Hong Kong Journal of Occupational Therapy (2016) **28**, 15–23

Available online at www.sciencedirect.com

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journal homepage: www.hkjot-online.com

Hong Kong Journal of Occupational Therapy (HKJOT)

ORIGINAL ARTICLE

Impact of Cognitive and Psychological Symptoms on Work Productivity and Quality of Life among Breast Cancer Survivors in Hong Kong

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Received 20 February 2016; received in revised form 18 November 2016; accepted 19 November 2016
Available online 29 December 2016

KEYWORDS
anxiety;
breast cancer survivors;
cognitive limitations;
depression;
quality of life;
work productivity

Summary *Objective/Background:* Employed breast cancer survivors (BCS) may experience residual symptoms that can impact their work productivity and quality of life (QoL), but it is unclear whether such associations exist among BCS in Hong Kong. Therefore, this study was designed to explore the symptom burden (cognitive limitation and psychological distress) of employed BCS in HK, and to investigate whether such factors are related to work productivity and QoL.
Methods: A cross-sectional study including employed BCS ($n = 30$), women with musculoskeletal conditions ($n = 30$), and healthy women ($n = 30$) was conducted. Participants completed a questionnaire covering their sociodemographics, the Hospital Anxiety and Depression Scale, Cognitive Symptom Checklist, Work Limitation Questionnaire, and European Organization for Research and Treatment of Cancer Quality of Life Questionnaire C30.
Results: The self-perceived cognitive limitations at work of BCS were significantly higher than that of the healthy control group (5.33 vs. 2.60; $p < .05$). The cognitive limitations in BCS were significantly associated with their QoL ($\beta = -0.320$; $p = .032$). A negative relationship between depression and QoL in BCS was also observed in this study.
Conclusion: This exploratory study provides local evidence that BCS experience greater work-task related cognitive limitations and that is related to QoL. Similar to findings in other

Funding/support: No financial or grant support was received for this study.
Conflicts of interest: All contributing authors declare that they have no conflicts of interest.
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http://dx.doi.org/10.1016/j.hkjot.2016.11.002

countries, this provides insight for the consideration of early identification of cognitive problems in this particular patient group. Further studies may be needed to further substantiate such findings and to examine the effectiveness of potential cognitive interventions.

Introduction

Breast cancer is the third most common type of cancer in Hong Kong (HK), and the leading type of cancer amongst women in HK (Hong Kong Cancer Registry, 2016). As demonstrated by a retrospective study, the median age of diagnosis is 50 years (mean, 54 years), with a 5-year relative survival rate of 84% (Kwong et al., 2011). Therefore, given that the survival rates are high, and that the age of diagnosis is well within the working-force age range, it is likely that many breast cancer survivors (BCS) will eventually return to work (Cheng, Zeng, & Feuerstein, 2015; Saito, Takahashi, Sairenchi, & Muto, 2014).

Addressing work-related issues among BCS is of relevance because work is an important component of recovery for cancer survivors. It contributes to greater well-being, and enhances one's sense of normalcy and daily structure, control, identity, and meaning (Bloom, Steward, Chang, & Banks, 2004; Kennedy, Haslam, Munir, & Pryce, 2007; Lundh et al., 2013; Rasmussen & Elverdam, 2008). However, BCS do confront challenges in the process of returning-to and sustaining employment—namely, persistent fatigue, emotional-distress, upper-body strength and mobility limitations, and cognitive impairment (Hidding, Beurskens, van der Wees, van Laarhoven, & Nijhuis-van der Sanden, 2014; Janelsins, Kelser, Ahles, & Morrow, 2014; Janz et al., 2007; Lam et al., 2010; McDougall, Oliver, & Scogin, 2014; Oberst, Bradley, Gardiner, Schenk, & Given, 2010). To highlight, cognitive impairments as a result of breast cancer and/or its treatment is an area that has been continually researched, with studies providing evidence that there is a negative impact of chemotherapy on cognitive performance (Falleti, Sanfilippo, Maruff, Weih, & Phillips, 2005; Janelsins et al., 2014; McDougall et al, 2014). However, the exact mechanism for such impairments is not yet clearly understood (Janelsins et al., 2014).

Collectively, these aforementioned factors may occur as a cluster and have the potential to compromise BCS capacity to perform work-related tasks and overall QoL (Calvio, Peugeot, Bruns, Todd, & Feuerstein, 2010; Hansen, Feuerstein, Calvio, & Olsen, 2008). In fact, several studies have investigated these associations among employed BCS. Calvio et al. (2010) and Hansen et al. (2008) reported that when compared to noncancer individuals, BCS reported higher levels of cognitive limitations at 3 years and 4 years postdiagnosis, respectively. Furthermore, Calvio et al. (2010) also found that anxiety and depression were higher in BCS, and that cognitive limitations were significant predictors of work-output in BCS. In a recent study conducted in mainland China, BCS reported higher levels of anxiety and cognitive limitations compared to musculoskeletal participants, with lower levels of work productivity 2-years after primary treatment (Zeng, Cheng, Feuerstein, 2016). Moreover, anxiety levels and cognitive limitations were found to be associated with productivity loss in BCS.

In terms of QoL, Waldmann, Pritzkuleit, Raspe, and Katalinic (2007) found that BCS had lower QoL in terms of physical and functional well-being when compared to those without cancer. Zeng et al. (2016) demonstrated that overall QoL was lower in BCS than individuals with musculoskeletal conditions. Associations were also found between anxiety, cognitive limitations and lower QoL for BCS. In local studies, it has been demonstrated that anxiety and depression were independently associated with multiple dimensions of QoL in BCS (Ho, So, Leung, Lai, & Chan, 2013; So et al., 2014).

Overall, these results suggest that employed BCS report greater levels of cognitive limitations, anxiety and depression, and lower QoL. And that greater cognitive limitations and psychological distress are associated with lower work productivity and QoL in BCS. Interestingly, depressive symptoms, but not cognitive limitations, seem to be associated with work limitations for noncancer individuals.

Despite the considerable number of studies conducted regarding the impact of breast cancer and its side effects on work issues, to date, this topic has been largely unstudied in HK. There is a knowledge gap in whether local BCS who have returned to work experience physical, cognitive, and/or psychological difficulties, and whether this has an impact on their work productivity and QoL. Without this understanding, it cannot be determined whether there is a need for interventions. Moreover, past studies have often used one noncancer group as a control, and it cannot be delineated whether the differences observed were due to the presence of an illness or specific to BCS. Therefore, this local preliminary study aims to fill the gap including two comparison groups: participants with musculoskeletal injuries and healthy participants. This may provide a greater understanding towards the specific impact of breast-cancer on variables of interest, and provide insights for the development of suitable hospital- or community-based programs that may facilitate work adjustment and enhance QoL. We predicted that musculoskeletal comparison (MSC) group and BCS group would have significant difference in terms of higher percentage of work productivity loss and lower QoL compared to healthy comparison (HC) group. However, the main contributory factor to this difference in BCS group was related to their cognitive limitations.

Methods

Study design

The study adopted a cross-sectional study design that involved BCS and two comparison groups, the MSC and HC groups, with 30 participants in each group. Inclusion criteria consisted of female HK residents aged 18–65 years who had a full-time (> 40 h/week) or part-time (< 40 h/week) job at the time of the assessment. In addition, BCS had to have received a stage I–III breast cancer diagnosis and completed primary treatment for at least 6 months. MSC participants had to be with musculoskeletal injury (e.g., cumulative traumatic disorder, back injury) but without a previous or current cancer diagnosis. HC participants had to be without a previous or current cancer diagnosis or musculoskeletal injury. Individuals who had a history of psychiatric disorder, or were not able to give voluntary consent were excluded.

Procedure

Ethical approval for the study had been obtained from both the Hospital Authority and the Hong Kong Polytechnic University, Kowloon, Hong Kong prior to study commencement. Potential participants in the BCS and MSC groups were identified and referred by the staff in the breast cancer clinic or Department of Occupational Therapy at Princess Margaret Hospital, New Territories, Hong Kong, and then approached by the research term. HC participants were identified by research team's personal network. Once confirmed that they satisfied the inclusion criteria and informed consent was obtained, participants were asked to spend around 15–20 minutes to complete the questionnaire.

Measures

Sociodemographics, general job, and clinical characteristics

Participants completed questions about their sociodemographics, general job, and clinical characteristics. Demographic information included age, education level, marital status, and whether they had children. Job-related information included work status, job type, and data of return-to-work for the BCS group. BCS and MSC groups needed to fill in the date of disease diagnosis while participants in the BCS group also provided information related to the stage of tumour, type of cancer treatment received, and date of completion of primary cancer treatment. BCS were also asked if cognitive training (e.g., memory and attention) would be beneficial to their daily lives or work.

Anxiety and depression

The Chinese version of the Hospital Anxiety and Depression Scale (HADS) was used to measure levels of anxiety and depression. It consists of two subscales: anxiety (A-scale) and depression (D-scale), with each subscale containing seven items being rated on a 4-point Likert scale. Each item is scored from 0 to 3. The anxiety and depression sub-scores are both on scales of 0–21. Scores of 8–10 indicate mild cases, 11–15 indicate moderate cases and ≥ 16 indicate severe cases. HADS has been found to have high internal consistency and a reliable factory structure when administered to patients with cancer (Moorey et al., 1991). It has high concurrent validity with the Beck Depression Inventory and State–Trait Anxiety inventory (0.722–0.749) and can detect anxiety and depressive symptoms in general hospital patients effectively (Michopoulos et al., 2008). It has been used with women with breast cancer in HK (Ho et al., 2013).

Work task-related cognitive symptoms

The simplified Cognitive Symptom Checklist (CSC-W21) with 21 items was used to assess work-related cognitive problems. The original English version consisted of three subscales, including working memory, executive functioning, and attention (Ottati & Feuerstein, 2013). It was shown to be a valid and internally reliable self-report measure ($\alpha = 0.88$) for working BCS (Ottati & Feuerstein, 2013). The Chinese version used by this current study was recently translated and validated with BCS (Cheng et al., 2015). A two-factor instead of three-factor structure accounting for 69.43% of the total variance was proposed in the Chinese version that combined items measuring task completion and executive function. It was found to have good item- and scale-level content validity (> 0.8), internal consistency of subscales ranged from 0.84 to 0.95 and good test–retest reliability with intraclass correlation between 0.795 and 0.955 (Cheng et al., 2015). Higher scores are indicative of more cognitive symptoms and thus greater cognitive limitations.

Work limitations

To measure the degree of work limitation, which is inversely related to work productivity, the 25-item Work Limitation Questionnaire (WLQ) was used, which consists of four subscales: time demands, physical demands, mental–interpersonal demands, and output demands; and users rate their ability or level of difficulty in fulfilling the job demands on a scale ranging from 1 to 5. Subscale scores and a total WLQ index can be calculated, of which the WLQ index can be further converted into the WLQ productivity loss score, which was used in this study to indicate the loss in productivity. The WLQ has been shown to be able to accurately assess the role of worker's health on their productivity (Prasad, Wahlqvist, Shikiar, & Shih, 2004). It demonstrated high reliability and validity in study with chronic condition groups and healthy employees that the four scales achieved Cronbach's alpha values of ≥ 0.90 and significant correlation was found with health status and self-reported work productivity (Lerner et al., 2001). A recent study on cancer survivors also indicated that the internal consistency and construct validity for the WLQ were sufficient (Tamminga, Verbeek, Frings-Dresen, & Boer, 2014). The Chinese version used was validated and found to be reliable (Dong, Liu, Wang, & Peng, 2013). Results from factor analysis indicated a cumulative variance contribution rate at 61.3%. Higher scores are indicative of greater work limitations.

Quality of life

To measure the QoL, the 30-item European Organization for Research and Treatment of Cancer Quality of Life

Questionnaire C30 (EORTC QLQ-C30) version 3 was used. It includes a scale measuring the global health-related QoL, five functioning scales (physical, role, emotional, cognitive, and social), and nine symptom scales (fatigue, nausea/vomiting, pain, dyspnoea, sleep disturbance, appetite loss, constipation, diarrhoea, and financial difficulties). Scores can be transformed to a 0–100 scale. For the health-related QoL and functioning subscale, a higher score represents a better QoL. By contrast, a higher score for a symptom subscale represents greater symptom severity. This subscale was found to have an acceptable internal reliability of $\alpha \geq 0.70$ for cancer patients receiving different years of education (Paiva et al., 2014).

Data analysis

All data were analysed using SPSS for Windows version 21 (IBM SPSS Inc., Chicago, IL, USA). Descriptive statistics were used for participants' sociodemographics, general clinical and job characteristics, and scores in HADS A-scale and D-scale, CSC-W21, WLQ, and EORTC QLQ-C30 (Cella et al., 1993). Chi-square test was used to test the differences in sociodemographics. One-way analysis of variance or Kruskal–Wallis test was used to compare the scores in each scale between three groups and *post hoc* test was conducted when significant difference was detected. Two separate multiple regression analyses were conducted to identify independent factors related to work limitations and QoL. Univariate linear regressions were used separately for the three groups with independent variables including demographics, medical history, job characteristics, and scale score of HADS A-scale, D-scale, and CSC-W21. Only those variables that were associated with work limitation or QoL in the univariate regressions ($p < .10$) were included in the final model. The significance level was set at $p < .05$.

Results

Demographic variables

A total of 90 women participated in this study. There were significant differences in age ($p < .01$), education ($p = .02$), and work status ($p = .049$) among these three groups (Table 1). Participants in HC group were of younger age and higher education level than those in BCS and MSC group. Besides, more BCS were part-time employers ($n = 14$, 46.7%) when compared with the MSC ($n = 6$, 20%) and HC ($n = 7$, 23.3%) participants. None of the BCS had received previously cognitive training.

Chi-square test could not be used to analyse the job type due to small expected values in many cells, but there was a difference in the distribution of job type between the three groups. The majority of participants were working as clerk/sales/nontechnical worker in BCS ($n = 27$, 90%) and MSC ($n = 27$, 90%) groups, whereas a much greater proportion of the HC group had a job in management/administration ($n = 9$, 30%) or professional/technical/science field ($n = 5$, 16.7%). Marital status and number of children were of similar proportions between the groups.

Table 1 Sociodemographics and Job Characteristics of BCS, MSC and HC Groups.[a]

Variables		*n* (%)		
		BCS ($n = 30$)	MSC ($n = 30$)	HC ($n = 30$)
Age** (y)				
	< 40	1 (3.3)	4 (13.3)	14 (46.7)
	40–49	12 (40.0)	8 (26.7)	3 (10.0)
	≥ 50	17 (56.7)	17 (56.7)	13 (43.4)
Highest education*				
	Secondary or below	26 (86.7)	23 (76.7)	14 (46.7)
	Tertiary or above	4 (13.3)	7 (23.3)	16 (53.3)
Marital status				
	Single/never married	8 (26.7)	11 (36.7)	14 (46.7)
	Married	16 (53.3)	16 (53.3)	13 (43.4)
	Divorced/separated/widowed	6 (19.9)	3 (10.0)	3 (10.0)
Has a child				
	Yes	16 (53.3)	17 (56.7)	14 (46.7)
	No	14 (46.7)	13 (43.3)	16 (53.3)
Work status*				
	Full-time (≥ 40 h/wk)	16 (53.3)	24 (80.0)	23 (76.7)
	Part-time (< 40 h/wk)	14 (46.7)	6 (20.0)	7 (23.3)
Job type				
	Clerical/sales/service/nontechnical worker	27 (90.0)	27 (90.0)	16 (53.3)
	Management/administration	0 (0.0)	1 (3.3)	9 (30.0)
	Professional/technical/science	3 (10.0)	2 (6.7)	5 (16.7)

Note. BCS = breast cancer survivors; HC = healthy comparison group; MSC = musculoskeletal comparison group.
*$p < .05$; **$p < .01$.
[a] Not all participants responded to all questions.

Clinical characteristics of BCS group

Table 2 shows the clinical characteristics of the BCS group. Nearly half of the participants were diagnosed with early stage ($n = 11$, 42.3%), followed by mid ($n = 8$, 30.8%), and late ($n = 7$, 26.9%) stage. They were on average 2.87 years after primary cancer treatment. Two-thirds of the survivors ($n = 20$, 66.7%) had received a combination of surgery, radiation, and chemotherapy and the rest were treated with radiation therapy ($n = 4$, 13.3%), surgery ($n = 3$, 10%), and combination of surgery and radiation therapy ($n = 3$, 10%).

Between group comparison

Assessment of the normality of data by Shapiro–Wilk statistic indicated that the data did not meet the criterion of normality. As a result, Kruskal–Wallis test was used to compare the scores of HADS-A, HADS-D, CSC, WLQ, and QoL in BCS, MSC, and HC groups (Table 3).

Anxiety and depression

There were no significant differences in the anxiety and depression levels between the three groups (Table 4). In general, the HC group reported the highest mean score on both anxiety and depression, while the MSC group had the lowest.

Table 2 Clinical Characteristics of Breast Cancer Survivors.[a]

Variables	*n* (%)	Mean (SD)
Disease stage		
Early	11 (42.3)	
Mid	8 (30.8)	
Late	7 (26.9)	
Treatment type		
Surgery	3 (10)	
Radiation	4 (13.3)	
Surgery + radiation	3 (10)	
Surgery + radiation + chemotherapy	20 (66.7)	
Time since completing primary cancer treatment (mo)		34.6 (38.3)

Note. SD = standard deviation.
[a] Not all participants responded to all questions. Information on adjuvant therapy was not available.

Table 3 Shapiro–Wilk Statistics for Breast Cancer Survivors, Musculoskeletal Comparison Group, and Healthy Comparison Group.

Variables	BCS	MSC	HC
HADS anxiety	0.003	0.000	0.015
HADS depression	0.127	0.157	0.046
Cognitive symptom checklist	0.21	0.002	0.000
Work limitation questionnaire			
Productivity loss score	0.000	0.000	0.002
Quality of life	0.090	0.444	0.005

Note. HADS = Hospital Anxiety and Depression Scale.

Cognitive symptoms

BCS reported the highest number of cognitive symptoms (5.33), followed by MSC (3.13), and HC (2.60; Table 4). Significant difference was found among three groups (chi-square test = 9.653, $p = .008$), with *post hoc* Mann–Whitney *U* test showing that the number of cognitive symptoms reported by BCS was significantly higher when compared with HC group ($p < .05$), especially for the symptoms related with working memory (BCS = 2.93; HC = 1.10, $p < .05$).

Work productivity loss and QoL

There was no significant difference in the overall WLQ productivity loss score among the three groups ($p = .212$; Table 4). In terms of QoL, HC group reported the highest global QoL score among three group (69.33) followed by the BCS group (67.20), and MSC group (65.30). Although there was no significant difference in global QoL, there were significant differences between three groups in physical functioning, role functioning, and financial difficulties subscales. The physical and role functioning of the BCS and MSC groups were significantly lower than that of HC group ($p < .05$). More financial difficulties were reported by the BCS group, which scored significantly higher than MSC (14.37 versus 5.50, $p < .05$) and HC (14.37 versus 1.1, $p < .05$) group.

Predication of work productivity loss by cognitive and psychological symptoms

The HADS-A, HADS-D, and CSC scores for the MSC group, and the demographics (work status), HADS-A, HADS-D, and CSC score for the HC group were associated with work limitations in the univariate regressions. These variables were therefore input into the final model for analysis. The effect and interaction are presented for each variable in the final model in Table 5. In the BCS group (reference group), the coefficient represents the change in work limitations for every unit change in the value of the independent variable. The coefficient for the interaction represents the difference in the MSC or HC groups with reference to the BCS group.

The final regression model explains 45.7% of the variance in work productivity loss for BCS, MSC, and HC groups. The overall symptom burden accounted for 41.2% of the variability in work productivity loss ($p < .001$). Only the interaction effect between HC group and cognitive limitation makes a contribution to the explanation of variance in work productivity loss ($\beta = 0.277$; $p = .047$), revealing that the relationship between cognitive limitations and work productivity loss is the strongest in the HC group.

Predication of QoL by cognitive and psychological symptoms

Only the HADS-D, HADS-A, and CSC score for the MSC group and the HADS-D and CSC scores for the HC group were associated with QoL in univariate regressions. These variables were therefore input into the final model for analysis, which is presented in Table 6. The r^2 suggests that 38.4% of

Table 4 Comparison of Outcome Measures among BCS, MSC, and HC Groups.

Variables	Mean (SD)		
	BCS	MSC	HC
HADS anxiety	4.63 (2.87)	3.87 (2.69)	5.20 (3.30)
HADS depression	3.03 (2.67)	2.37 (2.53)	3.10 (2.37)
Cognitive symptom checklist*	5.33 (4.71)	3.13 (3.01)	2.60 (4.30)
Working memory*	2.93 (2.29)	2.17 (2.21)	1.10 (1.97)
Executive functioning	2.40 (3.00)	0.97 (1.81)	1.50 (2.56)
Work limitation questionnaire			
Productivity loss score	0.023 (0.029)	0.025 (0.03)	0.038 (0.036)
Quality of life	67.20 (13.14)	65.30 (18.01)	69.33 (19.91)
Physical functioning*	86.53 (11.76)	82.43 (15.20)	92.5 (12.47)
Role functioning*	83.83 (20.78)	84.97 (20.15)	94.47 (11.77)
Emotional functioning	84.43(12.14)	84.77 (18.37)	80.83 (17.15)
Cognitive functioning	82.07 (16.34)	89.93 (14.91)	86.7 (17.10)
Social functioning	92.17 (14.36)	87.77 (15.05)	92.77 (16.79)
Fatigue	25.00 (17.48)	22.07 (22.00)	33.23 (22.13)
Nausea/vomiting	37.50 (14.61)	36.37 (13.53)	36.4 (10.37)
Pain	17.80 (21.35)	27.20 (23.33)	15.6 (20.0)
Dyspnoea	16.60 (22.74)	9.97 (19.87)	8.83 (17.30)
Sleep disturbance	24.40 (29.00)	21.03 (26.97)	17.67 (20.91)
Appetite loss	7.70 (14.20)	8.80 (14.84)	3.3 (10.07)
Constipation	12.17 (20.48)	5.50 (12.51)	6.63 (16.11)
Diarrhoea	6.60 (13.43)	3.30 (10.07)	5.5 (12.51)
Financial difficulties*	14.37 (20.83)	5.50 (12.51)	1.1 (6.03)

Note. BCS = breast cancer survivors; HADS = Hospital Anxiety and Depression Scale; HC = healthy comparison group; MSC = musculoskeletal comparison group; SD = standard deviation.
*$p < .05$.

Table 5 Predication of Work Productivity Loss by Cognitive and Psychological Symptoms ($n = 90$).[a]

Variables	Coefficient	t	p	r^2	Δr^2	p
Group (with reference to BCS)				.045	.045	.146
MSC group	−0.092	−0.423	.673			
HC group	−0.088	−0.392	.696			
Symptom burden**				.457	.412	< .001
HADS depression (cancer)	0.192	1.323	.190			
Group × HADS depression (MSC group)	0.148	0.852	.397			
Group × HADS depression (HC group)	0.314	1.605	.113			
HADS anxiety (cancer)	0.18	1.105	.273			
Group × HADS anxiety (MSC group)	−0.037	−0.332	.741			
Group × HADS anxiety (HC group)	−0.065	−0.268	.789			
Cognitive limitation (cancer)	0.056	0.401	.689			
Group × cognitive limitation (MSC group)	0.199	1.405	.164			
Group × cognitive limitation (HC group)*	0.277	2.021	.047			

Note. BCS = breast cancer survivors; HADS = Hospital Anxiety and Depression Scale; HC = healthy comparison group; MSC = musculoskeletal comparison group.
*$p < .005$; **$p < .001$.
[a] Interaction terms are constructed by multiplying each variable by the cancer status indicator (BCS = 0; MSC = 1; HC = 2) and represent the difference in regression coefficients between the BCS, MSC and HC groups.

the total variance in QoL for BCS, MSC, and HC groups can be explained. The education level and overall symptom burden accounted for 6.2% and 32.2% of the variability in QoL ($p < .001$), respectively. Both the education level ($\beta = -0.25$; $p = .044$) and effect of cognitive limitation for the BCS ($\beta = -0.320$; $p = .032$) make significant contribution to explain the score of QoL. The coefficient for cognitive limitation in BCS group also indicates that the association between cognitive limitations and QoL is strong relative to MSC and HC groups (Table 6).

Table 6 Predication of Quality of Life by Cognitive and Psychological Symptoms ($n = 90$).[a]

Variables	Coefficient	t	p	r^2	Δr^2	p
Group (with reference to BCS)				.016	.016	.495
BCS group	−0.135	−0.572	.569			
HC group	0.03	0.127	.899			
Education level*	−0.25	−2.393	.019	.062	.046	.044
Symptom burden**				.384	.322	< .0001
HADS depression (cancer)	−0.221	−1.438	.154			
Group × HADS depression (MSC group)	−0.197	−1.072	.287			
Group × HADS depression (HC group)	−0.312	−1.500	.138			
HADS anxiety (cancer)	−0.197	−1.192	.237			
Group × HADS anxiety (MSC group)	0.101	0.435	.664			
Group × HADS anxiety (HC group)	0.329	1.284	.203			
Cognitive limitation (cancer)*	−0.320	−2.191	.032			
Group × cognitive limitation (MSC group)	0.000	−0.002	.998			
Group × cognitive limitation (HC group)	0.052	0.365	.716			

Note. BCS = breast cancer survivors; HADS = Hospital Anxiety and Depression Scale; HC = healthy comparison group; MSC = musculoskeletal comparison group.
*$p < .005$; **$p < .001$.
[a] Interaction terms are constructed by multiplying each variable by the cancer status indicator (BCS = 0; MSC = 1; HC = 2) and represent the difference in regression coefficients between the BCS, MSC, and HC groups.

Discussion

Cognitive limitations, anxiety, and depression in BCS

Cognitive limitations were highest among BCS and this is consistent with previous studies indicating that the adjuvant treatment received by BCS may contribute to cognitive deficit (Hidding et al., 2014; Janelsins et al., 2014; Janz et al., 2007; Lam et al., 2010; Oberst et al., 2010; Rasmussen & Elverdam, 2008; Zeng et al., 2016). However, there were no significant differences between the groups in terms of anxiety and depression. This result indicates that cognitive limitations in BCS were not related to psychological symptoms. One possible explanation may be that the range for time postprimary treatment was from 6 months to 15 years. Given that there are distinct trajectories of change in psychological outcome, there is a possibility that our participants have experienced more positive outcomes over the course of recovery (Lam et al., 2010). However, longitudinal studies would be needed for greater understanding regarding this trajectory for BCS.

Work productivity and QoL in BCS

No significant difference was found in productivity loss among three groups. This did not align with previous studies that reported productivity loss was greater for BCS (Calvio et al., 2010; Hansen et al., 2008; Zeng et al., 2016). This may be due to the fact that some BCS have switched to jobs that matched their abilities after treatment (e.g., part-time), or that they have already adopted compensatory techniques; thus, productivity loss was not reflected. In fact, many BCS in our study had reported that they have adopted memory strategies (e.g., note-taking) during work, and the proportion of BCS who are in part-time jobs is nearly double compared to other groups. Furthermore, it was found that more BCS with cognitive limitations had left the workforce at 18 months postdiagnosis compared to those without impairment (Oberst et al., 2010). For those who had continued working, however, their working hours did not differ significantly from those without limitations, indicating that they may have managed to cope so that productivity loss was not reflected (Oberst et al., 2010).

As expected, BCS and MSC participants had lower global QoL score compared to the HC group, although results were not statistically significant. In particular, it is also of value to note that in terms of QoL subscale comparisons, BCS had significantly greater financial difficulties. This may be a result of costs from cancer treatment or from previous time taken off work. This points towards an unaddressed need for local BCS, and may be an area of concern that can be explored in future studies.

The results of this study showed no strong relationship between self-reported cognitive limitations and work productivity loss in BCS, which is inconsistent with previous studies. A possible explanation is that there may be a discrepancy between self-perceived cognitive decline and the objective cognitive assessment, so that even if greater cognitive limitations are reported by a participant, it may not actually be reflected in real-life performance (Downie, Mar Fan, Houede-Tchen, Yi, & Tannock, 2006; Jenkins et al., 2006). However, further studies with the inclusion of objective assessment may be needed for investigation.

Anxiety and depression were not significant in the final model. This is consistent with Hansen et al's (2008) study, but inconsistent with a recent study conducted in China (Zeng et al., 2016). Further studies may need to be conducted to establish more concrete associations.

Lastly, self-reported cognitive limitations in BCS group were significantly related to QoL with a negative relationship. This is consistent with a study that described that self-perceived cognitive deficits in BCS were associated with

QoL in different aspects of functioning (Hsu, Ennis, Hood, Graham, & Goodwin, 2013). Since cognitive appraisals lead to coping strategy such as engaging in less strenuous activity, cognitive deficits may decrease their abilities to generate and executive coping strategies which in turn lower their QoL. Moreover, although the results present that depression varies inversely with QoL, which is in line with previous studies, no significant and strong relationship was found. Therefore, our current results suggest that cognitive limitations may play a more important role in contributing to QoL in BCS.

Significance and clinical implications

Current results add strength to the idea that BCS experience a certain degree of cognitive impairment, which is associated with QoL. Although cognitive limitations and productivity loss were not significantly associated, this study draws the attention for considering early identification of cognitive problems in this particular patient group. In fact, studies that have been conducted overseas indicate the need for interventions on cognitive function of BCS. For example, Von Ah et al. (2012) reported that memory training group and online speed of processing training for BCS were associated with improvements in cognitive functioning, symptom distress and QoL. Derry et al., (2015) showed that BCS who had participated in a 12-week yoga intervention reported significantly fewer cognitive problems at 3-month follow-up. These provide insight for the inclusion of cognitive training for BCS to alleviate the impact of cognitive limitations in performing work tasks and to promote their QoL.

Limitations

Present findings must be considered in light of certain limitations. Sampling bias is possible as convenient sampling was used, and significant differences existed in some baseline demographics, although these did not have significant association with the outcome measures. Besides, the small sample size increases sampling error, which may lead to wrong estimation of the true population mean. As BCS were all employed and recruited from a single hospital, results cannot be generalized to all BCS in HK. Moreover, a causal relationship of cognitive symptoms with QoL cannot be established due to the cross-sectional design. It is because we cannot delineate which factor is the cause and which factor is the outcome, as both of them occur at the same time when the investigator is collecting the data. Other analytic observational methods, such as cohort and case—control study, to investigate temporal relationship between variables are recommended in future study to draw stronger conclusions on risk factors or predictors for certain outcomes and events. By contrast, self-report methods are susceptible to different sources of inaccuracy (e.g., social desirable responding) and may not reflect real performance (Paulhus & Vazire, 2007). Therefore, directions for future research include further examination of the relationship between cognitive limitations and work productivity while taking into account the limitations of this study. In addition, use of qualitative approach to explore the coping mechanisms and compensatory techniques adopted by BCS who have successfully sustained employment may also provide a more comprehensive understanding towards the experiences of this population. Lastly, as it has been identified that BCS experience significantly greater financial difficulties, it would be of value to explore the underlying factors, which may be related to their symptom burden.

Conclusion

Current results add to the support that BCS report greater cognitive limitations, which is associated with poorer self-reported QoL. However, associations between cognitive limitations and work-productivity have not been established, which may need to be further investigated for more conclusive results.

Acknowledgements

The authors are grateful for all the support and assistance received from Ms. Stella Cheng, Department of Occupational Therapy, Princess Margaret Hospital, and staff from the Breast Cancer Clinic, Princess Margaret Hospital.

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