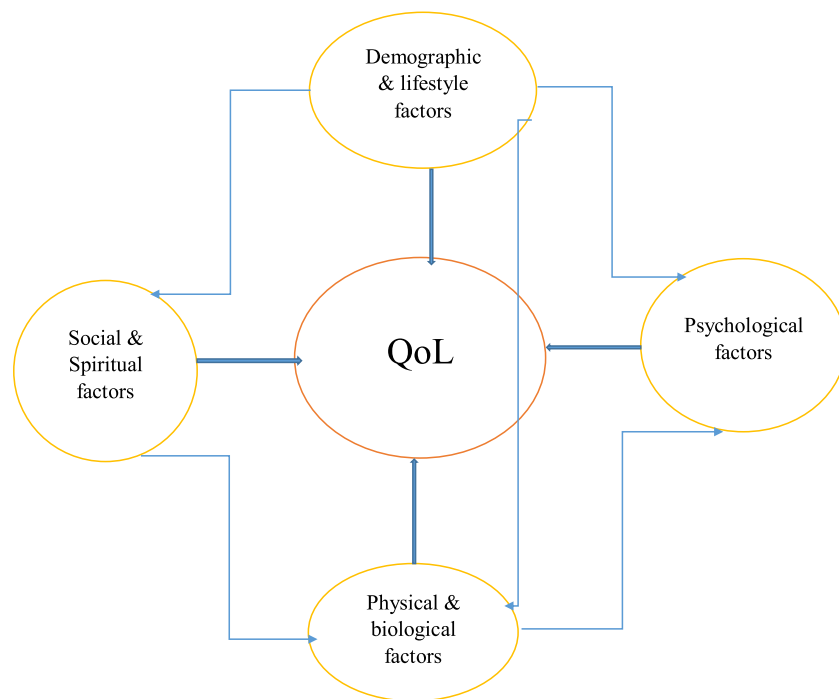


Figure 1. The conceptual framework model of QoL determinants.

in four subscales. The debates concern which of these components predominate in the effects on HRQoL. In the published studies of QoL of Iranian Muslim female breast cancer patients, the assessments were made in the first year of diagnosis in patients who were using therapeutic agents, not in breast cancer survivors. Nevertheless, the unifying structural associations between subscales with a formulation of a conceptual hypothesized model were not investigated.¹⁰⁻¹³ The data in this regard are sparse. The exploration of these relationships in Iranian Muslim women might be new to the literature and whether such a conceptual model fits the data from this sample, as the cultural characteristics of this population are different from their Western counterparts regarding mores, social values and interactions.

Culture plays a key role in influencing health beliefs and behaviours through health information resources that women have been exposed to and the pattern of health delivery and the patient's perception of illness.¹⁴ For example, Iranian Muslim women believe that the healing effect of prayers is in parallel with medical care.¹⁵ The majority of women in this population spend more time at home taking care of their families and children, thus they may be more susceptible to psychological distress that interferes with QoL. A distinct characteristic of Iranian breast cancer patients is that the age incidence is lower by a decade than in Western women.^{16,17} Despite advanced therapeutic agents for the treatment of breast cancer, the QoL remains poor. This evidence indicates the need to focus on biological, social, psychological and lifestyle factors for QoL, especially in the breast cancer population.

To the best of our knowledge, this is the first study that assessed the unifying structure of several determinants of QoL, including psychological distress, spirituality, social environment, comorbidities, demographics and lifestyle-related factors in

Iranian breast cancer survivors. The conceptual framework model of QoL determinants is presented in Figure 1. Considering the culture and religious background of Iranian Muslim women (99%),¹⁸ this study was implemented to investigate the role of psychological distress (including anxiety, depression and fatigue), spirituality and social support (the role of families, friends and communities), socio-economic conditions and health behaviour in the HRQoL of breast cancer survivors using structural equation modelling (SEM).

Materials and methods

Study design and subjects

This cross-sectional study was conducted on 305 breast cancer survivors who were referred for follow-up examinations at the Shahid Rajaii Hospital, Babolsar, northern Iran, from 1 January through 31 July 2017. Based on the underlying literature for SEM analysis, 10 cases per observed variable led to the minimum required sample size.¹⁹ For example, for 20 observed variables, at least 200 samples are required. However, in SEM analysis, the sample size varies by the number of constructs, the number of indicators (observed variables) and the effect size of the loading coefficient to be detected with a 95% confidence level and 80% power.¹⁹ We used an analytics calculator of online software for the SEM sample size calculation.²⁰ For detecting the effect size of the loading coefficient of 0.23, the number of latent variables of 6, the number of observed variables of 20 with a confidence level of 95% and power of 80%, the minimum required sample size was about 300. Thus the allocated sample size of the current study was 305, justified by the criteria used in SEM analysis. The study setting is a unique referral cancer management centre

that provides radiation and chemotherapy services to cancer patients, and its catchment population is >2 million. From a religious perspective, the majority of this population are Muslim. In our sampling scheme, all female breast cancer survivors who attended the follow-up examinations and met our inclusion criteria were consecutively recruited for the study. Among the women who attended this unique centre during the study recruitment, >90% completed the full protocol (the dropout rate was <10%). Thus the results are less affected by selection bias.

Inclusion and exclusion criteria

In recruiting the individuals, the inclusion criteria were a diagnosis of breast cancer >1 y previously. All received the standard treatment protocol, including surgery and/or chemotherapy/radiation therapy. In the recruitment of breast cancer survivors, patients with end-stage renal disease on haemodialysis, severe cardiac problems, death of first-degree relatives or divorced during the previous 3 months, those with cognitive impairments and those with a history of migraine headaches were excluded. All of these exclusion criteria were considered to enhance the internal validity of the study for comparability in the assessment of determinants of QoL.

Ethical considerations

The study protocol was approved by the National Institute for Medical Research Development (NIMAD) and the Ethics Committee of Babol University of Medical Sciences (MUBABOL.HRI.REC.1396.218). All recruited subjects completed a written informed consent before participating in the study based on the NIMAD guideline for patient consent.

Instruments and data collection

The data were collected with standard questionnaires by trained nurses. First, demographic data and clinical profiles, including tumour stage and other comorbidities such as hypertension, diabetes, history of heart disease and osteoporosis, as well as socio-economic status (SES), health behaviours, reproductive history and satisfaction with the appearance of the breast and overall shape of the body were collected. The second instrument was the validated European Organization for Research and Treatment of Cancer (EORTC) QLQ-C30, which consists of 30 items on seven subscales.^{21–24} These subscales include physical functioning (five items), role functioning (two items), cognitive functioning (three items), emotional functioning (four items), social functioning (two items), signs and symptoms of pain (two items) and fatigue (three items); the remaining six items assess the QoL conditions for dyspnoea, insomnia, appetite, constipation, diarrhoea and financial difficulties. All of these items were rated on a 4-point Likert scale. The other two items assess the overall health condition and overall health QoL on a 7-point scale. The Persian version of this instrument was validated by Montazari et al.²¹ with Cronbach's α of 0.63–0.95 in different subscales at the baseline assessment and 0.75–0.95 at the end of the follow-up. The score of each subscale of QoL was transformed from 0 (the worse) to 100 (the best). The third instrument was the standard religious and spiritual health System of Belief Inventory questionnaire

(SBI-15R).²⁵ This is composed of 15 items that measure spiritual beliefs (10 items) and religious beliefs (5 items) and the social support function of religious centres. Its validity and reliability have been approved in evaluating cancer patients.²⁵ All items of this scale were assessed on a 4-point Likert scale and the overall score ranged from 0 to 45. The fourth instrument, the Social Support Questionnaire–Short Form, was implemented and validated by Zimet et al.²⁶ This scale measures the perceived social support in three subscales (families, friends and society), using a 7-point Likert scale for scoring each item. The total score of this scale ranged from 0 to 72. Finally, the fifth instrument is a short form of the Hospital Anxiety and Depression Scale,^{6,27} and the fatigue severity scale (FSS).²⁸ This former scale consists of seven items for depression and seven items for anxiety. Each item is measured on a 4-point Likert scale (0, not at all; 1, less; 2, occasionally; 3, often). A total score >16 indicates the presence of depression and anxiety. Additionally, the FSS comprises a nine-item questionnaire related to how fatigue interferes with certain activities and assesses the severity of fatigue on a 7-point Likert scale (1, strongly disagree; 7, strongly agree). The Persian version of this scale was validated by Fereshtehnejad et al.²⁸ with good psychometric properties. Moreover, the comorbidity index was calculated based on self-reports of the total score of the presence of hypertension, diabetes mellitus, heart disease and osteoporosis.

The physical activity level was evaluated based on the total scores of five items of physical activity assessment using a lifestyle questionnaire. This included the daily usual activity level, the level of leisure-time exercise, the degree of changing the heart rate during exercise, the amount of light to moderate physical activity and the level of intense exercise at least 3 d/week and 20 min/d. Each item of activity level was rated on a 4-point Likert scale (1, not at all; 2, occasionally; 3, often; 4, always). The reliability coefficients as measured by Cronbach's α yielded >0.85 in the different subscales in all the instruments used in our study.

Statistical analysis

The statistical analysis was performed using SPSS version 18.0 (SPSS, Chicago, IL, USA) and SPSS Amos 24 (IBM, Armonk, NY, USA) software. For descriptive statistics, we used the median (quartile 1 [Q1], quartile 3 [Q3]) of different subscales and the overall score of QoL and other scales of QoL. Spearman's correlation coefficient was used to determine the intercorrelation between the scores of QoL with psychological distress, social health, spiritual well-being, comorbidity index and physical activity level. The scores of the different subscales of QoL, social support, spiritual health and psychological distress were compared according to age groups by the Wilcoxon test. We also categorized the continuous scores of depression, anxiety, FSS, having spiritual beliefs and social support with appropriate cut-off values to determine the prevalence of each according to the QoL (less than median, median or higher). We used the cut-off value of ≥ 16 for high anxiety and depression, ≥ 46 for high FSS, ≥ 49 for high spiritual beliefs and ≥ 31 for a high level of perceived social support. The χ^2 test was applied to examine their association with QoL in a bivariate analysis. Based on the hypothesized conceptual model under examination, the final output variable was the QoL.

The demographic characteristics, the observed socio-economic variables (level of education, satisfaction with income),

biological variables (comorbidities including diabetes, hypertension, osteoporosis and heart diseases), healthy lifestyle variables (physical activity), physical functioning score, emotional and cognitive scores, symptom and sign scores, depression score, anxiety score, FSS, social support score and spiritual beliefs and religious score were used in SEM based on the designated model. In SEM analysis, we dealt with latent variables such as social support (three observed variables: family, friends and society), spirituality (two observed variables: spiritual belief score and religious score), psychological construct (three observed scores: depression, anxiety and FSS) and QoL (the score of its subscales in seven dimensions, which has already been illustrated in the 'Instruments and data collection' section). We used the maximum likelihood procedure to estimate the direct and indirect standardized coefficients of each subscale—in particular, the effect of spirituality and social support on overall QoL. The indirect effect is defined by multiplying the regression coefficients of the indirect path, which included an intermediate or mediating factor. Then the structural components in the explanation of QoL were tested by χ^2 test. We used the summary goodness of fit indices and comparative fit indices recommended by Hu and Bentler²⁹ to evaluate the unifying structure of the proposed conceptual model. These criteria include the goodness of fit index (GFI), adjusted goodness of fit index (AGFI), normed fitting index (NFI), root mean square error of approximation (RMSEA), comparative fit index (CFI) and incremental fit index (IFI). The criteria for a close fit were CFI >0.90, AGFI >0.80, NFI >0.90, RMSEA <0.08, GFI >0.90 and IFI >0.90.

Results

A total of 305 female breast cancer survivors with a median age (Q1, Q3) of 50 y (43, 55) were enrolled in the study. The median (Q1, Q3) duration of time since diagnosis was 3 y (1.75, 5) and the median age of patients at diagnosis was about 46 y. The characteristics of the study population are shown in Table 1. The education level of more than half of the participants was high school level or higher. Roughly 250 (82%) subjects were housewives and 240 (80.6%) were married. Only 57 (18.7%) cases had a family history of breast cancer in a first-degree relative. A few participants (15 [4.9%]) were former smokers and only 1 (0.3%) was a current smoker. A total of 107 (46.5%) patients had stage III or IV tumours. About half of the participants were not satisfied or had very low satisfaction with the appearance of their breast. The family income of about half of the subjects was not sufficient and the majority of patients (273 [89.5%]) were inactive.

Table 2 shows the Spearman correlation coefficients between the QoL score with the relevant psychological distress, spirituality and social support scores and other characteristics. A significant negative correlation was found between depression ($r=-0.39$, $p=0.001$), anxiety ($r=-0.62$, $p=0.001$) and FSS ($r=-0.47$, $p=0.001$) with QoL, and a positive correlation of QoL was seen with social support ($r=0.14$, $p=0.01$) and a non-significant positive correlation with spirituality score. The comorbidity index, including diabetes, heart disease, osteoporosis and hypertension, was negatively associated with overall QoL ($r=-0.32$, $p=0.001$).

Table 3 presents the median (Q1, Q3) of the subscales of QoL, social support, spirituality and the three dimensions of psycho-

Table 1. Demographic characteristics of the study participants

Characteristics	Values
Age (years), median (Q1, Q3)	50 (43, 55)
Number of alive children, median (Q1, Q3)	3 (2, 3)
Number of abortions, median (Q1, Q3)	0 (0, 1)
Menarche age (years) median (Q1, Q3)	13 (12, 14)
Age of marriage (years) median (Q1, Q3)	19 (17, 21)
Time from diagnosis (years) median (Q1, Q3)	3 (1.75, 5)
Education, n (%)	
Illiterate	71 (23.3)
Primary	80 (26.2)
Elementary/high school	119 (39.0)
University	35 (11.5)
Occupation, n (%)	
Housewife	250 (82)
Worker	39 (12.8)
Retired	16 (5.2)
Residence, n (%)	
Urban	199 (65.2)
Rural	106 (34.8)
Marital status, n (%)	
Non-married	19 (6.3)
Married	245 (80.6)
Divorced	14 (4.6)
Widow	26 (8.6)
Family history of breast cancer, n (%)	
Not at all	206 (67.5)
First degree	57 (18.7)
Second degree	42 (13.8)
Stage of cancer, n (%)	
1	49 (16.7)
2	137 (46.8)
3	93 (31.7)
4	14 (14.8)
Smoking status, n (%)	
Not at all	289 (94.8)
Former smoker	15 (4.9)
Current smoker	1 (0.3)
Location of breast	
Right side	131 (43.1)
Left side	144 (47.2)
Two sides	29 (9.5)
Satisfaction with body shape, n (%)	
Not at all	63 (20.7)
Very low	87 (28.5)
A bit low	110 (36.1)
Very much	45 (14.8)
Family income, n (%)	
Not sufficient	137 (45.4)
Sufficient	165 (54.6)
Husband's education level, n (%)	
Illiterate	49 (17.0)
Primary	76 (26.4)
Elementary/high school	123 (42.7)
University	40 (13.9)
Physical activity level, n (%)	
Low	273 (89.0)
High	32 (10.5)

Values may not sum to n=305 because some information was missing from the patients' records.

Table 2. Spearman intercorrelation coefficients between QoL score with social support score, spirituality score and psychological index score, and physical activity score, comorbidity score and demographic characteristics

Variable	1	2	3	4	5	6	7	8	9	10	11
QoL	1(-)	0.14 (0.01)	0.06 (0.32)	-0.39 (0.001)	-0.62 (0.001)	-0.47 (0.001)	0.22 (0.001)	-0.32 (0.001)	-0.06 (0.41)	0.11 (0.05)	-0.09 (0.15)
SS		1 (-)	0.24 (0.001)	-0.24 (0.001)	-0.05 (0.39)	0.03 (0.55)	0.12 (0.04)	-0.18 (0.002)	-0.13 (0.02)	0.15 (0.01)	-0.10 (0.08)
SP			1 (-)	-0.14 (0.02)	0.001 (0.98)	0.09 (0.14)	0.04 (0.52)	-0.04 (0.46)	0.05 (0.39)	-0.07 (0.25)	0.02 (0.67)
Depression				1 (-)	0.39 (0.001)	0.36 (0.001)	-0.25 (0.001)	0.10 (0.08)	0.09 (0.12)	-0.25 (0.001)	0.08 (0.08)
Anxiety					1 (-)	0.54 (0.001)	-0.09 (0.13)	0.20 (0.001)	-0.01 (0.82)	-0.08 (0.18)	0.08 (0.15)
FSS						1 (-)	-0.18 (0.002)	0.13 (0.02)	-0.03 (0.62)	-0.08 (0.19)	0.07 (0.24)
PA							1 (-)	-0.05 (0.37)	-0.28 (0.001)	0.27 (0.001)	-0.10 (0.09)
Comorbidity score								1 (-)	0.36 (0.001)	-0.17 (0.004)	0.31 (0.001)
Age									1 (-)	-0.45 (0.001)	0.55 (0.001)
Education level										1 (-)	-0.30 (0.001)
Menopause											1 (-)

SS: social support; SP: spiritual health; FSS: fatigue severity scale; PA: physical activity. p-Values in parentheses.

logical characteristics according to age group <50 y and ≥50 y. The median of the overall QoL score was 62.22%, and the lowest score (median 58.33%) was observed for emotional functioning and the highest score for cognitive functioning and social functioning (66.67%). The median scores of both social support and spiritual beliefs were relatively higher than the expected average, whereas the observed psychological state in three aspects of anxiety, depression and FSS was almost around the expected average, and a higher score represents more psychological distress. The depression score was significantly higher in the younger age group (p=0.04), while the differences in other scales were not significant between the two age groups (p>0.05).

Table 4 shows the prevalence of psychological characteristics, perceived social support and spiritual beliefs according to QoL status. The prevalence of depression symptoms was lower than for anxiety and FSS. There was a significantly higher prevalence of depression (p=0.03), anxiety (p=0.001) and FSS (p=0.001) with lower QoL. Also, perceived high social support was more common (74.5%) in our study sample, and the higher level of perceived social support was linked with higher QoL (p=0.003). A high rate of spiritual belief (85.2%) was observed in our study population, and this percentage tended to be higher (non-significantly) with a higher level of QoL.

Table 5 summarizes the standardized direct, indirect and total effects of paths on QoL in the SEM used. For example, the standardized direct effect (i.e. direct arrow) of comorbidity on QoL was -0.32, but its indirect effect was estimated by multiplying two relevant coefficients through mediating by a psychological factor as: 0.40 (the coefficient of comorbidity on psychological factor) × -0.622 (the coefficient of psychological factor on QoL) = -0.248. Based on our findings, a negative significant standardized direct effect (β=-0.622) of psychological distress on QoL was revealed. Meanwhile, a higher physical activity level is linked with both psychological well-being and improvement of QoL. Spirituality has a positive direct effect (β=0.089) plus a negligible (β=0.020) indirect effect on QoL through mediation of social support and psychological factors, while the direct effect of

social support on QoL was negligible (β=0.010) but the indirect effect (β=0.085) through mediating psychological factors was observed in the SEM analysis. The comorbidity score, both directly and indirectly, has a significant negative influence through the psychological state on QoL. The influence of age on QoL was not significant, but higher SES measured by the level of education and income satisfaction was related to higher scores of physical activity (β=0.375), and SES indirectly influenced QoL through mediating lower scores of psychological distress. As Figure 2 shows, the coefficients of all subscales designated for the construct of QoL in the structural model were significant. The paths in Figure 2 show the standardized coefficients and the inter-relationship between demographic characteristics, socioeconomic, lifestyle, social support, spirituality and psychological behaviours and QoL. Table 6 presents the model fitting indexes with RMEA=0.07, CFI=0.89, IFI=0.89, NFI=0.82 and IFI=0.77, and overall the fitted model met the fitting criteria of the hypothesized model and shows the unifying structure of determinants of QoL in breast cancer survivors.

Discussion

The findings of the current study show that age has a direct positive effect on comorbidity, and subsequently comorbidity as a mediating biological variable has a negative significant effect on QoL. On the other hand, the comorbidity has a direct positive influence on psychological distress as a mediating variable of QoL. The influence of the indirect effect of comorbidity on QoL through mediating psychological distress was also significant. Furthermore, psychological distress was significantly influenced by SES and physical activity level. The indirect effect of physical activity through psychological distress has a greater impact on QoL than its direct effect. Based on our results, the higher SES corresponds to lower psychological distress and thus the higher SES, through mediating a reduction in psychological distress, has an effective role in the promotion of QoL. Moreover, the direct

Table 3. The different subscales of QoL social support score and spiritual score according to age group

QoL subscales ^a	All, median (Q1, Q3)	Age (years), median (Q1, Q3)		p-Value ^b
		<50	≥50	
GH	58.33 (50.00, 75.00)	66.67 (50.00, 75.00)	58.33 (41.67, 75.00)	0.11
PF	60.00 (33.33, 73.33)	60.00 (40.00, 73.00)	46.67 (33.33, 73.33)	0.10
RF	66.67 (50, 83.33)	66.67 (50.00, 83.33)	66.67 (33.33, 83.33)	0.96
EF	58.33 (53.33, 75.00)	58.33 (33.33, 75.00)	50.00 (25.00, 75.00)	0.78
CF	66.67 (50.00, 100)	66.67 (50.00, 91.67)	66.67 (50.00, 100)	0.71
SF	66.67 (33.33, 83.33)	66.67 (33.33, 100)	66.67 (53.33, 83.33)	0.33
Symptom	66.67 (51.28, 82.05)	67.95 (51.28, 82.05)	66.67 (48.72, 79.49)	0.63
Overall QoL	62.22 (46.11, 76.11)	65.28 (49.11, 76.67)	61.39 (43.89, 73.61)	0.51
Social support score ^c	60.00 (48.00, 67.00)	60.50 (49.00, 68.00)	57.50 (48.00, 66.00)	0.08
Spirituality score ^d	41.00 (35.00, 45.00)	40.50 (34.00, 44.5)	41.50 (35.00, 45.00)	0.66
Anxiety score ^e	11.00 (8.00, 13.00)	11.00 (8.00, 13.00)	11.00 (8.00, 14.00)	0.58
Depression score ^e	9.00 (6.00, 12.00)	11.00 (6.00, 12.00)	10.00 (7.00, 12.00)	0.04
FSS score ^f	44.00 (33.00, 53.00)	44.00 (33.00, 53.00)	45.00 (33.00, 53.00)	0.68

^a Scale ranged from 0 to 100. ^bThe p-value was calculated using the Wilcoxon ranked test. ^cScale ranged from 0 to 72. ^dScale ranged from 0 to 45. ^eAnxiety and depression scales ranged from 0 to 21. ^fFSS scale ranged from 9 to 63. GH: general health; PF: physical functioning; RF: role functioning; EF: emotional function; CF: cognitive functioning; SF: social functioning; FSS: fatigue severity scale; IQR: interquartile range; Q1: first quartile; Q3: third quartile.

Table 4. The prevalence of depression, anxiety, fatigue severity, spiritual beliefs and perceived social support according to QoL status

Characteristics	QoL			p-Value
	All, n (%)	<Median, n (%)	≥Median, n (%)	
Depression				0.03
Low	284 (96.3)	139 (93.9)	145 (98.6)	
High	11 (3.7)	9 (6.1)	2 (1.4)	
Anxiety				0.001
Low	261(88.2)	118 (79.2)	143 (97.3)	
High	35 (11.8)	31 (20.8)	4 (2.7)	
Fatigue severity				0.001
Low	160 (55.4)	56 (37.6)	104 (69.8)	
High	133 (44.6)	93 (62.4)	45 (32.2)	
Social support				0.003
Low	76 (25.5)	49 (32.9)	27 (18.1)	
High	222(74.5)	100 (67.1)	122 (81.9)	
Spiritual beliefs				0.33
Low	44 (14.8)	25 (16.8)	19 (12.8)	
High	254 (85.2)	124 (83.2)	13 (87.2)	

Values may not sum to n=305 because some information is missing from the patients' records.

effects of age, physical activity level and SES on QoL were not significant. In contrast, higher age was associated with higher spirituality, and spirituality directly influenced social support, but the indirect effect of spirituality through mediating social support was not significant on QoL. Based on the SEM approach, an inverse association has been observed between psychological state, including depression, anxiety and fatigue severity, and

QoL among breast cancer survivors. Meanwhile, a low positive correlation was found between social support and spirituality and QoL.

Based on the SEM implemented in the current study, psychological distress considered as a latent construct, which was measured in three dimensions of anxiety, depression and fatigue severity, had the greatest negative impact on QoL. These results

Table 5. Standardized direct, indirect and total effects of paths affecting the QoL of breast cancer survivors

Paths to QoL	Direct effect	Indirect effect	Total effect
Age → Spirituality	0.088	0.000	0.088
Age → Comorbidity	0.428	0.000	0.428
Age → Social support	0.000	0.022	0.022
Age → Psychological distress	-0.325	0.208	-0.118
Age → QoL	0.101	-0.078	0.023
Age → Physical activity	-0.195	0.000	-0.195
SES → Spirituality	0.019	0.000	0.034
SES → Social support	0.000	0.005	0.005
SES → Psychological distress	-0.185	-0.150	-0.335
SES → QoL	0.000	0.304	0.304
SES → Physical activity	0.375	0.000	0.375
Comorbidity → psychological distress	0.397	0.000	0.397
Comorbidity → QoL	-0.319	-0.426	-0.567
Physical activity → psychological distress	-0.152	0.000	-0.152
Spirituality → psychological distress	0.005	-0.034	-0.029
Physical activity → QoL	0.050	0.095	0.145
Spirituality → QoL	0.089	0.020	0.109
Social support → QoL	0.003	0.000	0.003
Psychological distress → QoL	-0.622	0.000	-0.622
Spirituality → Social support	0.244	0.000	0.244
Social support → QoL	0.010	0.085	0.095

are in line with those of Champion et al.³⁰ The presence of signs and symptoms such as pain, depression, anxiety, sleep disorders and fatigue have been reported as the key psychological determinants of QoL in breast cancer survivors in several studies.^{31,32} Depression, by decreasing social and physical activities, is associated with changes in sexual relationships and sleep disorders.³¹ Our findings indicate significant differences in depression scores for women <50 y of age and ≥50 y of age, while QoL scores were not significantly different between these age groups. However, women <50 y of age had the lowest scores in the emotional functioning dimension and women ≥50 y of age had the lowest scores for the physical functioning scale. The majority of breast cancer survivors <50 y of age have an underage child and/or are working in a full-time job and also newly married.³³ Nevertheless, the major concern of this age group of breast cancer survivors is the change in their body shape, breast and self-concept.

In older women, the lower level of physical functioning may be due to the ageing process and through subsequent comorbidities. Furthermore, women who undergo surgical procedures for their required treatment are more dependent on others, thus resulting in a loss of independence.³³ The results of this investigation showed that comorbidities such as heart disease, hypertension, diabetes and osteoporosis directly associate with QoL and also indirectly through mediating psychological distress in breast cancer survivors. However, the prevalence of these comorbidities increased with age, but the increased incidence of these comorbidities may result from the side effects of therapeutic agents used in breast cancer therapy (chemotherapy and hormonal therapy). Heart disease may develop in breast cancer survivors

Table 6. Model summary fitting indexes

NFI	RFI	IFI	CFI	RMSEA	CMIN/df	p-Value
0.82	0.77	0.89	0.86	0.07	2.39	0.001

CMIN: Minimum Chi-square; df: degrees of freedom.

due to cardiac toxicity of some breast cancer therapies, such as chemotherapy or ionizing radiation.³⁴ Also, using tamoxifen in premenopausal women can cause osteoporosis.³⁵

The findings of the current study indicate the influence of the direct and indirect effects of physical activity levels on QoL in breast cancer survivors. Physical activity, in addition to its direct impact on QoL and indirectly by decreasing psychological distress, increased the QoL of breast cancer survivors. A similar finding was observed by Phillips and McAuley.³⁶ Physical activity improves psychological well-being by increasing the level of self-efficacy, which ultimately leads to an overall improvement in health status and thus influences the QoL of cancer patients.

Based on our findings, the higher SES that was measured by the satisfaction of income and higher education level improved the QoL of breast cancer survivors. Perhaps economic concerns, considering the cost of therapeutic agents, plays an important role in the psychological distress of cancer patients. The fear of

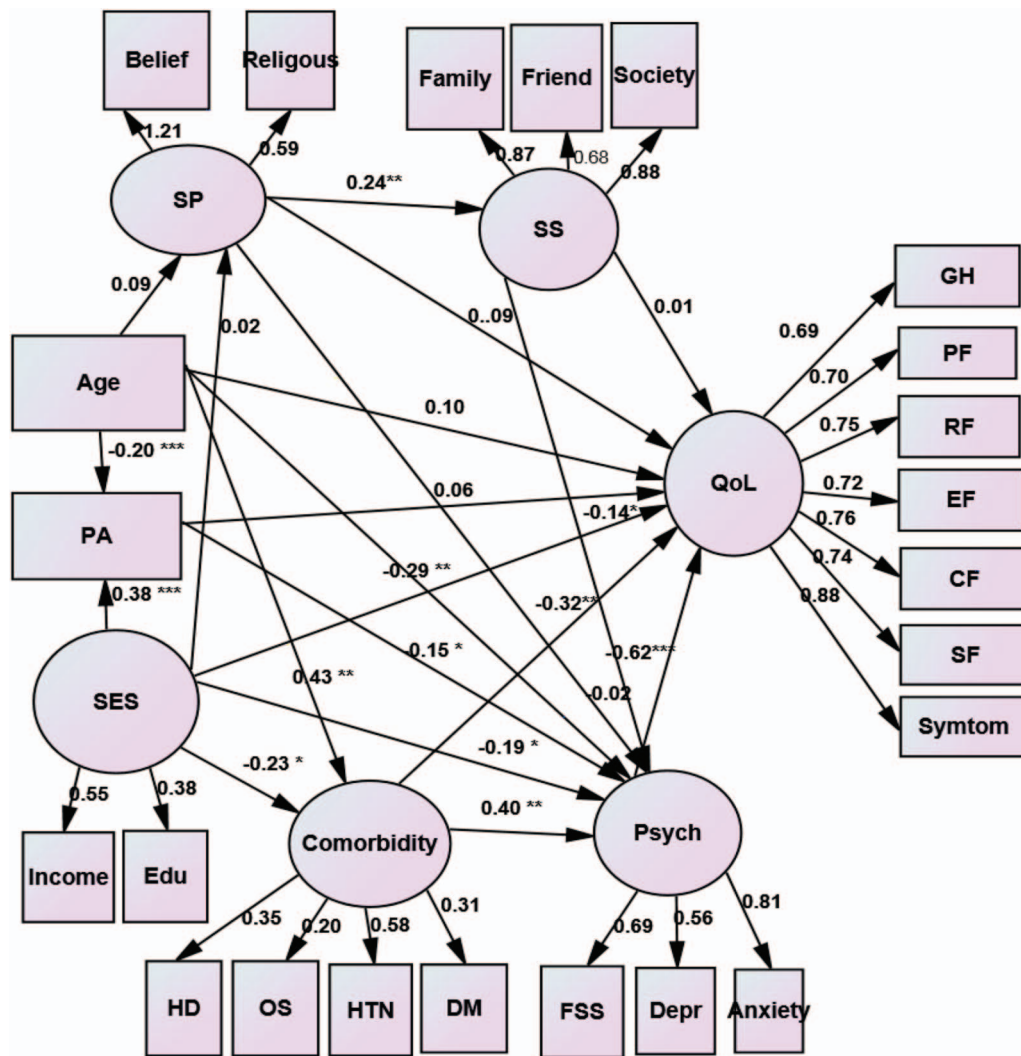


Figure 2. The path standardized coefficients of determinants of QoL in breast cancer survivors. SP: spiritual health; SS: social support; QoL: quality of life; GH: general health; PF: physical functioning; RF: role functioning; EF: emotional functioning; CF: cognitive functioning; SF: social functioning; PA: physical activity; SES: socio-economic status; Edu: education level; Psych: psychological distress; FSS: fatigue severity scale; Depr: depression; HD: heart disease; OS: osteoporosis; HTN: hypertension; DM: diabetes mellitus. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. All loading coefficients of observed variables to the related construct were significant ($p < 0.001$).

recurrence or death and a lack of confidence in the efficacy of treatment elevate the psychological burden of disease in breast cancer survivors, which in turn causes depression and anxiety.³⁷

According to the results of this study, spirituality is a factor in the QoL of breast cancer survivors, but its association with QoL is much lower than psychological well-being. Our SEM indicates a direct effect but a negligible indirect effect of spiritual well-being by intervening in the psychological distress path and thus influencing the QoL of breast cancer survivors. Several studies have explored the role and the association of spirituality with QoL in breast cancer survivors.^{38,39} From a holistic point of view, spirituality and religious practices are considered part of therapeutic care. Spiritual/religious beliefs and behaviours provide a means of managing problems and decreasing negative feelings and the critical outcome of stressful events.⁴⁰ When individ-

uals believe in a strong source of energy, they love and lean on it; thus they have less fear and their positive feelings help them manage undesirable events and so they have fewer experiences of negative feelings.³⁸ Even with a subsequent diagnosis and treatment, the level of spirituality is still elevated.⁴¹ Our findings show Muslim women have a relatively higher level of spirituality/religion, and they use this spirituality as an effective source in confronting negative psychological and physical outcomes. Spirituality through mediating social support may influence the QoL of breast cancer survivors. However, this mediating effect was not well explained in our study sample, perhaps due to a lack of variability in the spirituality score and social support.

The findings of the present study indicate an association between social support and QoL in breast cancer survivors in

a bivariate correlation analysis, but the path analysis of the SEM showed that the effect of social support on QoL was negligible. Several other studies have reported an association of social support and QoL in breast cancer survivors.^{12,42,43} Social support in breast cancer survivors corresponded to improvement in social, psychological and physical functioning and thus may enhance the overall QoL.⁴⁴ In other studies, individuals with a lack of social support had a higher rate of mortality.⁴² Moreover, a significant association between the socially isolated and adverse health outcomes such as hypertension, obesity and cigarette consumption has been reported.⁴² Indirectly, social support, by adjusting psychological distress, may influence health status and therefore protects individuals from serious psychological disorders during critical life events.⁴⁵ Overall, it facilitates health-promoting behaviours.⁴⁶ The presence of a supportive environment (family, friends and society) improves the strategies for dealing with stress.⁴¹ Moreover, in some, religious belief results in tranquillity, thus providing a source of energy and moral support in coping with diseases.⁴⁷⁻⁴⁹

Overall, our SEM analysis demonstrated that the Wilson and Cleary model fits relatively well for explaining the unifying structure of QoL in female Iranian Muslim breast cancer survivors by emphasizing the negative influence of psychological distress and the positive effect of biological variables such as comorbidities.

This study has some limitations. The cross-sectional nature of the design does not allow us to judge the causality of the associated factors for QoL, but more appropriately for direct and indirect effects that can only be described from cross-sectional data. The other limitation is that the requirement of the sample size for SEM is complicated by a number of factors and indicators and the magnitude of factor loadings.⁵⁰ Another limitation may be selection bias. However, our study setting is a single referral centre that covers a large population catchment area and therefore it is less likely to be affected by selection bias. Also, despite the fact that several exclusion criteria were used in our study, we did not use domestic abuse as an exclusion factor for this study since the definition of domestic violence may depend on the culture and it was difficult to obtain real data in our study population because of cultural issues. Furthermore, in terms of the generalizability of results, it should be noted that our results are only generalizable to female breast cancer survivors residing in northern Iran.

Conclusions

The findings of our SEM indicate that psychological distress has the greatest negative influence on QoL in breast cancer survivors and spiritual health and social environment show promising possible positive effects in promoting QoL. However, a future prospective interventional study should focus on the participation of cancer patients of a matched group in a social group activity, such as exercise, and participation in a national group organization of cancer supportive care. Supportive educational interventions at the family and population level through health-care systems, with the aim of strengthening psychological well-being, spiritual health and access to social supportive resources, should be provided so women can cope with their disease, thus increasing their QoL.

Authors' contributions: All authors contributed significantly to the study design and implementation and the analysis and interpretation of the data. KH conceived the study, designed the study protocol, managed data collection and analysis and wrote the first draft of the manuscript. MF contributed to the study design, analysis and interpretation of the data and writing of the manuscript. DM managed the case findings and data collection and critically revised and drafted the manuscript for intellectual content. All authors read and approved the final manuscript.

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Ethical approval: All procedures performed in the studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. This study has been approved by the Ethical Committee of Babol University of Medical Sciences (MUBABOL.HRI.REC.1396.218). Informed consent was obtained from all individual participants included in the study.

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