

Relationship of Lifestyle Habits to Health-Related Quality of Life of Recently Diagnosed Breast Cancer Between Younger and Older Women in China

Chao Zheng

The Second Hospital, Cheeloo College of Medicine, Shandong University

Li-Xiang Yu

The Second Hospital, Cheeloo College of Medicine, Shandong University

Hong-ying Jia

The Second Hospital, Cheeloo College of Medicine, Shandong University

Shu-De Cui

Affiliated Tumor Hospital of Zhengzhou University

Fu-Guo Tian

Shanxi Cancer Hospital

Zhi-Min Fan

The First Hospital of Jilin University

Cui-Zhi Geng

The Fourth Hospital of Hebei Medical University

Xu-Chen Cao

Tianjin Medical University Cancer Institute and Hospital

Zhen-Lin Yang

The First Affiliated Hospital of Binzhou Medical University

Xiang Wang

Cancer Hospital, Chinese Academy of Medical Sciences

Hong Liang

Linyi People's Hospital

Shu Wang

Peking University People's Hospital

Hong-Chuan Jiang

Beijing Chaoyang Hospital

Xue-Ning Duan

Peking University First Hospital

Hai-Bo Wang

Qingdao University Affiliated Hospital

Guo-Lou Li

Weifang Traditional Chinese Hospital

Qi-Tang Wang

The Second Affiliated Hospital of Qingdao Medical College

Jian-Guo Zhang

The Second Affiliated Hospital of Harbin Medical University

Feng Jin

The First Affiliated Hospital of China Medical University

Jin-Hai Tang

Nanjing Medical University Affiliated Cancer Hospital

Liang Li

Zibo Central Hospital

Shi-Guang Zhu

Qindao University Medical College Affiliated Yantai Yuhuangding Hospital

Wen-Shu Zuo

Shandong Tumor Hospital and Institute

Fei Wang

Second Hospital of Shandong University

Fei Zhou

Second Hospital of Shandong University

Yu-Juan Xiang

Second Hospital of Shandong University

Ming-ming Guo

Second Hospital of Shandong University

Yong-Jiu Wang

Second Hospital of Shandong University

Shu-ya Huang

Second Hospital of Shandong University

Liyuan Liu (✉ liuliyuanforever@163.com)

The Second Hospital, Cheeloo College of Medicine, Shandong University <https://orcid.org/0000-0002-9862-7471>

Zhi-Gang Yu

The Second Hospital, Cheeloo College of Medicine, Shandong University

Research

Keywords: quality of life, breast cancer, lifestyle habits, age-related differences

Posted Date: June 4th, 2020

DOI: <https://doi.org/10.21203/rs.3.rs-32081/v1>

License: © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Abstract

Background: Breast cancer is the most common cancer among women in China. Hence, how best to live with and improve the health-related quality of life (HRQoL) of this growing population of women is thus becoming of great public health importance. The aim of the study was to evaluate the relationship of lifestyle habits to HRQoL among younger and older women who were initially diagnosed with breast cancer within the first two weeks, determine the contribution of lifestyle habits factors on HRQoL.

Methods: A multi-center, hospital-based, case control study was conducted among breast cancer women from 22 hospitals in 11 provinces or municipalities in northern and eastern China from April 2012 to April 2013. The Functional Assessment of Cancer Therapy-Breast Cancer (FACT-B) simplified Chinese version 4 was used to measure HRQoL. Chi-square test, ANOVA and Multivariable generalized linear models were conducted to verify differences in HRQoL between two groups and to evaluate the contribution of lifestyle habits factors (including smoking, passive smoking, alcohol intake, Tea, Coffee, Sleep satisfaction, Current life satisfaction, Physical activity, BMI) on HRQoL of breast cancer patients.

Results: 1199 eligible breast cancer patients were used for analysis. Younger women (age < 50 years) appeared to show lower scores than older women (age \geq 50 years) in HRQoL subscales including emotional well being ($p = 0.003$), functional well being ($p = 0.006$), breast cancer subscale ($p = 0.038$), and FACT-B Total scores ($p = 0.028$). Tea and alcohol consumption, very satisfied with sleep and current life were the strongest predictors of higher HRQoL in younger group. Meanwhile, no coffee consumption, frequent participation in physical activities, high sleep satisfaction and current life satisfaction were the key predictors of higher HRQoL in older breast cancer women.

Conclusion: The relationship of the nine lifestyle habit items to HRQoL were different between younger and older women. Associated variable of low HRQoL can help clinicians take intervention early in order to improve the prognosis of breast cancer patients.

Introduction

Breast cancer is the most common cancer among women in China. The crude incidence of breast cancer is 41.82 per 100,000 women with 279,000 new cases diagnosed in 2014 (1). As evidenced by the high incidence rates and relatively low mortality rates, breast cancer is the most prevalent cancer in China (2). It has been predicted that by 2021, there will be 2.2 million cases of breast cancer in China amongst women aged 35–49 years in 2001, which is equivalent to more than 100 new cases per 100,000 women (3). Therefore, efforts to improve the health-related quality of life (HRQoL) of this growing population of women has thus become an issue of great public health importance.

In 1993, the World Health Organization (WHO) defines quality of life (QOL) as "an individual's perception of his or her status in life in the context of the culture and value systems in which he or she lives, and in relation to his or her goals, expectations, standards and concerns" (4). The QOL reflects the overall physical and mental response and the sense of real self-worth from the heart when the individual suffers

from the pain (5). This functional scale for a certain cancer can accurately evaluate the patient's condition and play an irreplaceable role (6, 7), and is now considered an important endpoint in cancer clinical trials.

As well-documented in previous studies, assessing HRQoL in cancer patients could contribute to improved treatment and could even be as prognostic as medical factors could be prognostic (8–11). From a clinical point of view, breast cancer patients perform poorly in terms of psychology, physiology, and sociology. Therefore, breast cancer patients need more support and help in these aspects. It is very important to evaluate and study the HRQoL of breast cancer patients, pay attention to their physical and mental condition, and take active measures and intervention methods to improve their QOL.

At present, many researchers are committed to exploring the influencing factors affecting the HRQoL of breast cancer patients, and hope to improve the overall health of breast cancer patients by changing these factors. Psychosocial factors, sociodemographic variables, and medical variables have been identified as predictors of HRQoL in cancer patients (7, 9), but current research on the impact of various lifestyle habits factors on the HRQoL of breast cancer patients is still controversial (12, 13). Mosher and Danoff-Burg reviewed studies on age differences in psychological adjustment to breast cancer and suggested age may be best viewed as a risk factor for distress with other variables operating to produce this demographic difference(14). Furthermore, previous studies have shown that younger women have higher rates of psychological morbidity and poorer HRQoL after breast cancer diagnosis than older women (10, 15). However, the differences in relationship of lifestyle habits to HRQoL between younger and older women in China has not been studied. More importantly, most studies on QOL after breast cancer have been performed in women at least 4 months to upwards of 5–10 years after cancer diagnosis, and sometimes after the completion of treatment (9, 10, 12). Few studies have assessed the HRQoL of women initially diagnosed with breast cancer in the first few weeks (16).

The aim of the study was to evaluate the relationship of lifestyle habits to HRQoL among younger and older women who were initially diagnosed with breast cancer within the first two weeks, determine the contribution of lifestyle habits factors on the HRQoL. The findings of this study can potentially help guide the training/initiatives that are organized for shaping lifestyle habits of breast cancer patients after cancer diagnosis, and may influence the woman's future course of breast cancer.

Materials And Methods

Recruitment

Breast cancer patients were recruited from 22 hospitals in 11 provinces or municipalities in northern and eastern China from April 2012 to April 2013, as described previously (17, 18). Han Chinese women newly diagnosed with primary breast cancer confirmed by histology and aged from 25 to 70 years were included in this study. Exclusion criteria were: (1) < 25 or > 70 years of age; (2) diagnosed with recurrent breast cancer; (3) diagnosed with metastatic breast cancer; (4) patients with other malignant tumors; (5)

patients who refused to enroll. A self-designed structured questionnaire was used on the interview, as described previously (17, 18). The questionnaire mainly includes the following contents: demographic characteristics, female physiological and reproductive factors, medical and family history, lifestyle habits, and breast cancer-related knowledge. In this study, we only analyzed the lifestyle habits: including smoking (including passive smoking), alcohol consumption, dietary habits (tea and coffee consumption), sleep satisfaction, current life satisfaction, physical activity, and body-mass index (BMI, kg/m²).

QOL assessment

The Functional Assessment of Cancer Therapy-Breast Cancer (FACT-B) simplified Chinese version 4 instrument is administered during the baseline interview to assess QOL. The FACT-B is a 36-item questionnaire that includes both 27 items of general QOL (FACT-G) associated with cancer and another 9 items of QOL related to breast cancer, the breast cancer subscale (BCS). FACT-B consists of the following subscales: physical well-being (PWB) (seven items), social/family well-being (SWB) (seven items), emotional well-being (EWB) (six items), functional well-being (FWB) (seven items), and BCS. The simplified Chinese translation was performed using a standardized methodology using a series of forward and backward translations as well as review and field testing. The FACT-B uses a five-point scale (0 = not at all; 1 = a little bit; 2 = somewhat; 3 = quite a bit; 4 = very much) to indicate how true the statements were to the subjects over the previous 7 days. If more than half of the items that make up the subscale were answered, the missing values were calculated as an average of the observed items. Depending on the scale, higher scores may represent either a higher level of well-being or a lower level of well-being. The items that are expressed in the opposite direction were transformed before being summed up to calculate each subscale's score. Higher scores represent higher levels of well-being. The Cronbach α in this study was 0.881 for the total FACT-B, 0.821 for PWB, 0.800 for SWB, 0.757 for EWB, 0.876 for FWB, and 0.653 for BCS.

Before the start of the study, the investigators were all trained and assessed. The baseline and FACT-B questionnaires were collected in a unified standard and unified manner to reduce information bias. Face-to-face interviews were conducted to collect the basic information and QOL information from the patients. And the baseline and FACT-B questionnaires were completed within 2 weeks after the diagnosis of breast cancer.

Statistical analysis

Data entry, process and analysis methods are the same as described previously (17, 18). Pearson's chi-square tests were used to compare frequency distribution differences between women aged < 50 years and \geq 50 years. Mean and standard deviations were calculated for all QOL domains. P-values were calculated using one-way analysis of variance (ANOVA). Multivariable generalized Linear Models were used to estimate for the total FACT-B score to determine the characteristics that were most strongly

associated with these QOL scores. A two-sided P-value < 0.05 was considered to be statistically significant.

Results

The study initially recruited 1489 eligible breast cancer patients as described previously, and 1199 cases were used for analysis as appropriate. Of these women, the mean age was 47.66 years. Patients were divided into two groups in this study: women aged < 50 years and women aged \geq 50 years. Women aged < 50 years constituted 62.0 percent of the entire dataset. Figure 1 presents the flow of patients in the study. The basic characteristics of the two groups are shown in Table 1. There were statistically significant differences between the two groups in education levels ($\chi^2 = 43.845$, $P < 0.001$), family average revenue ($\chi^2 = 11.962$, $P = 0.018$), and postmenopausal status ($\chi^2 = 585.054$, $P < 0.001$). No significant differences were found for location, economic status, social status, marriage, and family history of breast cancer between different age groups. In this study, no significant lifestyle habits differences existed based on age categories, except for BMI distribution. Women age \geq 50 years reported significantly lower BMI ($\chi^2 = 19.080$, $P = 0.001$).

Table 1

Differences in the basic characteristics between younger and older breast cancer women.

Variable	Age		χ^2	P
	< 50(n = 743)	≥ 50(n = 456)		
Basic demographic information				
Location			0.893	0.345
Urban	336(47.6%)	225(50.4%)		
Rural	370(52.4%)	221(49.6%)		
Education			43.845	<0.001
Elementary or low	102(14.1%)	122(27.9%)		
Middle	274(38.0%)	126(28.8%)		
High	220(30.5%)	145(33.1%)		
College	120(16.6%)	44(10.0%)		
Postgraduate	6(0.8%)	1(0.2%)		
Family average revenue (RMB)			11.962	0.018
< 1000	48(6.6%)	47(10.5%)		
1000–1999	119(16.4%)	92(20.6%)		
2000–2999	208(28.7%)	117(26.2%)		
3000–4999	175(24.1%)	105(23.5%)		
≥ 5000	176(24.2%)	85(19.1%)		
Economic status			4.939	0.176
High	19(2.6%)	13(2.7%)		
Good	159(21.8%)	97(21.7%)		
Average	461(63.2%)	262(58.6%)		
Poor	90(12.3%)	75(16.8%)		
Social status			1.999	0.573
High	23(3.2%)	13(3.0%)		
Good	163(22.5%)	103(23.4%)		
Average	499(68.9%)	292(66.4%)		
Poor	39(5.4%)	32(7.3%)		

Variable	Age		χ^2	P
	< 50 (n = 743)	≥ 50 (n = 456)		
Menopause			585.054	< 0.001
Yes	56(7.7%)	340(76.9%)		
No	667(92.3%)	102(23.1%)		
Marriage			1.376	0.241
Ever	722(97.2%)	448(98.2%)		
Never	21(2.8%)	8(1.8%)		
Family history of breast cancer			0.444	0.505
Yes	45(6.3%)	23(5.3%)		
No	668(93.7%)	407(94.7%)		
Lifestyle habits characteristics.				
Cigarette smoking			1.465	0.226
Yes	20(2.7%)	18(4.0%)		
No	721(97.3%)	436(96.0%)		
Second-hand smoking			0.880	0.348
Yes	277(60.5%)	174(64.0%)		
No	181(39.5%)	98(36.0%)		
Alcohol drinking			0.109	0.742
Yes	96(13.0%)	56(12.3%)		
No	643(87.0%)	398(87.7%)		
Tea			1.640	0.200
Yes	141(19.3%)	100(22.4%)		
No	589(80.7%)	346(77.6%)		
Coffee			0.035	0.853
Yes	31(4.3%)	20(4.5%)		
No	694(95.7%)	424(95.5%)		
Sleep satisfaction			2.436	0.296
Very satisfied	90(12.3%)	48(10.8%)		

Variable	Age		χ^2	P
	< 50 (n = 743)	≥ 50 (n = 456)		
Satisfied	514(70.4%)	305(68.2%)		
Dissatisfied	126(17.3%)	92(20.7%)		
Current life satisfaction			4.565	0.102
Very satisfied	82(11.0%)	39(8.6%)		
Satisfied	493(66.4%)	329(72.1%)		
Dissatisfied	168(22.6%)	88(19.3%)		
Physical activity			2.142	0.343
Often	210(28.5%)	129(28.5%)		
Occasionally	311(42.3%)	175(38.6%)		
Never	215(29.2%)	149(32.9%)		
BMI (kg/m²)			19.080	< 0.001
< 24.0	373(51.9%)	183(42.6%)		
24.0–28.0	275(38.2%)	169(39.3%)		
≥ 28.0	71(9.9%)	78(18.1%)		

The mean FACT-B scores for each individual QOL domain and overall scores are shown in Table 2. The mean FACT-B overall score of younger women was 83.63, while in older women group was 85.88. Younger women (age < 50 years) at diagnosis of breast cancer appeared to be related to lower scores than older women (age \geq 50 years) in all of the QOL subscales except PWB and SWB. EWB ($p = 0.003$), FWB ($p = 0.006$), BCS ($p = 0.038$), and FACT-B Total ($p = 0.028$) were significantly related with age.

Table 2
Health-related Quality of life differences by age group

	Age		<i>F</i>	<i>P</i>
	≤50 (n = 734)	≥ 50 (n = 456)		
PWB	19.45 ± 4.385	19.32 ± 4.798	0.217	0.614
SWB	16.14 ± 5.519	16.28 ± 5.214	0.182	0.670
EWB	13.92 ± 4.416	14.67 ± 4.475	8.623	0.003
FWB	12.80 ± 5.515	13.72 ± 5.746	7.656	0.006
BCS	21.32 ± 4.622	21.90 ± 4.849	4.337	0.038
Total	83.63 ± 16.211	85.88 ± 17.244	5.215	0.023
PWB = physical well being; SWB = social well being; EWB = emotional well being; FWB = functional well being; BCS = breast cancer subscale. (Higher scores represent better HRQoL).				

As shown in Table 3, in order to more specifically examine which items in lifestyle habits were correlated with HRQoL among younger and older women diagnosed with breast cancer within two weeks, we compared the mean scores of the FACT-B Total between two age groups. The relationships of the 9 lifestyle habit items to HRQoL were different between younger and older women. Firstly, very satisfied with sleep and current life at diagnosis were associated with higher scores in all the women with breast cancer. Secondly, tea ($p = 0.009$) and alcohol drinking ($p = 0.001$) women showed a significantly higher score in younger age group, while drinking coffee ($p = 0.009$) showed a significantly lower score in older age group. Thirdly, compared to the younger age group, frequent participation in physical activities in older age group was associated with higher HRQoL overall ($p = 0.002$). And smoking showed worse HRQoL in the older age group ($p = 0.045$). No other significant items of lifestyle habits were observed in association with FACT-B Total scores.

Table 3

Comparison of mean FACT-B Total scores of lifestyle habit items between the two age groups.

Variable	≤ 50			≥ 50		
	Scores	F	P	Scores	F	P
Cigarette smoking		3.838	0.050		4.026	0.045
Yes	91.10 ± 17.029			77.67 ± 15.080		
No	83.80 ± 16.418			85.79 ± 16.894		
Second-hand smoking		3.614	0.058		0.127	0.722
Yes	82.59 ± 16.531			85.61 ± 16.851		
No	85.67 ± 17.577			86.43 ± 18.928		
Alcohol drinking		10.498	0.001		0.191	0.662
Yes	89.06 ± 19.729			86.23 ± 17.958		
No	83.26 ± 15.820			85.17 ± 16.834		
Tea		6.788	0.009		3.775	0.053
Yes	87.22 ± 16.178			88.31 ± 18.895		
No	83.21 ± 16.510			84.55 ± 16.447		
Coffee		2.758	0.097		6.955	0.009
Yes	88.81 ± 18.541			75.50 ± 10.081		
No	83.77 ± 16.444			85.70 ± 17.150		
Sleep satisfaction		7.275	0.001		4.438	0.012
Very satisfied	89.63 ± 17.633			89.69 ± 18.659		
Satisfied	82.67 ± 15.894			83.68 ± 15.668		
Dissatisfied	84.89 ± 16.878			88.15 ± 18.804		
Current life satisfaction		11.823	0.001		15.430	0.001
Very satisfied	89.10 ± 19.505			93.05 ± 20.578		
Satisfied	84.75 ± 15.735			86.57 ± 16.390		
Dissatisfied	79.24 ± 15.840			77.41 ± 14.562		
Physical activity		2.915	0.055		6.345	0.002
Often	83.93 ± 17.145			89.51 ± 19.928		
Occasionally	85.53 ± 17.023			84.97 ± 16.064		

Variable	≤ 50			≥ 50		
	Scores	F	P	Scores	F	P
Never	82.01 ± 14.887			82.36 ± 14.589		
BMI (kg/m²)		1.991	0.137		1.435	0.239
≤ 24.0	84.73 ± 16.417			85.97 ± 17.516		
24.0–28.0	82.25 ± 15.859			84.52 ± 15.862		
≥ 28.0	84.82 ± 17.045			88.41 ± 17.180		

Meanwhile, we also analyzed the mean FACT-B scores for each individual HRQoL domain of the 9 items in lifestyle habits in ESM_1–5. Cigarette smoking in younger women showed a better SWB ($p = 0.009$), while associated with worse EWB in older age group ($p = 0.040$). Alcohol drinking was significantly related to better SWB, EWB and BCS in younger age group ($p = 0.001, 0.001, 0.042$, respectively), but the older age group did not show any correlation. Tea consumption in younger women showed higher PWB, SWB and BCS scores ($p = 0.001, 0.012, 0.049$, respectively), while older women showed only higher BCS scores ($p = 0.001$). Opposite to the better PWB of coffee consumption in younger age group ($p = 0.019$), the older group showed worse EWB and BCS ($p = 0.008$ and 0.011). Sleep satisfaction in younger women was associated with higher scores in all individual HRQoL domain, in contrast, current life satisfaction in older women showed the similar results. In addition, frequent participation in physical activities in older age group is associated with better PWB, EWB and BCS ($p = 0.021, 0.001, 0.002$, respectively). Second-hand smoking and BMI distribution group did not show any correlation to each individual HRQoL domain, except for BMI ≥ 28.0 in older age group that showed better BCS ($p = 0.019$).

The relationship of lifestyle habits to HRQoL was further analyzed using GLM, as shown in Tables 4 and 5. Tea and alcohol drinking, being very satisfied with sleep and with current life were again the strongest predictors of higher HRQoL in younger age group. Meanwhile, no coffee consumption, frequent participation in physical activities and very satisfied with sleep and current life were the key predictors of higher HRQoL in older age group.

Table 4

Multivariable Generalized Linear Models examining Health-related Quality of life scores in relation to lifestyle habits in younger group (age \geq 50 years).

	B	S.E.	95% C.I.		wald	df	P
			Lower	Upper			
Alcohol drinking	6.030	1.7843	2.533	9.527	11.423	1	0.001
Tea	3.524	1.5218	0.541	6.507	5.363	1	0.021
Very satisfied with Sleep	4.604	2.2634	0.168	9.040	4.137	1	0.042
Very satisfied with Current life	9.376	2.2459	4.974	13.778	17.429	1	<0.001

Table 5

Multivariable Generalized Linear Models examining Health-related Quality of life scores in relation to lifestyle habits in younger group (age \geq 50 years).

	B	S.E.	95% C.I.		wald	df	P
			Lower	Upper			
Coffee	-9.462	3.6877	-16.609	-2.234	6.583	1	0.010
often participate in physical activities	7.116	1.9780	3.239	10.993	12.943	1	<0.001
Very satisfied with Sleep	4.095	1.9618	0.250	7.940	4.358	1	0.037
Very satisfied with Current life	15.438	3.2623	8.954	21.742	22.134	1	<0.001

Discussion

In the present study, we examined the HRQoL among breast cancer patients in Chinese populations and investigated their relationship with specific lifestyle habits factors. To the best of our knowledge, this is the first report on the relationship between ages and the specific lifestyle habits factors and HRQoL in Chinese breast cancer patients using the FACT-B questionnaires. The Functional Assessment of Cancer Therapy-Breast (FACT-B), is an international scale developed by Rush-Presbyterian-St. Luke's Medical Center, Chicago, United States, which is widely used to assess the HRQoL of breast cancer patients (19). It has been translated into many languages, such as (simplified) Chinese, Malayalam, and Korean (20). Previous studies have demonstrated that Chinese versions of the FACT-B (version 4) are effective, sensitive, and reliable in evaluating the HRQoL of breast cancer patients in China (20–22), which was also confirmed in this study. Using this internationally consistent and effective scale to assess the quality of life of Chinese patients is important to improve our understanding of the prognosis of breast cancer.

Most of the previous studies examining the HRQoL of women with breast cancer have been conducted in women at least four months after a breast cancer diagnosis (9, 10, 12). By this time, women have begun

their initial treatment process, and have had some time to adjust to their condition. There are few studies that have examined HRQoL within a few weeks after women are diagnosed (16). As previous studies have demonstrated, a cancer diagnosis can have direct impacts on a person's mental health immediately, and subsequent the ability to cope with the diagnosis can vary substantially (10, 23). The early psychosocial adaptation to a diagnosis of breast cancer may affect important survivorship issues, such as receiving and adhering to treatment (24, 25), coping mechanisms (25), and long-term prognosis (26–28). Hence, in this study, we set the time point as within two weeks of breast cancer diagnosis to analyze the early factors affecting HRQoL of breast cancer patients in China.

Moreover, the age group with the highest incidence of breast cancer in women is 45–59 years old, and some independent studies have reported that the peak age of breast cancer was between 45–55 years in China (3, 17). In this study, the age was divided into < 50 years and \geq 50 years as an approximate indicator of menopausal status, this cutoff point is used in epidemiologic literature and large breast cancer HRQoL studies as well as clinical practice. The results of this study suggested that older breast cancer patients showed better HRQoL than younger women in most of the HRQoL domains except SWB and PWB, which was supported in previous studies (29, 30). Compared to older women, the younger women are more susceptible to suffer from psychosocial influences (10, 29), may receive more aggressive treatment than older groups, are more likely to receive chemotherapy, while older patients have more resources or skills to deal with breast cancer and maintain economic stability.

This study complements the very limited number of research studies that access the impact of lifestyle habits (i.e., smoking (including passive smoking), alcohol intake, dietary habits (tea and coffee), sleep satisfaction, current life satisfaction, physical activity, and BMI) on HRQoL in Chinese women who were diagnosed with breast cancer within two weeks. The results suggest that the breast cancer patients who adopted different lifestyle behaviors had different HRQoL between ages, as shown in Table 3 and ESM_1–5. In this study, cigarette smoking in younger women showed a better SWB, while associated with worse EWB in older age group, and alcohol drinking was significantly related to better SWB, EWB and BCS in younger age group. Previous studies have demonstrated that Women who drunk more alcohol daily reported fewer disturbing vasomotor symptoms (31), which are considered to be the most specific symptom of menopause (32), while women who smoked cigarettes daily had more symptoms of depression than non-smokers, except for the menstrual symptoms domain (31, 33). These observations are in agreement with the results of this study which show worse EWB in older smokers and high HRQoL (including SWB, EWB and BCS) in younger alcohol consumers.

Clinically significant premenstrual syndrome (PMS) affects 15–20% of premenopausal women and significantly reduces quality of life (34). Rossignol et al. (35, 36), along with three other similar studies (37–39) found a strong positive correlation between caffeine and coffee intake and premenstrual syndrome. Women with severe premenstrual symptoms appear to be able to alter caffeine intake - increasing caffeine intake to treat symptoms such as fatigue. These observations support our result that younger women with tea and coffee intake have higher HRQoL (87.22 and 88.81, respectively). In contrast, tea in China has thousands of years of cultural heritage, the Chinese older women prefer to drink

traditional tea but refuse coffee, which causes no coffee to have a higher HRQoL. However, this explanation should be provided with discretion and needs more study. But it's worth noting that tea intake was associated with higher HRQoL in both younger and older women. Some studies have shown that tea or its constituents (40), particularly, epigallocatechin-3-gallate as the most abundant and biologically active tea catechins(41), suppress mammary tumorigenesis via effects on antioxidant activity(42), sex hormones(43), or different molecular pathways(44), which may also have a potential impact on quality of life.

It is important to note that frequency of physical activity was positively associated with higher HRQoL of breast cancer patients in older group, while there was no statistical difference in the younger group. Angenete et al found that the preoperative physical activity is positively associated with an enhanced physical recovery after breast cancer surgery (45). More importantly, evidence from observational studies shows a statistically significant positive correlation between inactivity and sedentary behavior and breast cancer risk and poorer health outcomes (46, 47). In breast cancer patients, higher levels of physical activity have been shown to be associated with fewer adverse treatment related side effects, higher HRQoL and improved disease-specific prognoses including longer survival and reduced risk of recurrence and mortality (13, 48, 49). With this evidence, guidelines for physical activity for breast cancer survivors recommend that physical activity should be an integral and ongoing part of the care of all breast cancer patients.

A population-based survey of HRQoL conducted by Katainen et al suggested BMI was a risk factor for lower HRQoL (31). Women with BMI of 25 to 30 kg/m² had more physical and vasomotor symptoms than women with BMI lower than 25 kg/m². Women with BMI higher than 30 kg/m² had more physical and depressive symptoms than women with lower BMI, and more cognitive impairments than women with BMI lower than 25 kg/m². In our study, though the distribution of BMI between the younger and older women in China with breast cancer showed significant differences, the BMI showed no influence on HRQoL in all the women. The remaining factors, very satisfied with sleep and current life at diagnosis were associated with higher HRQoL scores in all the women with breast cancer, as expected.

Finally, the inherent limitations of this study should not be neglected. The most important limitations of this study include that the study was descriptive and cross-sectional, and some factors were collected retrospectively, which may have influenced our results; in our study, the exact stage of the disease has not been determined, which may be an important factor affecting the HRQoL of patients. Notwithstanding its limitations, the results of this large population-based study may help guide interventions to improve quality of life. It is believed that this study can provide reference and basis for future research.

Conclusion

In summary, we found that younger patients < 50 years showed significantly lower QOL than older patients ≥ 50 years. Tea and alcohol consumption, very satisfied with sleep and current life were the strongest predictors of higher HRQoL in Chinese women when diagnosed with breast cancer at younger

age. Meanwhile, no coffee consumption, frequent participation in physical activities and high sleep satisfaction and current life satisfaction were the key predictors of higher HRQoL in older breast cancer women. Associated variable of quality of life can help clinicians identify patients at risk for low quality of life. When these characteristics or situations can be balanced, changing them through intervention can improve a patient's quality of life, and as women gradually receive treatment and then enter into their long-term survivorship period, their effects may change subsequent adjustments and functions regarding breast cancer, consequently improve the prognosis of breast cancer patients.

Abbreviations

HRQoL: Health-related quality of life; WHO: World Health Organization; QOL: Quality of life; FACT-B: Functional Assessment of Cancer Therapy-Breast Cancer; BCS: Breast cancer subscale; PWB: Physical well-being; SWB: Social/family well-being; EWB: Emotional well-being; FWB: Functional well-being; PMS: Premenstrual syndrome; ANOVA: Analysis of variance.

Declarations

Ethics approval and consent to participate

All procedures performed involving human participants were in accordance with the ethical standards of the Second Hospital of Shandong University Research Committee. Written informed consent was obtained from all participants by investigators as part of the interview.

Consent for publication

All authors consent to publication in Military Medical Research

Availability of data and materials

The datasets during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

Funding

This research was primarily granted funding from the Minister-affiliated hospital key project of the Ministry of Health of the People's Republic of China (establishment and improvement of high-risk populations screening and evaluation system for breast cancer), and the Major Scientific and Technological Innovation Project of Shandong Province (2017CXGC1212), and the National Key Research and Development Program of China (2016YFC0901304), and the National Natural Science Foundation of China (81702603), and the Taishan Scholars Program of Shandong Province (tsqn201812135).

Author Contributions

ZY conceived the study. CZ, HJ and LL contributed to the study design and performed statistical analyses. CZ and LL wrote the manuscript. LY, FW, FZ, YX, MG, YW and SH contributed to manuscript revision and statistical analyses. SC, FT, ZF, CG, XC, ZY, XW, HL, SW, HJ, XD, HW, GL, QW, JZ, FJ, JT, LL, SZ and WZ contributed to the collection of the data and biological samples.

Acknowledgments

The authors gratefully thank Santosh Kumar Paidi from Johns Hopkins University, USA, for useful comments and suggestions for improving the manuscript. We would like to thank all participants involved in the study for their cooperation.

References

1. Li H, Zheng RS, Zhang SW, Zeng HM, Sun KX, Xia CF, et al. Incidence and mortality of female breast cancer in China, 2014. *Zhonghua zhong liu za zhi [Chinese journal of oncology]*. 2018 2018 Mar;40(3):166-71. PubMed PMID: MEDLINE:29575833.
2. Zheng R, Zeng H, Zhang S, Chen T, Chen W. National estimates of cancer prevalence in China, 2011. *Cancer letters*. 2016 Jan 1;370(1):33-8. PubMed PMID: 26458996. Epub 2015/10/16. eng.
3. Li T, Mello-Thoms C, Brennan PC. Descriptive epidemiology of breast cancer in China: incidence, mortality, survival and prevalence. *Breast cancer research and treatment*. 2016 Oct;159(3):395-406. PubMed PMID: 27562585. Epub 2016/08/27. eng.
4. Study protocol for the World Health Organization project to develop a Quality of Life assessment instrument (WHOQOL). *Quality of life research : an international journal of quality of life aspects of treatment, care and rehabilitation*. 1993 Apr;2(2):153-9. PubMed PMID: 8518769. Epub 1993/04/01. eng.
5. Leplege A, Hunt S. The problem of quality of life in medicine. *Jama*. 1997 Jul 2;278(1):47-50. PubMed PMID: 9207338. Epub 1997/07/02. eng.
6. Bottomley A. The cancer patient and quality of life. *The oncologist*. 2002;7(2):120-5. PubMed PMID: 11961195. Epub 2002/04/19. eng.

7. Su M, Hua X, Wang J, Yao N, Zhao D, Liu W, et al. Health-related quality of life among cancer survivors in rural China. *Quality of life research : an international journal of quality of life aspects of treatment, care and rehabilitation*. 2019 Mar;28(3):695-702. PubMed PMID: 30374776. Epub 2018/10/31. eng.
8. Lopes JV, Bergerot CD, Barbosa LR, Calux N, Elias S, Ashing KT, et al. Impact of breast cancer and quality of life of women survivors. *Revista brasileira de enfermagem*. 2018 Nov-Dec;71(6):2916-21. PubMed PMID: 30517393. Epub 2018/12/06. eng por.
9. Xia J, Tang Z, Deng Q, Yang R, Wang J, Yu J. Predictors of the quality of life in Chinese breast cancer survivors. *Breast cancer research and treatment*. 2018 Jan;167(2):537-45. PubMed PMID: 28965272. Epub 2017/10/02. eng.
10. Kwan ML, Ergas IJ, Somkin CP, Quesenberry CP, Jr., Neugut AI, Hershman DL, et al. Quality of life among women recently diagnosed with invasive breast cancer: the Pathways Study. *Breast cancer research and treatment*. 2010 Sep;123(2):507-24. PubMed PMID: 20140494. Pubmed Central PMCID: PMC2935682. Epub 2010/02/09. eng.
11. Montazeri A. Health-related quality of life in breast cancer patients: a bibliographic review of the literature from 1974 to 2007. *Journal of experimental & clinical cancer research : CR*. 2008 Aug 29;27(1):32. PubMed PMID: 18759983. Pubmed Central PMCID: PMC2543010. Epub 2008/09/02. eng.
12. Gong XH, Wang JW, Li J, Chen XF, Sun L, Yuan ZP, et al. Physical exercise, vegetable and fruit intake and health-related quality of life in Chinese breast cancer survivors: a cross-sectional study. *Quality of life research : an international journal of quality of life aspects of treatment, care and rehabilitation*. 2017 Jun;26(6):1541-50. PubMed PMID: 28229328. Epub 2017/02/24. eng.
13. Oberguggenberger A, Meraner V, Sztankay M, Hilbert A, Hubalek M, Holzner B, et al. Health Behavior and Quality of Life Outcome in Breast Cancer Survivors: Prevalence Rates and Predictors. *Clinical breast cancer*. 2018 Feb;18(1):38-44. PubMed PMID: 29017754. Epub 2017/10/12. eng.
14. Mosher CE, Danoff-Burg S. A review of age differences in psychological adjustment to breast cancer. *Journal of psychosocial oncology*. 2005;23(2-3):101-14. PubMed PMID: 16492654. Epub 2006/02/24. eng.
15. Park BW, Lee S, Lee AR, Lee KH, Hwang SY. Quality of Life Differences between Younger and Older Breast Cancer Patients. *Journal of breast cancer*. 2011 Jun;14(2):112-8. PubMed PMID: 21847405. Pubmed Central PMCID: PMC3148538. Epub 2011/08/19. eng.
16. Dell'Antonio Pereira L, Brandao-Souza C, Amaral Musso MA, Vieira Calmon M, Costa Neto SB, Monteiro de Barros Miotto MH, et al. Quality of life of women with pre-and post-operative breast cancer. *Investigacion y educacion en enfermeria*. 2017 Jan;35(1):109-19. PubMed PMID: 29767930. Epub 2017/01/01. eng.
17. Liu LY, Wang F, Cui SD, Tian FG, Fan ZM, Geng CZ, et al. A case-control study on risk factors of breast cancer in Han Chinese women. *Oncotarget*. 2017 Nov 14;8(57):97217-30. PubMed PMID: 29228605. Pubmed Central PMCID: PMC5722557. Epub 2017/12/13. eng.

18. Wang F, Liu L, Cui S, Tian F, Fan Z, Geng C, et al. Distinct Effects of Body Mass Index and Waist/Hip Ratio on Risk of Breast Cancer by Joint Estrogen and Progesterone Receptor Status: Results from a Case-Control Study in Northern and Eastern China and Implications for Chemoprevention. *The oncologist*. 2017 Dec;22(12):1431-43. PubMed PMID: 28912152. Pubmed Central PMCID: PMC5728030. Epub 2017/09/16. eng.
19. Cella DF, Tulsky DS, Gray G, Sarafian B, Linn E, Bonomi A, et al. The Functional Assessment of Cancer Therapy scale: development and validation of the general measure. *J Clin Oncol*. 1993;11(3):570-9. PubMed PMID: 8445433.
20. Nguyen J, Popovic M, Chow E, Cella D, Beaumont JL, Chu D, et al. EORTC QLQ-BR23 and FACT-B for the assessment of quality of life in patients with breast cancer: a literature review. *Journal of comparative effectiveness research*. 2015 Mar;4(2):157-66. PubMed PMID: 25825844. Epub 2015/04/01. eng.
21. Shen FR, Liu M, Zhang X, Feng YH, Zhou LS, Chen YG. Health-related quality of life among breast cancer patients and its influencing factor in a Chinese population. *Asian Pacific journal of cancer prevention : APJCP*. 2012;13(8):3747-50. PubMed PMID: 23098465. Epub 2012/10/27. eng.
22. Cao A, Zhang J, Liu X, Wu W, Liu Y, Fan Z, et al. Health-related quality of life of postmenopausal Chinese women with hormone receptor-positive early breast cancer during treatment with adjuvant aromatase inhibitors: a prospective, multicenter, non-interventional study. *Health and quality of life outcomes*. 2016 Mar 24;14:51. PubMed PMID: 27009092. Pubmed Central PMCID: PMC4806477. Epub 2016/03/25. eng.
23. Northouse L. A longitudinal study of the adjustment of patients and husbands to breast cancer. *Oncology nursing forum*. 1989 Jul-Aug;16(4):511-6. PubMed PMID: 2755858. Epub 1989/07/01. eng.
24. Goodwin JS, Hunt WC, Key CR, Samet JM. The effect of marital status on stage, treatment, and survival of cancer patients. *Jama*. 1987 Dec 4;258(21):3125-30. PubMed PMID: 3669259. Epub 1987/12/04. eng.
25. Sprehn GC, Chambers JE, Saykin AJ, Konski A, Johnstone PA. Decreased cancer survival in individuals separated at time of diagnosis: critical period for cancer pathophysiology? *Cancer*. 2009 Nov 1;115(21):5108-16. PubMed PMID: 19705348. Pubmed Central PMCID: PMC2767449. Epub 2009/08/26. eng.
26. Falagas ME, Zarkadoulia EA, Ioannidou EN, Peppas G, Christodoulou C, Rafailidis PI. The effect of psychosocial factors on breast cancer outcome: a systematic review. *Breast cancer research : BCR*. 2007;9(4):R44. PubMed PMID: 17640330. Pubmed Central PMCID: PMC2206717. Epub 2007/07/21. eng.
27. Goodwin PJ, Ennis M, Bordeleau LJ, Pritchard KI, Trudeau ME, Koo J, et al. Health-related quality of life and psychosocial status in breast cancer prognosis: analysis of multiple variables. *Journal of clinical oncology : official journal of the American Society of Clinical Oncology*. 2004 Oct 15;22(20):4184-92. PubMed PMID: 15483029. Epub 2004/10/16. eng.

28. Phillips KA, Osborne RH, Giles GG, Dite GS, Apicella C, Hopper JL, et al. Psychosocial factors and survival of young women with breast cancer: a population-based prospective cohort study. *Journal of clinical oncology : official journal of the American Society of Clinical Oncology*. 2008 Oct 1;26(28):4666-71. PubMed PMID: 18824713. Pubmed Central PMCID: PMC2653129. Epub 2008/10/01. eng.
29. Wenzel LB, Fairclough DL, Brady MJ, Cella D, Garrett KM, Kluhsman BC, et al. Age-related differences in the quality of life of breast carcinoma patients after treatment. *Cancer*. 1999 Nov 1;86(9):1768-74. PubMed PMID: 10547550. Epub 1999/11/05. eng.
30. Avis NE, Crawford S, Manuel J. Quality of life among younger women with breast cancer. *Journal of clinical oncology : official journal of the American Society of Clinical Oncology*. 2005 May 20;23(15):3322-30. PubMed PMID: 15908646. Epub 2005/05/24. eng.
31. Katainen RE, Siirtola TJ, Engblom JR, Erkkola RU, Polo-Kantola P. A population-based survey of quality of life in middle-aged Finnish women. *Menopause (New York, NY)*. 2015 Apr;22(4):402-13. PubMed PMID: 25268405. Epub 2014/10/01. eng.
32. Bachmann GA. Menopausal vasomotor symptoms: a review of causes, effects and evidence-based treatment options. *The Journal of reproductive medicine*. 2005 Mar;50(3):155-65. PubMed PMID: 15841927. Epub 2005/04/22. eng.
33. Williams RE, Levine KB, Kalilani L, Lewis J, Clark RV. Menopause-specific questionnaire assessment in US population-based study shows negative impact on health-related quality of life. *Maturitas*. 2009 Feb 20;62(2):153-9. PubMed PMID: 19157732. Epub 2009/01/23. eng.
34. Purdue-Smithe AC, Manson JE, Hankinson SE, Bertone-Johnson ER. A prospective study of caffeine and coffee intake and premenstrual syndrome. *The American journal of clinical nutrition*. 2016 Aug;104(2):499-507. PubMed PMID: 27385613. Pubmed Central PMCID: PMC4962155. Epub 2016/07/08. eng.
35. Rossignol AM, Bonnlander H. Caffeine-containing beverages, total fluid consumption, and premenstrual syndrome. *American journal of public health*. 1990 Sep;80(9):1106-10. PubMed PMID: 2382749. Pubmed Central PMCID: PMC1404841. Epub 1990/09/01. eng.
36. Rossignol AM, Bonnlander H, Song L, Phillis JW. Do women with premenstrual symptoms self-medicate with caffeine? *Epidemiology (Cambridge, Mass)*. 1991 Nov;2(6):403-8. PubMed PMID: 1790191. Epub 1991/11/01. eng.
37. Rasheed P, Al-Sowielem LS. Prevalence and predictors of premenstrual syndrome among college-aged women in Saudi Arabia. *Annals of Saudi medicine*. 2003 Nov-Dec;23(6):381-7. PubMed PMID: 16868373. Epub 2006/07/27. eng.
38. Chayachinda C, Rattanachaiyanont M, Phattharayuttawat S, Kooptiwoot S. Premenstrual syndrome in Thai nurses. *Journal of psychosomatic obstetrics and gynaecology*. 2008 Sep;29(3):199-205. PubMed PMID: 18608818. Epub 2008/07/09. eng.
39. Pinar G, Colak M, Oksuz E. Premenstrual Syndrome in Turkish college students and its effects on life quality. *Sexual & reproductive healthcare : official journal of the Swedish Association of Midwives*.

- 2011 Jan;2(1):21-7. PubMed PMID: 21147455. Epub 2010/12/15. eng.
40. Samavat H, Ursin G, Emory TH, Lee E, Wang R, Torkelson CJ, et al. A Randomized Controlled Trial of Green Tea Extract Supplementation and Mammographic Density in Postmenopausal Women at Increased Risk of Breast Cancer. *Cancer prevention research (Philadelphia, Pa)*. 2017 Dec;10(12):710-8. PubMed PMID: 28904061. Epub 2017/09/15. eng.
41. Kao YH, Hiipakka RA, Liao S. Modulation of endocrine systems and food intake by green tea epigallocatechin gallate. *Endocrinology*. 2000 Mar;141(3):980-7. PubMed PMID: 10698173. Epub 2000/03/04. eng.
42. Wiseman SA, Balentine DA, Frei B. Antioxidants in tea. *Critical reviews in food science and nutrition*. 1997 Dec;37(8):705-18. PubMed PMID: 9447271. Epub 1998/02/03. eng.
43. Wu AH, Arakawa K, Stanczyk FZ, Van Den Berg D, Koh WP, Yu MC. Tea and circulating estrogen levels in postmenopausal Chinese women in Singapore. *Carcinogenesis*. 2005 May;26(5):976-80. PubMed PMID: 15661801. Epub 2005/01/22. eng.
44. Yang CS, Wang X, Lu G, Picinich SC. Cancer prevention by tea: animal studies, molecular mechanisms and human relevance. *Nature reviews Cancer*. 2009 Jun;9(6):429-39. PubMed PMID: 19472429. Pubmed Central PMCID: PMC2829848. Epub 2009/05/28. eng.
45. Nilsson H, Angeras U, Bock D, Borjesson M, Onerup A, Fagevik Olsen M, et al. Is preoperative physical activity related to post-surgery recovery? A cohort study of patients with breast cancer. *BMJ open*. 2016 Jan 14;6(1):e007997. PubMed PMID: 26769776. Pubmed Central PMCID: PMC4735182. Epub 2016/01/16. eng.
46. Schmidt ME, Chang-Claude J, Vrieling A, Seibold P, Heinz J, Obi N, et al. Association of pre-diagnosis physical activity with recurrence and mortality among women with breast cancer. *International journal of cancer Journal international du cancer*. 2013 Sep 15;133(6):1431-40. PubMed PMID: 23444048. Epub 2013/02/28. eng.
47. Lahart IM, Metsios GS, Nevill AM, Carmichael AR. Physical activity, risk of death and recurrence in breast cancer survivors: A systematic review and meta-analysis of epidemiological studies. *Acta oncologica (Stockholm, Sweden)*. 2015 May;54(5):635-54. PubMed PMID: 25752971. Epub 2015/03/11. eng.
48. Ibrahim EM, Al-Homaidh A. Physical activity and survival after breast cancer diagnosis: meta-analysis of published studies. *Medical oncology (Northwood, London, England)*. 2011 Sep;28(3):753-65. PubMed PMID: 20411366. Epub 2010/04/23. eng.
49. Rogers LQ, McAuley E, Anton PM, Courneya KS, Vicari S, Hopkins-Price P, et al. Better exercise adherence after treatment for cancer (BEAT Cancer) study: rationale, design, and methods. *Contemporary clinical trials*. 2012 Jan;33(1):124-37. PubMed PMID: 21983625. Pubmed Central PMCID: PMC3253876. Epub 2011/10/11. eng.

Figures

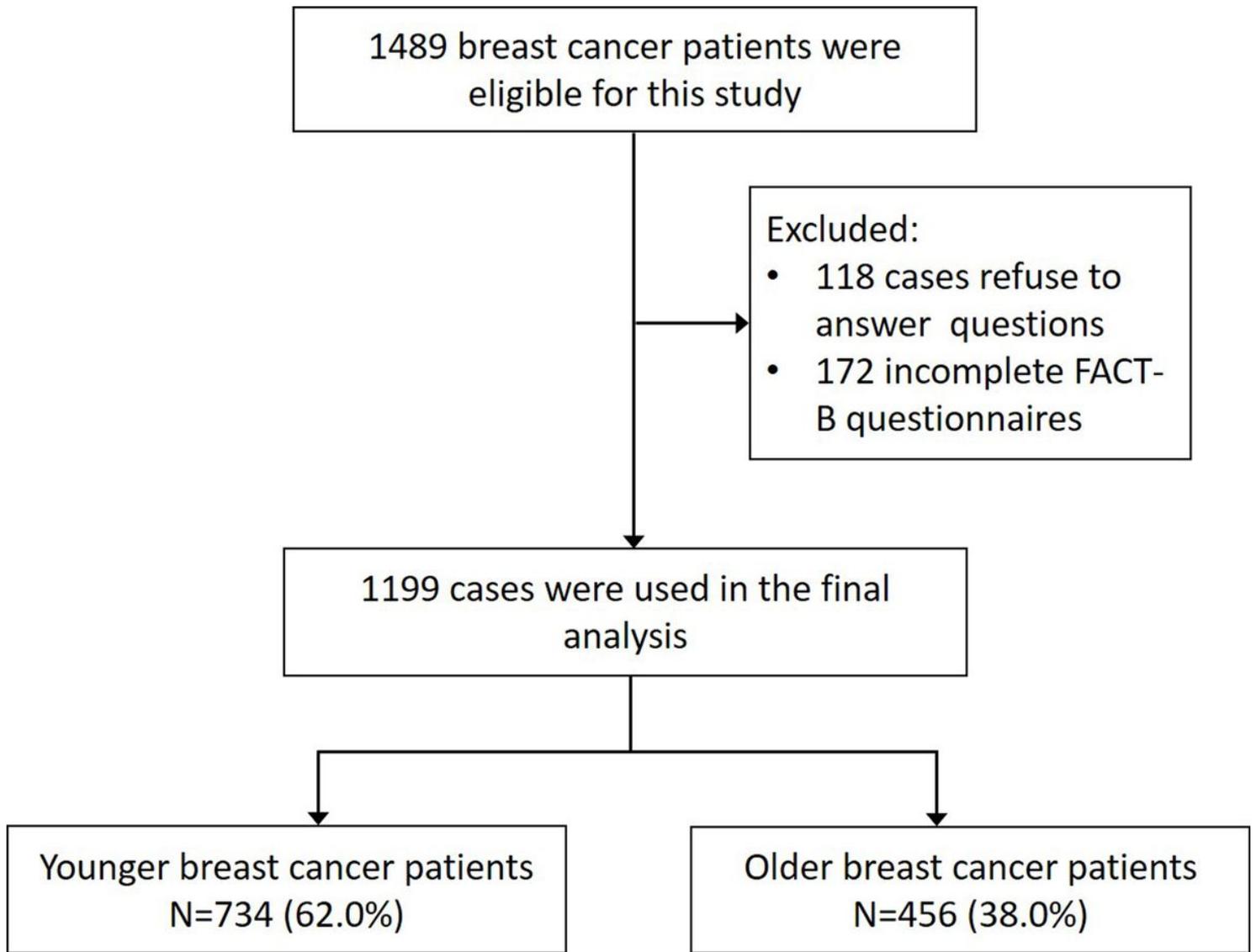


Figure 1

Flow chart of patients eligible for the study.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [ElectronicSupplementaryMaterial.docx](#)