

Sense of Coherence as Predictor of Quality of Life in Early Breast Cancer Patients

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Abstract. *Background/Aim:* To examine the association between sense of coherence (SOC) and health-related quality of life (HRQoL) in early breast cancer patients. *Patients and Methods:* The study population included 406 disease-free breast cancer survivors who participated in 3-year and 5-year follow-ups of a randomized exercise intervention. SOC was assessed using the short version of the Orientation to life questionnaire (SOC-13) in the 3-year follow-up. HRQoL was self-reported using the EORTC QLQ30 questionnaire in both 3-year and 5-year follow-ups. The association between SOC and HRQoL was analyzed using the Spearman's rank correlation coefficient. *Results:* SOC had a strong positive correlation with global HRQoL in both 3-year ($r_s=0.57$, $p<0.01$) and 5-year ($r_s=0.51$, $p<0.01$) follow-ups. *Conclusion:* This study provides evidence of SOC's predictive value for HRQoL in early breast cancer patients. SOC might be used for identifying patients who will profit most from psychosocial support and intervention during the rehabilitation period.

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Breast cancer is the most common cancer in women worldwide (1). In 2019 there were over 76449 women living with breast cancer diagnosis in Finland (2). However, the prognosis of breast cancer has dramatically improved over the past decades (3). The relative five-year survival rate compared to an age-matched population in 2019 was 91% in Finland (2).

Along the increasing numbers of breast cancer survivors (BCS), more attention is being paid to the psychological adjustment to breast cancer and to the adverse psychological and physical effects of cancer treatments. The diagnosis of breast cancer elicits substantial distress regardless of prognosis (4, 5). Breast cancer and its treatments are known to impair patients' health-related quality of life (HRQoL) not only during and immediately after initial treatment, but also later in life (6-10).

People differ in how they cope with life after illness. Some do not need nor desire any professional psychosocial support, while others may profit greatly from it. Different interventions are needed to help BCS to live a normal life. For the planning and targeting of effective psychosocial interventions it is important to understand which psychosocial factors predict poor coping and impaired HRQoL.

The Sense of Coherence (SOC) theory by Aaron Antonovsky, first presented in 1979, is a classic among psychological theories and has generated vast scientific research and literature, both theoretical and applied. Sense of coherence is defined as "the extent to which one has a pervasive, enduring though dynamic, feeling of confidence that one's environment is predictable and that things will work out as well as can reasonably be expected." In other words, it can be perceived as a mixture of optimism and control. It has three components: *comprehensibility*,

manageability, and *meaningfulness*. *Comprehensibility* is the extent to which events are perceived as making logical sense, that they are ordered, consistent, and structured. *Manageability* is the extent to which a person feels she/he can cope. *Meaningfulness* is the extent to which one feels that life makes sense, and that challenges are worth of commitment. The sense of coherence has been shown to be relatively stable over time (11).

The experience of potentially life-threatening illness, like breast cancer, forces patients to confront fear, uncertainty, and mortality. SOC is claimed to be a useful tool in explaining how some people manage to stay well despite extremely difficult life situations (12, 13) and there is a considerable amount of literature on its relationship with the HRQoL in different clinical populations (14). However, few studies (15-19), and a meta-analysis (20), have been published on the effects of SOC on breast cancer patients' HRQoL.

According to the meta-analysis by Winger (20), SOC seems to have a strong negative association with distress in breast cancer patients. Moreover, some studies suggest that lower SOC is associated with less adequate coping strategies, poor health status, poor HRQoL (15) and a high symptom burden (21) in breast cancer patients. One study (15) found that the stronger the SOC, the more positive emotional perceptions of general health and subjective mental well-being were reported after breast cancer surgery. Additionally, the meaningfulness dimension of the SOC has been shown to correlate with breast cancer patients' sexual functioning (22). To the authors' knowledge, only two longitudinal studies (17, 18) have been published about this topic. According to these longitudinal studies with breast cancer patients, SOC seems to be associated with HRQoL over time and remains stable during at least one-year of follow-up. In a six-month follow-up study (19), high SOC and the level of HRQoL at first measurement were the strongest predictors of changes in HRQoL over time. According to this growing body of research, there is reason to believe that SOC might be useful in predicting long-term HRQoL of breast cancer survivors.

Even though the evidence for the importance of SOC for breast cancer patients' HRQoL seems promising, there are only a limited number of published studies on the topic. The main limitation of the research field is the lack of longitudinal and prospective studies. Furthermore, in most of the studies reviewed above, sample sizes varied from small to medium (n=60-206) and only four studies (17-19, 23) had larger samples ranging from 255 to 487 patients.

The present study is part of an open prospective randomized multicenter phase III trial in Finland (BREX, clinicaltrials.gov. identifier NCT00639210) whose aim is to investigate whether supervised exercise training shortly after adjuvant treatments of breast cancer could reduce the long-term side-effects of adjuvant treatments of primary breast cancer, especially osteoporosis, and improve quality of life

and well-being (10, 24). In the present study, the question to be addressed was why there are variations in HRQoL in breast cancer survivors. The specific aim was to evaluate the potential of SOC-13 as predictor of the HRQoL of BCS.

Patients and Methods

Study population and design. The BREX study was limited to include women aged 35-68 years who had recently (within four months) completed adjuvant chemotherapy or started endocrine therapy for surgically treated early breast cancer. Detailed inclusion and exclusion criteria are presented in our previous publications (10, 24). The flow diagram of the participants throughout five years included in the present study (those having completed the SOC questionnaire at 3 and 5 years) is presented in Figure 1. The BREX trial was approved by the ethical committee of Helsinki University Hospital (DNRHUS 265/E5/05) and is registered in the Helsinki and Uusimaa Hospital District Clinical Trials Register (trial number 210590) (25) and ClinicalTrials.gov (26). Informed consent was obtained from all individual participants included in the study.

Of the 537 randomized patients in the original Brex study, 444 received the SOC-13 questionnaire at the 3-year follow-up. A total of 406 patients, who participated both in the 3-year and the 5-year follow-ups and completed and returned the SOC-13 questionnaire, were included into the final analyses. Due to missing data, the sample size varies between 370 and 406 depending on the analysis.

Measures

Sense of coherence. Sense of coherence was assessed at the 3-year follow-up using a 13-item Finnish or Swedish (depending on the patients' maternal language) short forms (SOC-13) of the Orientation to life Questionnaire (27). The answers are provided using a seven-point semantic response scale. The total score goes from thirteen to a maximum of 91 indicating very strong SOC. Example questions are: "How often do you have the feeling that there is little meaning in the things you do in your daily life?" (meaningfulness), "Do you have a feeling that you are in an unfamiliar situation and don't know what to do?" (comprehensibility) and "How often do you have feelings that you are not sure you can control yourself?" (manageability). The summary score is obtained by summing all the scores (1 to 7 points for each question) after reversing the scale for the questions 1, 2, 3, 7 and 10.

Quality of life. Quality of life was measured by the EORTC QLQC30 version 3, one of the most commonly used questionnaires in HRQoL studies on breast cancer patients (28, 29). The questionnaire includes 20 items and consists of five functioning scales (physical, role, emotional, cognitive, and social), three symptom scales (nausea/vomiting, pain, and fatigue), and a scale of global QoL. In addition, the questionnaire contains six single items for assessing financial difficulties, dyspnea, diarrhea, appetite loss, sleep disturbances, and constipation. This instrument has been validated and cross-culturally tested in hundreds of cancer populations (30, 31).

Statistical analyses. The internal consistency of SOC-13 was tested by Cronbach's alpha. The associations between SOC-13 and HRQoL scales were tested by the Spearman's rank correlation coefficient. SPSS (IBM, Armonk, NY, USA) version 24 was used for the analyses.

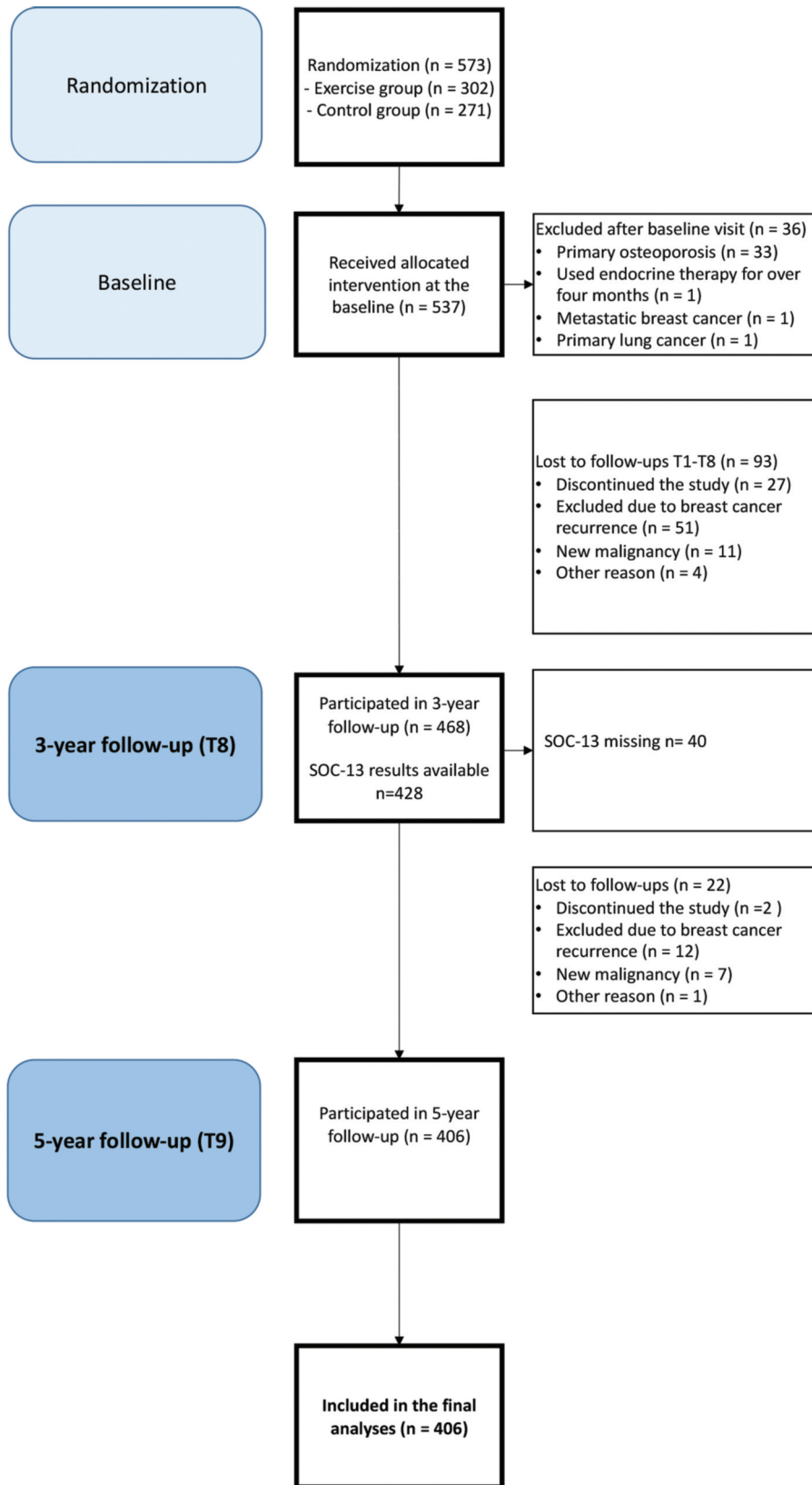


Figure 1. Flow diagram of the participants through the follow-ups.

Results

Patient and tumour characteristics, adjuvant treatments as well as SOC-13 and EORTC QLQ-30 scores are shown in Table I. The reliability of the SOC-13 scale in the present study was high (Cronbach’s alpha, $\alpha=0.89$).

The Spearman’s rank correlation coefficients between SOC-13 and EORTC QLQC30 scores are shown in Table II. There was a highly significant correlation of moderate strength between the SOC-13 score at 3 years and the EORTC QLQC30 global QoL scores at both 3 years ($r_s=0.57, p<0.01$) and 5 years ($r_s=0.51, p<0.01$). There was also a highly significant association between the SOC-13 score and emotional function ($r_s=0.57$ and 0.54) at 3 and 5 years, respectively, and to cognitive function ($r_s=0.55$ and 0.47). The associations between SOC-13 and physical function, role function and social function were weaker, but still highly significant. The distribution of EORTC QLQC30 scores across SOC-13 quartiles are shown in Table III.

Discussion

Coping with diagnosis and treatments of cancer is a very challenging experience. We have previously shown, that HRQoL is compromised for several years after treatment of breast cancer compared to an age-matched population (32). Given limited resources, the health care professionals are in a dire need of methods of identifying those patients who will gain most from psychosocial support and intervention during their rehabilitation period.

In the present study, sense of coherence measured by the SOC 13 scale was found to associate with a simultaneous, 3-year follow-up measurement of the HRQoL and also to predict QoL two years later at the time of 5-year follow-up. Our results support the buffering effect of SOC on the psychological health in dealing with stressful life events. Studies carried out in United States (33), China (23, 34), France (22), Sweden (16, 17), and in Iran (18, 19, 35) have indicated, that the association between SOC and HRQoL in breast cancer patients is independent of cultural context. A large Swedish breast cancer study ($n=487$) reported that SOC remained stable for 2-3 years of follow-up (17), and moreover, that a high SOC was associated significantly to a reduced risk of recurrence and to an improved overall survival (36). A Brazilian study of only 90 postradiotherapy patients with laryngeal cancer also reported that a strong sense of coherence was associated to high QoL scores measured using the University of Washington Quality of Life (UW-QOL) questionnaire (37). A Chinese study of 162 patients with brain metastases from different types of cancer also reported that SOC was significantly associated to HRQoL measured with the EORTC Q LQ30 questionnaire (38).

Table I. Descriptive statistics of the study sample.

	n	%	Mean (SD)	Range
Age at 3 yr (years)	406		56.16 (7.40)	38.48-71.67
Menopausal state at diagnosis				
Premenopausal	183	45.1		
Postmenopausal	223	54.9		
T-stage				
DCIS, Tx or T1	230	56.7		
N-stage				
N0	164	40.4		
Grade				
1	68	16.7		
2	180	44.3		
3	154	37.9		
Missing	4	1		
ER				
Positive	332	81.8		
HER2				
Positive	82	20.2		
Adjuvant treatment				
Chemotherapy	364	89.7		
Radiotherapy	316	77.8		
Endocrine treatment	335	82.2		
Trastuzumab	68	16.7		
Cohabiting	258	64.3		
Missing	5	1.2		
Sense of coherence (SOC) at 3 yr	406		70.54 (11.93)	26-90
SOC-13 summary scale divided into quartiles				
Quartile 1 (lowest)	106	26.1		
Quartile 2	97	23.9		
Quartile 3	103	25.4		
Quartile 4 (highest)	100	24.6		
Health-related quality of life				
3-year follow-up				
Global health/quality of life	405		74 (20)	0-100
Physical function	406		86 (15)	20-100
Role function	406		89 (20)	0-100
Cognitive function	406		85 (19)	17-100
Emotional function	405		82 (20)	0-100
Social function	403		93 (17)	0-100
5-year follow-up				
Global health/quality of life	373		75 (19)	17-100
Physical function	371		86 (15)	20-100
Role function	371		90 (19)	0-100
Cognitive function	373		87 (19)	0-100
Emotional function	373		84 (18)	0-100
Social function	371		93 (15)	0-100

Study strengths and limitations. To the authors’ knowledge, this is one of the largest studies investigating the impact of SOC on HRQoL of long-term breast cancer survivors. The SOC-13 scale is generally considered as reliable, valid and cross-culturally applicable, and in the present study, as in

Table II. Spearman's correlations between SOC and HRQoL variables.

	SOC3	QoL 3	QoL 5	PF 3	PF 5	RF 3	RF 5	CF 3	CF 5	EF 3	SF 3	SF 5
SOC3												
QoL 3	0.57**											
QoL 5	0.51**	0.61**										
PF 3	0.39**	0.53**	0.46**									
PF 5	0.34**	0.44**	0.54**	0.77**								
RF 3	0.36**	0.51**	0.37**	0.51**	0.40**							
RF 5	0.34**	0.36**	0.51**	0.38**	0.51**	0.45**						
CF 3	0.55**	0.52**	0.40**	0.44**	0.39**	0.45**	0.36**					
CF 5	0.47**	0.35**	0.47**	0.35**	0.42**	0.32**	0.41**	0.63**				
EF 3	0.57**	0.62**	0.45**	0.42**	0.33**	0.38**	0.29**	0.58**	0.44**			
EF 5	0.54**	0.42**	0.58**	0.38**	0.43**	0.28**	0.42**	0.41**	0.55**	0.58**		
SF 3	0.37**	0.52**	0.36**	0.40**	0.34**	0.57**	0.43**	0.44**	0.35**	0.46**	0.34**	
SF 5	0.29**	0.33**	0.50**	0.33**	0.46**	0.43**	0.63**	0.33**	0.42**	0.25**	0.41**	0.53**

** $p < 0.01$, * $p < 0.05$. SOC: Sense of coherence; QoL: EORTC C30 global quality of life; PF: physical function; RF: role function; CF: cognitive function; EF: emotional function; SF: social function; 3: 3-year follow-up; 5: 5-year follow-up.

Table III. Health-related quality of life (HRQoL) across the quartiles of sense of coherence (SOC).

Health-related quality of life	Sense of coherence							
	Quartile 1		Quartile 2		Quartile 3		Quartile 4	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
3-year follow-up								
EORTC QLQ-C30								
Global health/quality of life	58.41	19.87	71.13	16.45	80.47	16.73	85.58	15.48
Physical function	77.59	17.69	85.74	14.07	88.01	13.04	92.00	12.25
Role function	78.93	25.75	87.97	21.62	93.69	15.68	96.33	9.65
Cognitive function	68.71	22.62	84.19	16.73	92.56	11.84	95.50	10.29
Emotional function	66.33	22.61	81.96	15.32	90.66	13.23	93.58	12.91
Social function	86.19	20.34	90.88	19.11	97.90	10.09	97.33	12.01
5-year follow-up								
EORTC QLQ-C30								
Global health/quality of life	62.25	19.15	71.86	18.23	80.79	15.99	85.04	14.93
Physical function	79.20	16.58	84.96	14.56	87.05	12.45	91.23	13.44
Role function	81.83	22.11	89.88	17.93	93.68	15.97	94.02	16.12
Cognitive function	72.17	24.28	87.84	16.34	92.63	11.84	95.52	9.56
Emotional function	70.75	20.90	81.57	13.73	90.26	11.70	94.09	10.82
Social function	86.87	20.38	93.73	13.84	97.02	9.72	97.28	9.97

several previous studies, its reliability was high (16, 39). Both theory and psychometric evaluations (27, 39) support the use of this instrument as an unidimensional measure without separating the three components (comprehensibility, manageability and meaningfulness). We also followed the recommendation (13) not to divide the SOC summary scale into high or low SOC given that “normal” level has not been defined for SOC. Accordingly, the summary score was used as a continuous variable in the present study.

Some limitations need to be considered when interpreting the present findings. It could be argued that the study design would

have been stronger if SOC measurements were available already at the baseline level. However, a true baseline value (indicating level before illness) cannot be obtained in an intervention study like this one. The patients were asked for informed consent to participate in the study only after they had received their diagnosis and participated in their primary treatments. Any effects of this on their SOC and QoL would therefore already have affected their baseline scores. Given that SOC is generally found to be a relatively stable characteristic in adulthood, there is no reason to expect significant or non-predictable variation in SOC during the first 3 years after primary treatment. In general,

we strongly feel that enriching a longitudinal study with a new insight during its course is entirely acceptable and useful, as long as the new elements do not interfere with the original ones.

Clinical implications. Currently existing research results have shown that the need for and usefulness of psychosocial interventions varies among breast cancer patients; one size indeed does not fit all. As an example, Admiraal *et al.* reported that while their web-based tailored psychoeducational program (ENCOURAGE) for breast cancer patients, aiming at empowering patients to take control over prevailing problems, failed to show any difference between intervention and control groups, an unplanned subgroup analysis showed that in clinically distressed patients, the use of the ENCOURAGE program increased optimism and sense of control over the future at 12 weeks more than in patients in the control group (40).

The present findings might help clinicians to plan more individualized interventions. One potential approach of this salutogenic model would be to offer different kind of psychosocial support to patients having lower or higher SOC at the time of diagnosis. Those having lower SOC might profit more organized information and psychoeducation, professional social support, and regular psychosocial monitoring to cope with disease- and treatment-related symptoms and concerns. For those with higher SOC and strong social networks, basic information about disease, physical activity, and nutritional counseling, contact information of peer support groups and breast cancer organizations might be sufficient. However, additional research in this field is warranted.

Conclusion

The present findings strongly support the use of the SOC-13 diagnostic instrument, based on the central concept, sense of coherence, of the salutogenic theory by Antonovsky, as a cost-effective and reliable tool in detecting those patients most in need of psychosocial support.

Conflicts of Interest

The Authors have no conflicts of interest to declare in relation to this study.

Authors' Contributions

NV and LH-B drafted the manuscript. NV and CB analyzed the data. All Authors designed the study, interpreted the results, provided critical revision of the manuscript for important intellectual content, and read and approved the final manuscript.

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References

- 1 Bray F, Ferlay J, Soerjomataram I, Siegel RL, Torre LA and Jemal A: Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin* 68(6): 394-424, 2018. PMID: 30207593. DOI: 10.3322/caac.21492
- 2 Pitkaniemi J, Malila N, Virtanen A, Degerlund H, Heikkinen S and Seppä K: Cancer in Finland, 2018. Available at: https://syoparekisteri.fi/assets/files/2020/05/Cancer_in_Finland_2018-report.pdf [Last accessed on August 31, 2021]
- 3 De Angelis R, Sant M, Coleman MP, Francisci S, Baili P, Pierannunzio D, Trama A, Visser O, Brenner H, Ardanaz E, Bielska-Lasota M, Engholm G, Nennecke A, Siesling S, Berrino F, Capocaccia R and EUROCARE-5 Working Group: Cancer survival in Europe 1999-2007 by country and age: results of EUROCARE—5-a population-based study. *Lancet Oncol* 15(1): 23-34, 2014. PMID: 24314615. DOI: 10.1016/S1470-2045(13)70546-1
- 4 Fiszer C, Dolbeault S, Sultan S and Brédart A: Prevalence, intensity, and predictors of the supportive care needs of women diagnosed with breast cancer: a systematic review. *Psychooncology* 23(4): 361-374, 2014. PMID: 24677334. DOI: 10.1002/pon.3432
- 5 Jassim GA, Whitford DL, Hickey A and Carter B: Psychological interventions for women with non-metastatic breast cancer. *Cochrane Database Syst Rev* (5): CD008729, 2015. PMID: 26017383. DOI: 10.1002/14651858.CD008729.pub2
- 6 Knobf MT: Psychosocial responses in breast cancer survivors. *Semin Oncol Nurs* 23(1): 71-83, 2007. PMID: 17303518. DOI: 10.1016/j.soncn.2006.11.009
- 7 Montazeri A: Quality of life data as prognostic indicators of survival in cancer patients: an overview of the literature from 1982 to 2008. *Health Qual Life Outcomes* 7: 102, 2009. PMID: 20030832. DOI: 10.1186/1477-7525-7-102
- 8 Penttinen H, Rautalin M, Roine R, Jahkola T, Kellokumpu-Lehtinen PL, Huovinen R, Kautiainen H, Järvenpää S, Hakamies-Blomqvist L, Blomqvist C and Saarto T: Quality of life of recently treated patients with breast cancer. *Anticancer Res* 34(3): 1201-1206, 2014. PMID: 24596360.
- 9 Penttinen HM, Saarto T, Kellokumpu-Lehtinen P, Blomqvist C, Huovinen R, Kautiainen H, Järvenpää S, Nikander R, Idman I, Luoto R, Sievänen H, Utriainen M, Vehmanen L, Jääskeläinen AS, Elme A, Ruohola J, Luoma M and Hakamies-Blomqvist L: Quality of life and physical performance and activity of breast cancer patients after adjuvant treatments. *Psychooncology* 20(11): 1211-1220, 2011. PMID: 20878646. DOI: 10.1002/pon.1837
- 10 Saarto T, Penttinen HM, Sievänen H, Kellokumpu-Lehtinen PL, Hakamies-Blomqvist L, Nikander R, Huovinen R, Luoto R, Kautiainen H, Järvenpää S, Idman I, Utriainen M, Vehmanen L, Jääskeläinen AS, Elme A, Ruohola J, Palva T, Vertio H, Rautalahti M, Fogelholm M, Blomqvist C and Luoma ML: Effectiveness of a 12-month exercise program on physical performance and quality of life of breast cancer survivors. *Anticancer Res* 32(9): 3875-3884, 2012. PMID: 22993332.
- 11 Eriksson M and Mittelmar MB: The Handbook of Salutogenesis. In: *The Handbook of Salutogenesis*. Mittelmar MB, Sagy S,

- Eriksson M, Bauer GF, Pelikan JF, Lindström B and Espnes GA (eds.). Springer International Publishing, pp. 107-122, 2016.
- 12 Antonovsky A: Health, stress and coping. San Francisco, CA, USA, Jossey-Bass, 1979.
 - 13 Antonovsky A: Unraveling the mystery of health: How people manage stress and stay well. San Francisco, CA, USA, Jossey-Bass, 1987.
 - 14 Eriksson M and Lindström B: Antonovsky's sense of coherence scale and the relation with health: a systematic review. *J Epidemiol Community Health* 60(5): 376-381, 2006. PMID: 16614325. DOI: 10.1136/jech.2005.041616
 - 15 Boman L, Björvell H, Langius A and Cedermark B: Two models of care as evaluated by a group of women operated on for breast cancer with regard to their perceived well-being. *Eur J Cancer Care (Engl)* 8(2): 87-96, 1999. PMID: 10476111. DOI: 10.1046/j.1365-2354.1999.00139.x
 - 16 Kenne Sarenmalm E, Browall M, Persson LO, Fall-Dickson J and Gaston-Johansson F: Relationship of sense of coherence to stressful events, coping strategies, health status, and quality of life in women with breast cancer. *Psychooncology* 22(1): 20-27, 2013. PMID: 21910162. DOI: 10.1002/pon.2053
 - 17 Lindblad C, Sandelin K, Petersson LM, Rohani C and Langius-Eklöf A: Stability of the 13-item sense of coherence (SOC) scale: a longitudinal prospective study in women treated for breast cancer. *Qual Life Res* 25(3): 753-760, 2016. PMID: 26319753. DOI: 10.1007/s11136-015-1114-4
 - 18 Rohani C, Abedi HA, Sundberg K and Langius-Eklöf A: Sense of coherence as a mediator of health-related quality of life dimensions in patients with breast cancer: a longitudinal study with prospective design. *Health Qual Life Outcomes* 13: 195, 2015. PMID: 26651334. DOI: 10.1186/s12955-015-0392-4
 - 19 Rohani C, Abedi HA, Omranipour R and Langius-Eklöf A: Health-related quality of life and the predictive role of sense of coherence, spirituality and religious coping in a sample of Iranian women with breast cancer: a prospective study with comparative design. *Health Qual Life Outcomes* 13: 40, 2015. PMID: 25889384. DOI: 10.1186/s12955-015-0229-1
 - 20 Winger JG, Adams RN and Mosher CE: Relations of meaning in life and sense of coherence to distress in cancer patients: a meta-analysis. *Psychooncology* 25(1): 2-10, 2016. PMID: 25787699. DOI: 10.1002/pon.3798
 - 21 Kenne Sarenmalm E, Browall M and Gaston-Johansson F: Symptom burden clusters: a challenge for targeted symptom management. A longitudinal study examining symptom burden clusters in breast cancer. *J Pain Symptom Manage* 47(4): 731-741, 2014. PMID: 23916827. DOI: 10.1016/j.jpainsymman.2013.05.012
 - 22 Quintard B, Constant A, Lakdja F and Labeyrie-Lagardère H: Factors predicting sexual functioning in patients 3 months after surgical procedures for breast cancer: the role of the Sense of Coherence. *Eur J Oncol Nurs* 18(1): 41-45, 2014. PMID: 24169031. DOI: 10.1016/j.ejon.2013.09.008
 - 23 Leonhart R, Tang L, Pang Y, Li J, Song L, Fischer I, Koch M, Wuensch A, Fritzsche K and Schaefer R: Physical and psychological correlates of high somatic symptom severity in Chinese breast cancer patients. *Psychooncology* 26(5): 656-663, 2017. PMID: 27350559. DOI: 10.1002/pon.4203
 - 24 Penttinen H, Nikander R, Blomqvist C, Luoto R and Saarto T: Recruitment of breast cancer survivors into a 12-month supervised exercise intervention is feasible. *Contemp Clin Trials* 30(5): 457-463, 2009. PMID: 19394448. DOI: 10.1016/j.cct.2009.04.007
 - 25 Helsinki and Uusimaa Hospital District Clinical Trials Register. Available at: www.hus.fi [Last accessed September 3, 2021]
 - 26 Finnish Breast Cancer Group: Breast Cancer and Exercise (Brex). *ClinicalTrials.gov*. Available at: <https://www.clinicaltrials.gov/ct2/show/record/NCT00639210> [Last accessed on September 3, 2021]
 - 27 Antonovsky A: The structure and properties of the sense of coherence scale. *Soc Sci Med* 36(6): 725-733, 1993. PMID: 8480217. DOI: 10.1016/0277-9536(93)90033-z
 - 28 Aaronson NK, Ahmedzai S, Bergman B, Bullinger M, Cull A, Duez NJ, Filiberti A, Flechtner H, Fleishman SB and de Haes JC: The European Organization for Research and Treatment of Cancer QLQ-C30: a quality-of-life instrument for use in international clinical trials in oncology. *J Natl Cancer Inst* 85(5): 365-376, 1993. PMID: 8433390. DOI: 10.1093/jnci/85.5.365
 - 29 Lemieux J, Goodwin PJ, Bordeleau LJ, Lauzier S and Théberge V: Quality-of-life measurement in randomized clinical trials in breast cancer: an updated systematic review (2001-2009). *J Natl Cancer Inst* 103(3): 178-231, 2011. PMID: 21217081. DOI: 10.1093/jnci/djq508
 - 30 Kaasa S, Bjordal K, Aaronson N, Moum T, Wist E, Hagen S and Kvikstad A: The EORTC core quality of life questionnaire (QLQ-C30): validity and reliability when analysed with patients treated with palliative radiotherapy. *Eur J Cancer* 31A(13-14): 2260-2263, 1995. PMID: 8652253. DOI: 10.1016/0959-8049(95)00296-0
 - 31 Mystakidou K, Tsilika E, Parpa E, Kalaidopoulou O, Smyrniotis V and Vlahos L: The EORTC core quality of life questionnaire (QLQ-C30, version 3.0) in terminally ill cancer patients under palliative care: validity and reliability in a Hellenic sample. *Int J Cancer* 94(1): 135-139, 2001. PMID: 11668488. DOI: 10.1002/ijc.1439
 - 32 Roine E, Sintonen H, Kellokumpu-Lehtinen PL, Penttinen H, Utriainen M, Vehmanen L, Huovinen R, Kautiainen H, Nikander R, Blomqvist C and Saarto T: Health-related quality of life of breast cancer survivors attending an exercise intervention study: a five-year follow-up. *In Vivo* 34(2): 667-674, 2020. PMID: 32111767. DOI: 10.21873/invivo.11821
 - 33 Gibson LM and Parker V: Inner resources as predictors of psychological well-being in middle-income african american breast cancer survivors. *Cancer Control* 10(5 Suppl): 52-59, 2003. PMID: 14581905. DOI: 10.1177/107327480301005s08
 - 34 Tang L, Fritzsche K, Leonhart R, Pang Y, Li J, Song L, Fischer I, Koch M, Wuensch A, Mewes R and Schaefer R: Emotional distress and dysfunctional illness perception are associated with low mental and physical quality of life in Chinese breast cancer patients. *Health Qual Life Outcomes* 15(1): 231, 2017. PMID: 29191208. DOI: 10.1186/s12955-017-0803-9
 - 35 Kulik L and Kronfeld M: Adjustment to breast cancer: the contribution of resources and causal attributions regarding the illness. *Soc Work Health Care* 41(2): 37-57, 2005. PMID: 16048861. DOI: 10.1300/J010v41n02_03
 - 36 Lindblad C, Langius-Eklöf A, Petersson LM, Sackey H, Bottai M and Sandelin K: Sense of coherence is a predictor of survival: A prospective study in women treated for breast cancer. *Psychooncology* 27(6): 1615-1621, 2018. PMID: 29528529. DOI: 10.1002/pon.4702

- 37 Bonzanini LIL, Soldera EB, Ortigara GB, Schulz RE, Knorst JK, Ardenghi TM and Ferrazzo KL: Effect of the sense of coherence and associated factors in the quality of life of head and neck cancer patients. *Braz Oral Res* 34: e009, 2020. PMID: 32049110. DOI: 10.1590/1807-3107bor-2020.vol34.0009
- 38 Qiu X, Zhang N, Pan SJ, Zhao P and Wu BW: Sense of coherence and health-related quality of life in patients with brain metastases. *Front Psychol* 11: 1516, 2020. PMID: 32714254. DOI: 10.3389/fpsyg.2020.01516
- 39 Eriksson M and Lindström B: Validity of Antonovsky's sense of coherence scale: a systematic review. *J Epidemiol Community Health* 59(6): 460-466, 2005. PMID: 15911640. DOI: 10.1136/jech.2003.018085
- 40 Admiraal JM, van der Velden AWG, Geerling JI, Burgerhof JGM, Bouma G, Walenkamp AME, de Vries EGE, Schröder CP and Reyners AKL: Web-based tailored psychoeducation for breast cancer patients at the onset of the survivorship phase: a multicenter randomized controlled trial. *J Pain Symptom Manage* 54(4): 466-475, 2017. PMID: 28711750. DOI: 10.1016/j.jpainsymman.2017.07.009

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