



Quality of working life can protect against cognitive and emotional vulnerability in women living with metastatic breast cancer: a cross-sectional study

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Abstract

Purpose Research focusing on the cognitive and emotional health of women with metastatic breast cancer (MBC) is limited. The focal aim of the current study was to explore how quality of working life was related to global health, perceived cognitive function, anxiety and depression. To this end, women's experience of employers after MBC diagnosis and its relationship to quality of working life was also explored.

Methods Women living with MBC ($N=88$) completed online questionnaires assessing their global health status, perceived cognitive and emotional vulnerability and their experience of employers following diagnosis. Women working at the time of the study also reported on their quality of working life.

Results Women's experience of employers after MBC diagnosis was positively related to their quality of working life. Importantly, greater quality of working life met with better perceived cognitive function and global health, as well as lower levels of depression in working women.

Conclusions Our study is the first to establish the role of quality of working life in protecting against levels of cognitive vulnerability and emotional vulnerability to depression in women with MBC. We also highlight the importance of having a positive experience with employers. Our findings suggest that educational programmes can be provided to employers to enhance their understanding and awareness of the needs of women with MBC.

Implications for Cancer Survivors Women with MBC may benefit from employers accessing educational (or support) programmes that can increase their awareness of the treatment-related sequelae and needs of women with MBC in the workplace.

Keywords Anxiety · Depression · Experience of employer · Metastatic breast cancer · Perceived cognitive function · Quality of working life

Introduction

Only a very limited amount of research has explored the cognitive and emotional health of women living with metastatic breast cancer (MBC). It is estimated that currently, around 35,000 women are living with MBC in the United Kingdom (UK) [1]. According to recent figures, approximately 25% of women with stage 4 breast cancer will survive at least

5 years, a figure expected to continuously rise over the coming years as treatments advance further [2]. MBC survival rate is affected by a host of factors including the region of metastatic spread (e.g. brain, liver, lungs or bones), number of metastatic sites, tumour characteristics (e.g. oestrogen-receptor positive) and 'de novo' or metastases after primary breast cancer [3, 4].

Women with MBC are highly susceptible to experiencing emotional distress, including anxiety and depression [5–7] as well as cognitive problems [8]. This is partly due to the adverse side effects from treatment, poor social support and risk of disease (tumour) progression [5, 9]. Depression has been linked to poorer health-related quality of life, medical comorbidities, activity disruption and sleep problems in women with MBC [10–12]. In a recent

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meta-analysis [13], it was shown that anxiety and depression independently predicted all-cause mortality and cancer-related mortality by up to 30% in MBC respectively, calling for an urgent need for interventions that can target cognitive and emotional health and improve the quality of life (QoL) in MBC. In a recent study by Dobretsova and Derakshan [14], it was found that good cognitive functioning and its interaction with social support protected against depression in women with MBC such that those with high levels of cognitive functioning and high support had the lowest levels of depression. Depression has also been shown to negatively correlate with employment status, such that being unemployed is significantly associated with greater depression in cancer survivors [15]. An earlier study has shown that a reduction in depression over the first year of a randomised control trial increased duration of survival time in MBC by approximately 28.5 months (median survival time for decrease = 53.6 months and increase = 25.1 months) [16].

Research shows that work plays a central role in providing a sense of value and meaning in everyday life and substantially contributes to re-affirming identity after a breast cancer diagnosis. Most often women with earlier-stage cancer report returning to work gave them a sense of normality and distraction away from their cancer patient identity as well as helping with financial concerns [17, 18]. Financial worries and economic burden (i.e. reduction in the number of working hours) created by a cancer diagnosis are significantly associated with a worse QoL [19, 20] and higher levels of anxiety [7] and depression [21].

Verrill et al. [22] showed that approximately one in four (25%) women with MBC are unable to work following their diagnosis. Factors such as pain, nausea, fatigue, sadness, drowsiness, memory difficulties and numbness/tingling have been associated with poor sustainment of work in individuals with metastatic cancer [23]. Similarly, to women with earlier-stage breast cancer, women with MBC have been shown to experience reduced workability and productivity [22, 24, 25]. In women with earlier-stage cancer, employer and co-worker support and flexibility have been linked to better workability, confidence, retention of work and an earlier return to work [26–28]. Lyons et al. [25] delineated that over two-thirds of women living with advanced breast cancer reported that they were restricted in the types of work they can perform (68%), had to reduce their work (71%) or needed to take frequent rest breaks at work to manage their adverse side effects (71%). These figures indicate that women with MBC require a high level of employer understanding, support and flexibility.

A recent qualitative study by Chapman et al. [29] revealed that working women living with a history of primary breast cancer often experience a lack of

understanding from their employers when it comes to fatigue and cognitive impairment. Factors such as social support, job stress and fatigue have been shown to significantly influence quality of working life amongst cancer survivors [30, 31]. Quality of working life is defined as ‘the experiences and perceptions of cancer survivors in their work life’ [32]. At present, the effects of workplace experiences with employers (e.g. understanding towards required adjustments) and quality of working life on cognitive and emotional health are understudied in women living with a diagnosis of MBC.

Current investigation

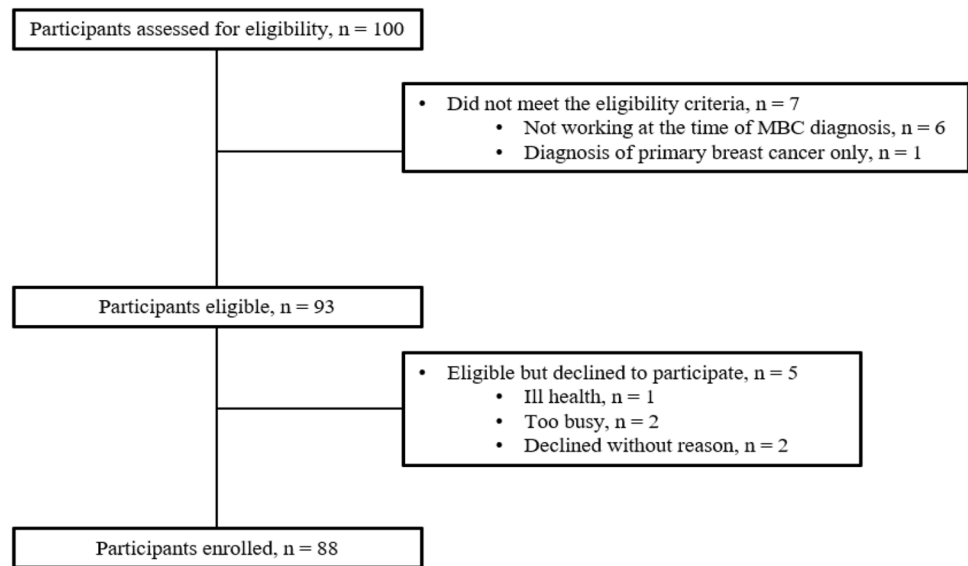
Considering studies have shown that continued work has a plethora of benefits including better quality of life and lower emotional distress in non-metastatic breast cancer, it is crucial to extend this research and explore the relationships between quality of working life and workplace experiences (e.g. understanding) with perceived cognitive and emotional vulnerability (anxiety and depression) as well as global health in women with a diagnosis of MBC. Our main aim was to examine how quality of working life was related to anxiety and depression levels as well as perceived cognitive functioning and global health. To this end, we investigated women’s experiences of employers (MBC-EE) and its relationship with quality of working life. As younger age is predictive of psychological distress including anxiety and depression in MBC [11, 33] and its interaction with cognitive functioning in predicting traumatic stress has recently been established in MBC [14], we looked at the role(s) of age and other demographic factors such as education and time since diagnosis.

Accordingly, we predicted that self-reported quality of working life would be associated with global quality of life measures as well as negatively related to emotional vulnerability to anxiety and depression and cognitive vulnerability. We also predicted that women’s experience of employers would correlate positively with quality of working life.

Method

Design

The design was cross-sectional. Women were asked to complete a battery of online questionnaires assessing their cognitive and emotional wellbeing as well as their work experiences following their MBC diagnosis. The study was approved by the Research Ethics Committee of the Department of Psychological Sciences, the College Research Ethics

Fig. 1 Flowchart of participants

Committee at Birkbeck College, University of London, and the Economic and Social Research Council.

Participants

Women living with an MBC diagnosis ($N=88$) in the UK were recruited via voluntary sampling using online advertisements placed on breast cancer support groups and forums including, ‘Building Resilience in Breast Cancer Centre’ (BRiC; <http://briccentre.bbk.ac.uk/>), Macmillan, MET UP UK, Stage4needs more between 1st March 2021 and 4th June 2021. The inclusion criteria included living with a diagnosis of MBC, over the age of 18 years, receiving treatment(s) including hormone therapy, target therapy, chemotherapy and radiotherapy or not receiving treatment. Women were also required to be working (employed, self-employed or volunteering) at the time of their MBC diagnosis but did not have to be working at the time of enrolment. Reasons given for not taking part in the study included not working at the time of MBC diagnosis ($n=6$), diagnosis of primary breast cancer ($n=1$), being too busy to complete ($n=2$) and unexpected ill health ($n=1$) (see Fig. 1 for the flowchart of participants).

Materials

MBC Demographics Questionnaire (MDQ)

The MDQ (developed by the authors; [14]) contains 26 items assessing women’s sociodemographic (i.e. civil status, level of education and ethnic origin), MBC history (i.e. time since MBC diagnosis and region of cancer metastases) and work-related characteristics. All information was self-reported.

Functional Assessment of Cancer Therapy-Cognitive Scale (FACT-Cog)

The Functional Assessment of Cancer Therapy-Cognitive Scale (FACT-Cog) [34] is a highly reliable and valid 37-item patient report outcome measure (PROM) that is used in breast cancer research [35] to assess cognitive function. The FACT-Cog is composed of four subscales known as perceived cognitive impairment (PCI, 20 items, range=0–80, Cronbach’s $\alpha=0.96$), perceived cognitive ability (PCA, nine items, range=0–36, Cronbach’s $\alpha=0.91$), impact on quality of life (QoL, four items, range=0–16, Cronbach’s $\alpha=0.95$) and comments from others (CFO, four items, range=0–16, Cronbach’s $\alpha=0.79$). Items are measured on a 5-point Likert scale from (0) ‘never’ or ‘not at all’ to (4) ‘several times a day’ or ‘very much’ with reverse scoring for the negatively phrased scales (PCI, QoL, CFO). Total scores range from 0 to 148, with higher subscale scores and a total score (summation of subscales) demonstrating a better perceived cognitive function.¹ An excellent Cronbach’s α was found for the total score (Cronbach’s $\alpha=0.96$) in the current study. The total score was selected as the variable of interest to increase power in our analyses.

Hospital Anxiety and Depression Scale (HADS)

The Hospital Anxiety and Depression Scale [38] is a reliable and valid PROM that measures the level of anxiety and

¹ In line with Cheung et al. [36] and Bell et al. [37], all 37 items of the FACT-Cog were used to calculate the total score. As recommended by FACIT.org, individual item-total score correlation coefficients were explored for PCI, PCA and FACT-Cog total. Results showed that all 37 items from the FACT-cog should be included in the current study.

depression experienced in the last 7 days. The HADS is a widely applied scale that has previously been used in MBC research [7]. It is composed of 14 items that form two subscales (anxiety and depression) and a total score representing emotional distress. Items are measured on a 4-point Likert scale from 0 to 3, with total scores ranging from 0 to 21. Higher scores show a higher level of anxiety or depression. High Cronbach's α scores were identified for the current study (Anxiety: Cronbach's $\alpha=0.85$; Depression: Cronbach's $\alpha=0.78$; HADS total: Cronbach's $\alpha=0.86$).

European Organisation for Research and Treatment of Cancer Quality of Life (EORTC-QLQ-Q30, Version 3)

The European Organisation for Research and Treatment of Cancer Quality of Life [39] is a reliable and valid PROM that assesses health-related quality of life and is used in MBC research [40]. The EORTC-QLQ-C30 is comprised of five functional scales (physical, role, emotional, cognitive and social functioning), three symptom scales (fatigue, nausea and vomiting and pain), six symptom items (dyspnoea, insomnia, appetite loss, constipation, diarrhoea and financial difficulties) and two global health status items (health and quality of life). Functional scales, symptom scales and symptom items are measured on a 4-point Likert scale from 'not at all' (1) to 'very much' (4). Global health status items are measured on a 7-point Likert scale from 'very poor' (1) to 'excellent' (7). Scores are calculated by summing the responses and then dividing by the number of answered items. The raw score is then converted using linear transformation to create a score that ranges from 0 to 100. Three overall scores are formed including the global health status score ($\alpha=0.88$), financial impact score and EORTC-summary score ($\alpha=0.90$). The EORTC-QLQ-C30 summary score is calculated from the mean of the transformed functional scales, symptom scales and five symptom items (excluding financial difficulties) [41]. Higher scores for the EORTC-summary score and global health status score represent a better health-related quality of life and ability to function in everyday life whilst higher scores for the financial impact score demonstrate more severe financial difficulty. The present study had a good Cronbach's α ($\alpha=0.82$). The global health status score and financial difficulty were used as variables of interest.

Quality of Working Life for Cancer Survivors (QWLQ-CS)

The 23-item Quality of Working Life for Cancer Survivors [42] is a reliable and valid PROM that assesses work experience. The QWLQ-CS is composed of five subscales known as the (1) meaning of work (four items), (2) perception of the work situation (five items), (3) atmosphere in

the work environment (five items), (4) understanding and recognition (five items) and (5) problems due to health (four items). Each item is measured on a 6-point Likert scale from 'Totally disagree' to 'Totally agree' with reverse scoring for the five negatively phrased items. Scores for each of the subscales and the QWLQ-CS total are then converted to a standardised score that ranges from 0 to 100 using the formula: $((\text{sum of items} - \text{lowest possible sum score}) / (\text{range between lowest and highest score}) \times 100)$. At least 50% of the items must be answered for a score to be calculated. Higher scores represent a better quality of working life. Excellent Cronbach's α scores were found for the current study (Meaning of work: Cronbach's $\alpha=0.96$, Perception of the work situation: Cronbach's $\alpha=0.86$, Atmosphere in work environment: Cronbach's $\alpha=0.85$, Understanding and recognition: Cronbach's $\alpha=0.81$, Problems due to health: Cronbach's $\alpha=0.82$, Overall QWLQ-CS score: Cronbach's $\alpha=0.91$). The overall QWLQ-CS score was used as the variable of interest to increase power in our analyses.

Work Productivity and Activity Impairment Questionnaire: Specific Health Problem (WPAI: SHP)

The Work Productivity and Activity Impairment Questionnaire: Specific Health Problem (version 2) [43] is a self-report questionnaire composed of six items that examine the impact of MBC on workability and on ability to carry out regular activities. Item one assesses current employment status. Items two, three and four ask about the number of hours missed or worked in the last 7 days and items five and six measure the impact of MBC on productivity at work and ability to complete regular daily activities outside of work. Items five and six are measured on a Likert scale ranging from 0 to 10, with higher scores representing a greater adverse impact of MBC. Four sub-scores ((1) absenteeism due to MBC, (2) impairment at work due to MBC, (3) overall work impairment due to MBC and (4) activity impairment due to MBC) are calculated using the values reported and then converted into a percentage. Higher scores reflect worse impairment and productivity loss as a result of MBC. The WPAI: SHP has been used in previous MBC research [22, 24, 44].

Workplace Experience Questions (WPEQ)

The 22 items were developed by the authors to explore women's experiences with their employers in the workplace following their diagnosis of MBC. Multiple-choice items were used to assess the influence of employers on employment status, factors that prompted the decision to leave the workforce and financial burden. Furthermore, multiple-choice items were also used to examine the required work adjustments. Ten Likert scale items measured women's

experiences with employer support, understanding, awareness and the impact on confidence at work. Each item is measured on a 6-point scale from ‘not at all’ or ‘much less’ (0) to ‘extremely’ or ‘much more’ (5). Higher scores represent a better experience of employers and more positive views of work. Two composite mean scores were formed and referred to as experience of employers score (MBC-EE score: Cronbach’s $\alpha = 0.88$) and personal views of work score (MBC-PVW score: Cronbach’s $\alpha = 0.85$). The experience of employers score (MBC-EE) and personal views of work score (MBC-PVW) were used as the variables of interest in the current study.

Procedure²

Women who expressed interest in participating in the study were sent an email containing the study information, participant inclusion criteria and a secure URL link to access the questionnaires. Women were asked to provide online consent before completing the MDQ followed by the cognitive and emotional health questionnaires and WPEQ. Those who outlined being employed, self-employed or volunteering were asked to complete the work questionnaires (QWLQ-CS, WPAI: SHP). Women were asked to complete the questionnaires during a single session to ensure consistency although they were told they could take short breaks as required. Upon completion, a £6 gift voucher was sent via email.

Statistical analysis

Statistical analyses were carried out using the Statistical Packages for the Social Sciences (SPSS, version 28). Outliers were assessed using histograms and box plots and dealt with using Winsorization prior to analysis. Descriptive statistics were produced for the sociodemographic information, breast cancer history and work-related characteristics as well as self-reported questionnaire scores (see Table 1 for participant demographics and Table 2 for summaries for questionnaire scores).

Using Shapiro–Wilk normality was assessed. Pearson’s correlation analysis with bootstrapping was performed between women’s experience of employers (MBC-EE score) and quality of working life for cancer survivors (QWLQ-CS) to examine whether women’s experience with their employer after their MBC diagnosis related to their quality of working life. Likewise, analysis was also conducted between personal views of work (MBC-PVW score) and QWLQ-CS to

investigate whether women’s views of work correlated with their perceived quality of working life.

Hierarchical regression analyses were then conducted to examine the relationship of quality of working life in women working (employed, self-employed or volunteering) at the time of the study to four dependent variables including perceived cognitive function, anxiety, depression and global health status after allowing for sociodemographic factors. Step 1 included education, time since MBC diagnosis and current age. Overall quality of working life (as measured by QWLQ-CS) was added as the final predictor on step 2. Assessing analysis of standardised residual, no outliers were found for depression (Cooks distance = 0.2, std Residual Min = -1.9, std Residual Max = 2.9), anxiety (Cooks distance = 0.2, std Residual Min = -2.0, std Residual Max = 2.2), global health status (Cooks distance = 0.1, std Residual Min = -2.0, std Residual Max = 2.6) and perceived cognitive function (Cooks distance = 0.2, std Residual Min = -2.2, std Residual Max = 1.9).

Moreover, checks for violations of the assumptions of collinearity, independent error, normality, homoscedasticity and linearity were conducted using histogram and normal P-P plots and all assumptions were met for all of the regression analyses performed. Cohen’s f^2 was calculated.

Additional bootstrapped Pearson’s correlation analysis was conducted to explore whether financial difficulty related to perceived cognitive and emotional vulnerability (anxiety and depression) as well as global health in women attending paid work (employed or self-employed) or not in paid work (volunteering or not undertaking any form of work) at the time of the study.

Results

Sample characteristics

Table 1 shows the sociodemographic, breast cancer history and work-related characteristics of the 88 women recruited. Women had a mean age of 46 years ($SD = 7.5$, range 33–65) at the time of MBC diagnosis and a mean time of 31.6 ($SD = 24.3$, range 0–115) months since their MBC diagnosis. Approximately 74% of women were employed, self-employed or undertaking volunteering at the time of the study.

Table 2 shows the descriptive summaries for women’s cognitive and emotional health scores (anxiety and depression) as well as global health status and experience of employers (MBC-EE) following their MBC diagnosis across the entire sample ($N = 88$). Personal views of work score (MBC-PVW) for women working (employed, self-employed or volunteering) at the time of study is also included.

² This study was conducted during the COVID-19 outbreak in the UK.

Table 1 Participant sociodemographic, breast cancer history and work-related characteristics

| | <i>N</i> = 88 | (%) |
|--|------------------------------------|------|
| Sociodemographic | | |
| Age | Mean 49.5 (SD = 7.2, range 36–68) | |
| Education ^a | | |
| Secondary education | 9 | 10.2 |
| Further education | 19 | 21.6 |
| Higher education | 58 | 65.9 |
| Ethnicity | | |
| White | 83 | 94.3 |
| Asian | 2 | 2.3 |
| Multi-ethnic | 2 | 2.3 |
| Middle Eastern | 1 | 1.1 |
| Civil status | | |
| Married/civil partnership/cohabiting | 67 | 76.1 |
| Divorced/separated | 7 | 7.9 |
| Single/widowed | 14 | 15.9 |
| Psychiatric condition | 10 | 11.4 |
| Neurological condition | 8 | 9.1 |
| Clinical breast cancer history | | |
| Age at MBC diagnosis ^b | Mean 46.7 (SD = 7.5, range 33–65) | |
| Time since MBC diagnosis (months) ^c | Mean 31.6 (SD = 24.3, range 0–115) | |
| Region of cancer metastases | | |
| Bone | 66 | 75.0 |
| Lungs | 25 | 28.4 |
| Brain | 6 | 6.8 |
| Liver | 23 | 26.1 |
| Other | 12 | 13.6 |
| Current treatment | | |
| Surgery | 1 | 1.1 |
| Chemotherapy | 26 | 29.5 |
| Radiotherapy | 1 | 1.1 |
| Hormone therapy | 55 | 62.5 |
| Target therapy | 49 | 55.7 |
| Other | 7 | 8.0 |
| None | 1 | 1.1 |
| Work | | |
| Current work | | |
| Employed | 56 | 64.4 |
| Self-employed | 6 | 6.9 |
| Undertaking volunteering work | 3 | 3.4 |
| Not undertaking any form of work | 23 | 26.4 |

^aTwo participants did not report their highest level of education, ^bOne participant did not report their age at the time of their MBC diagnosis, ^cSix participants did not state the number of months since their MBC diagnosis

Relationship between women's experience of employers and quality of working life

In working (employed, self-employed or volunteering) women, experience of employers (MBC-EE score) was significantly correlated with the quality of working life

(QWLQ-CS) $r(61) = 0.48$, BCa 95% CI [0.28, 0.65], $p < 0.001$, suggesting that better experience with employers (e.g. greater understanding) was associated with a greater quality of working life (Fig. 2).

Similarly, the personal views of work score (MBC-PVW score) significantly correlated with QWLQ-CS, r

Table 2 Descriptive summaries for each of the self-reported questionnaires

| | Mean (SD) | Range (minimum–maximum) |
|--|-------------|-------------------------|
| Perceived cognitive function (FACT-Cog total score) ^a | 93.1 (27.1) | 34–144 |
| Anxiety (HADS-A) | 9.2 (4.2) | 2–19 |
| Depression (HADS-D) | 6.3 (3.5) | 0–16 |
| Global health status (EORTC-QLQ-C30) | 60.3 (19.2) | 8.33–100 |
| Experience of employers (MBC-EE) | 3.7 (1.1) | 1–5 |
| Personal views of work (MBC-PVW) | 2.9 (1.2) | 0–5 |

Independent (bootstrapped) *t*-test showed no significant difference in experience of employers (MBC-EE) (0.32, BCa 95% CI [0.64, 4.26], *t* (84) = 2.61, *p* = .26) between women who were working (employed, self-employed or volunteering) at the time of the study (*M* = 3.82, *SD* = 1.11) and those not working (*M* = 3.49, *SD* = 1.17) at the time of the study

^aPerceived cognitive function (FACT-Cog): higher score = greater perceived cognitive function; Anxiety and depression (HADS): higher score = greater symptomology; Global health status (EORTC-QLQ-C30): higher score = better global health; MBC-EE: higher score = better experience with employers; MBC-PVW: higher score = more positive view of work

Fig. 2 A scatterplot showing the relationship between women’s experience of employers (MBC-EE score) and quality of working life (QWLQ-CS). *R*² = 0.23

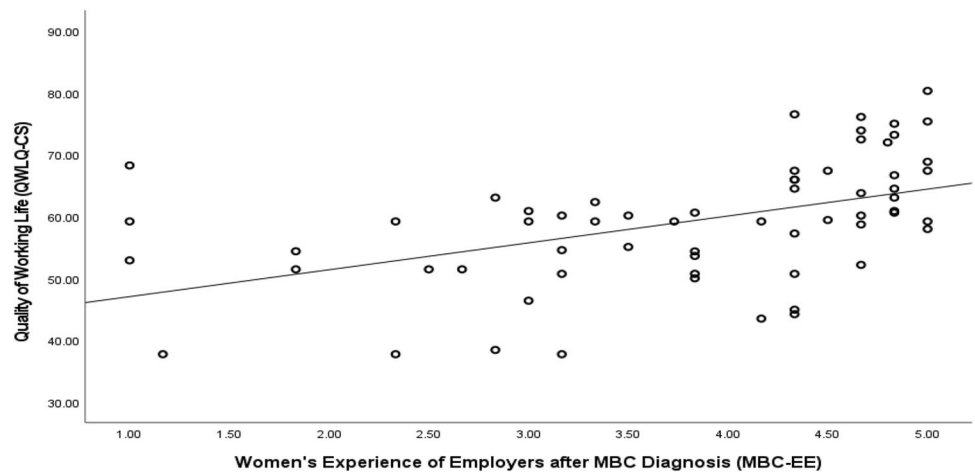
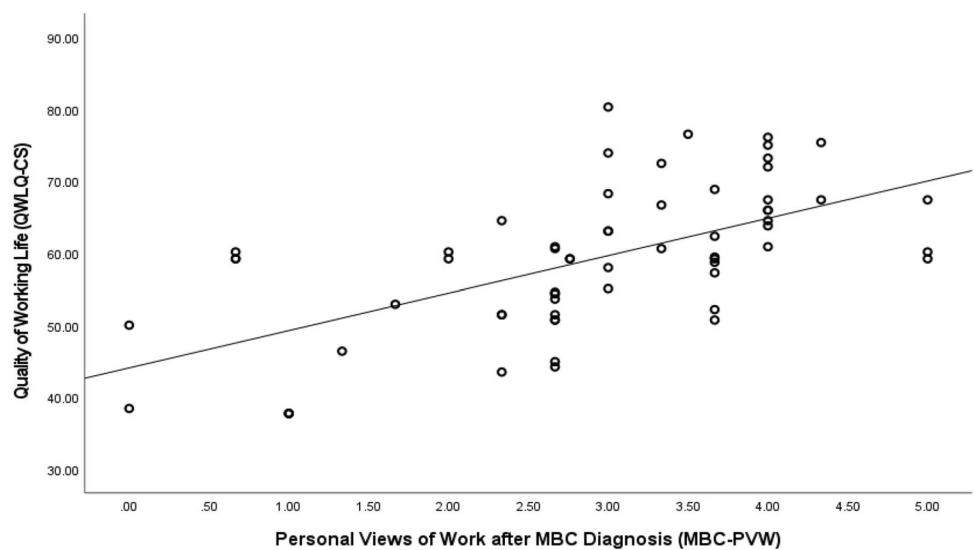


Fig. 3 A scatterplot showing the relationship between personal views of work (MBC-PVW score) and quality of working life (QWLQ-CS). *R*² = 0.37



(61)=0.60, BCa 95% CI [0.43, 0.74], $p < 0.001$, indicating that more positive views of work met with a greater quality of working life (Fig. 3).

Relationships between quality of working life with perceived cognitive impairment, emotional distress and global health in working women with MBC

Perceived cognitive function³ As Table 3 shows, quality of working life (QWLQ-CS) was a significant predictor ($t(60) = 3.75$, $p < 0.001$) of perceived cognitive function as measured by the FACT Cog total score (Cohen's $f^2 = 0.23$), with the model overall predicting around 23% of the variance in cognitive function.

Depression Table 3 shows that education was a significant predictor of depression on step 1 ($t(60) = -2.0$, $p = 0.05$). Lower education levels (secondary/further education) were met with higher depression ($M = 7.33$, $SD = 2.94$) compared with those who had higher education degrees who had lower depression scores ($M = 5.68$, $SD = 3.68$). Quality of working life significantly predicted depression on step 2 ($t(60) = -3.23$, $p < 0.005$). Education remained a significant predictor ($p < 0.05$). Overall, the model explained around 21% of the variance in depression (Cohen's $f^2 = 0.17$).

Anxiety The only variables significant in predicting anxiety on both steps were education and current age, both t 's > -2.5 , both p 's = 0.01. Lower education levels (secondary/further education) were met with higher anxiety ($M = 10.67$, $SD = 3.89$) compared with those who had higher education degrees ($M = 8.75$, $SD = 3.99$). Younger (current) age was also met with higher anxiety (younger: $M = 10.11$, $SD = 4.27$; older: $M = 8.33$, $SD = 3.50$). Quality of working life did not significantly predict anxiety ($t(60) = -1.22$, $p > 0.05$). Overall, approximately 18% of the variance was explained by the models in predicting anxiety (see Table 3 for regression).

Global health status The only significant predictor of global health was quality of working life ($t(60) = 3.26$, $p < 0.005$) with an overall 15% of variance explained. Greater quality of working life met with higher global health status. Cohen's $f^2 = 0.18$ (see Table 3 for regression).

Checks for violation of assumptions using residuals revealed that assumptions of collinearity (Tolerance > 0.01 , VIF < 10), independent error (Perceived cognitive function:

Durbin-Watson = 1.7, Depression: Durbin-Watson = 1.9, Anxiety: Durbin-Watson = 2.2, Global health status: Durbin-Watson = 2.1), normality and homogeneity of variance and linearity were met for perceived cognitive function, anxiety, depression and global health status.

Additional analyses

Relationships between financial difficulty and cognitive and emotional vulnerability depending on work status at the time of the study

In working women in paid work (employed, self-employed), financial difficulty was significantly correlated with quality of working life (QWLQ-CS) ($r(60) = -0.50$, BCa 95% CI $[-0.67, -0.29]$, $p < 0.001$), depression ($r(62) = 0.28$, BCa 95% CI $[0.06, 0.48]$, $p = 0.03$) and perceived cognitive function ($r(62) = -0.37$, BCa 95% CI $[-0.55, -0.18]$, $p = 0.003$), suggesting that greater financial difficulty was associated with a poorer quality of working life, greater depression and worse perceived cognitive function. No significant relationship was found with anxiety ($p > 0.05$).

Furthermore, financial difficulty significantly correlated with anxiety, $r(22) = 0.46$, BCa 95% CI $[0.11, 0.72]$, $p = 0.02$ in women not in paid work (volunteering or not undertaking any form of work) at the time of the study, suggesting greater financial difficulty was related to greater anxiety. No significant relationships were found with depression or perceived cognitive function ($p > 0.05$).

Discussion

To our knowledge, the current study is the first to investigate the relationship between quality of working life and perceived cognitive function, anxiety, depression and global health status in women living with a diagnosis of MBC in the UK, in addition to exploring women's experience of employers (MBC-EE) and its relationship with quality of working life. As predicted, we found that women's experience of employers after MBC diagnosis positively correlated with self-reported quality of working life, such that having a better experience with employers met with a greater quality of working life. Similarly, we found that a more positive view of work (MBC-PVW) met with a better quality of working life. Much like early-stage breast cancer, women with MBC experience a series of debilitating treatment-related sequelae such as fatigue [45] and pain [46]. Women also attend regular oncology appointments and treatment sessions that can adversely impact their work presenteeism. In a recent study by Lyons et al. [25], it was shown that more than two-thirds of women with MBC report being restricted in work and require a series of work-based adaptations indicating social

³ Quality of working life (QWLQ-CS) was a significant predictor of the FACT sub-scale PCI ($t(60) = 3.12$, $p < .005$), PCA ($t(60) = 3.31$, $p < .005$) and QoL ($t(60) = 4.67$, $p < .001$).

Table 3 Hierarchical regression analyses for perceived cognitive function, depression, anxiety and global health status

| | <i>b</i> | <i>SE B</i> | β | <i>t</i> | <i>p</i> |
|-------------------------------------|-----------------------|-------------|---------|----------|----------|
| Perceived cognitive function | | | | | |
| Step 1 | | | | | |
| Constant | 62.90 (3.06, 122.73) | 29.92 | | 2.10 | 0.04 |
| Education | 11.16 (−4.27, 26.59) | 7.72 | 0.20 | 1.45 | 0.15 |
| Time since MBC diagnosis | −0.07 (−0.39, 0.26) | 0.16 | −0.05 | −0.42 | 0.67 |
| Current age | 0.50 (−0.58, 1.58) | 0.54 | 0.12 | 0.93 | 0.36 |
| $R^2=0.05$ | | | | | |
| $F(3,61)=0.96$ | | | | | |
| $p=0.42$ | | | | | |
| Step 2 | | | | | |
| Constant | −2.20 (−66.66, 62.27) | 32.23 | | −0.07 | 0.95 |
| Education | 10.43 (−3.58, 24.44) | 7.01 | 0.18 | 1.49 | 0.14 |
| Time since MBC diagnosis | 0.07 (−0.23, 0.37) | 0.15 | 0.05 | 0.45 | 0.65 |
| Current age | 0.31(−0.68, 1.29) | 0.49 | 0.08 | 0.62 | 0.54 |
| Quality of working life | 1.21 (0.56, 1.85) | 0.32 | 0.44 | 3.75 | 0.00 |
| $R^2=0.23$ | | | | | |
| $\Delta R^2=0.18$ | | | | | |
| $\Delta F(1,60)=14.07$ | | | | | |
| $p<0.001$ | | | | | |
| Depression | | | | | |
| Step 1 | | | | | |
| Constant | 11.48 (3.81, 19.15) | 3.84 | | 2.99 | 0.00 |
| Education | −1.98 (−3.96, −0.00) | 0.99 | −0.27 | −2.00 | 0.05 |
| Time since MBC diagnosis | 0.01 (−0.03, 0.05) | 0.02 | 0.06 | 0.43 | 0.67 |
| Current age | −0.09 (−0.22, 0.05) | 0.07 | −0.16 | −1.23 | 0.22 |
| $R^2=0.08$ | | | | | |
| $F(3,61)=1.72$ | | | | | |
| $p=0.17$ | | | | | |
| Step 2 | | | | | |
| Constant | 18.84 (10.37, 27.32) | 4.24 | | 4.45 | 0.00 |
| Education | −1.90 (−3.74, −0.06) | 0.92 | −0.25 | −2.06 | 0.04 |
| Time since MBC diagnosis | −0.01 (−0.05, 0.03) | 0.02 | −0.04 | −0.33 | 0.75 |
| Current age | −0.06 (−0.19, 0.07) | 0.07 | −0.12 | −0.97 | 0.34 |
| Quality of working life | −0.14 (−0.22, −0.05) | 0.04 | −0.39 | −3.23 | 0.00 |
| $R^2=0.21$ | | | | | |
| $\Delta R^2=0.14$ | | | | | |
| $\Delta F(1,60)=10.41$ | | | | | |
| $p=0.002$ | | | | | |
| Anxiety | | | | | |
| Step 1 | | | | | |
| Constant | 20.80 (12.42, 29.19) | 4.19 | | 4.96 | 0.00 |
| Education | −2.77 (−4.93, −0.60) | 1.08 | −0.32 | −2.56 | 0.01 |
| Time since MBC diagnosis | 0.01 (−0.04, 0.06) | 0.02 | 0.06 | 0.45 | 0.65 |
| Current age | −0.20 (−0.35, −0.05) | 0.08 | −0.33 | −2.65 | 0.01 |
| $R^2=0.16$ | | | | | |
| $F(3,61)=3.83$ | | | | | |
| $p=0.01$ | | | | | |
| Step 2 | | | | | |
| Constant | 24.07 (14.16, 33.98) | 4.96 | | 4.86 | 0.00 |
| Education | −2.73 (−4.88, −0.58) | 1.08 | −0.32 | −2.53 | 0.01 |
| Time since MBC diagnosis | 0.00 (−0.04, 0.05) | 0.02 | 0.02 | 0.15 | 0.88 |

Table 3 (continued)

| | <i>b</i> | <i>SE B</i> | β | <i>t</i> | <i>p</i> |
|--------------------------|-----------------------|-------------|---------|----------|----------|
| Current age | −0.19 (−0.34, −0.04) | 0.08 | −0.32 | −2.52 | 0.01 |
| Quality of working life | −0.06 (−0.16, 0.04) | 0.05 | −0.15 | −1.22 | 0.23 |
| $R^2=0.18$ | | | | | |
| $\Delta R^2=0.02$ | | | | | |
| $\Delta F(1,60)=1.50$ | | | | | |
| $p=0.23$ | | | | | |
| Global health status | | | | | |
| Step 1 | | | | | |
| Constant | 56.96 (18.01, 95.90) | 19.48 | | 2.92 | 0.01 |
| Education | 0.93 (−9.12, 10.97) | 5.02 | 0.03 | 0.19 | 0.85 |
| Time since MBC diagnosis | 0.04 (−0.17, 0.25) | 0.11 | 0.05 | 0.38 | 0.71 |
| Current age | 0.04 (−0.66, 0.74) | 0.35 | 0.02 | 0.12 | 0.91 |
| $R^2=0.003$ | | | | | |
| $F(3,61)=0.05$ | | | | | |
| $p=0.98$ | | | | | |
| Step 2 | | | | | |
| Constant | 19.25 (−23.73, 62.22) | 21.48 | | 0.90 | 0.37 |
| Education | 0.51 (−8.84, 9.85) | 4.67 | 0.01 | 0.11 | 0.91 |
| Time since MBC diagnosis | 0.12 (−0.08, 0.32) | 0.10 | 0.15 | 1.18 | 0.24 |
| Current age | −0.07 (−0.73, 0.58) | 0.33 | −0.03 | −0.22 | 0.83 |
| Quality of working life | 0.70 (0.27, 1.13) | 0.22 | 0.40 | 3.26 | 0.00 |
| $R^2=0.15$ | | | | | |
| $\Delta R^2=0.15$ | | | | | |
| $\Delta F(1,60)=10.62$ | | | | | |
| $p=0.002$ | | | | | |

(95% confidence intervals)

support and understanding in the workplace are essential. It has been shown that greater social support, as well as lower job stress and fatigue, predicts a better quality of working life in cancer survivors [30, 31]. It is plausible that our finding could be underpinned by greater experience of employers reducing levels of job stress, increasing work engagement and promoting a sense of value and worthiness in the workplace, subsequently improving perceptions of quality of working life. Supporting the needs of women with MBC in the workplace is, however, highly complex and many employers may not feel adequately equipped to provide the level of support and work-based adaptations required, potentially resulting in limited communication and disclosure of information. Further qualitative research is needed to understand women's experiences of employers and explore the factors influencing quality of working life in women living with MBC. We advocate that research also urgently needs to better understand employers' experiences of supporting an employee with MBC.

In line with our prediction, we also found that greater quality of working life met with better perceived cognitive function and global health status as well as fewer depressive symptomology. Such findings suggest that quality of

working life may play a crucial role in protecting against escalating levels of pre-existing cognitive vulnerability and emotional vulnerability to depression in working women living with MBC. Substantiating evidence has shown that emotional distress (anxiety and depression) [6], cognitive impairment [8] and reduced quality of life [46] are common amongst women with MBC. Depression has been associated with poorer adherence to treatment [47], health-related quality of life and sleep problems [11] as well as increased suicidal ideations [48] in cancer patients including those with breast cancer. Given that an earlier meta-analysis conducted by Wang et al. [13] found depression to increase the risk of cancer-related mortality by up to 29% in women with breast cancer, our finding has important implications. In particular, we advocate that more accessible resources and educational (or support) programmes should be offered to employers and co-workers of women diagnosed with MBC to help enhance their understanding and awareness of the common treatment-related sequelae and possible adjustments needed in the workplace. Notably, Giese-Davis et al. [16] found reductions in depression increased MBC survival time by around 28 months. It is, therefore, possible that enhancing the quality of working life by improving experience of

employers may contribute to longer-term survivorship in working women with MBC, although further longitudinal research is required to substantiate this claim.

As mentioned, we found that women with a greater quality of working life experienced better perceived cognitive functioning; this is an important finding as our earlier work has shown that reduced self-reported cognitive function adversely affects workability, general emotional health and work-related confidence in women with a history of primary breast cancer [29]. Collectively our findings indicate that greater quality of working life may play an influential role in enhancing workability by increasing perceived cognitive function in working women with MBC. Reduced workability and work productivity are common amongst women with MBC [22, 24, 25]. We recommend that subsequent research be conducted to investigate the moderating role of quality of working life in the relationship between perceived cognitive function and workability. It is feasible that women with a higher quality of working life experience less job stress, which has been associated with self-reported cognitive function in cancer survivors [49]. Stress has been shown to adversely affect key brain regions including the prefrontal cortex and hippocampus [50]. Similar to our finding, Mehnert and Koch [51] found higher work satisfaction correlated with better health-related quality of life amongst cancer survivors. More research is needed to develop our understanding of the factors underpinning the relationships between quality of working life with perceived cognitive function and health-related quality of life.

Interestingly, we found that quality of working life was not associated with anxiety in women with MBC; however, in line with existing research, both current age and level of education were significantly associated with anxiety in our study [11, 52]. We found that younger age and lower education met with more severe anxiety. Education was also predictive of depression, with lower education associated with greater depression. These findings have vital implications as they evince that younger working women with MBC and those with a lower level of education are more vulnerable to developing anxiety and depression, escalating their risk of premature mortality. Healthcare professionals including occupational health should account for these sociodemographic factors when determining the support provided, as women in these high-risk groups may benefit from receiving early or more continuous access to e-health apps, counselling services or cognitive interventions that promote emotional resilience. One possible reason for our non-significant finding is that the anxiety experienced by women with MBC is driven by factors such as treatment uncertainty, fear for disease progression and death, which are not impacted by quality of working life. In a recent study by Verduzco-Aguirre et al. [53], it was shown that uncertainty is met with high levels of anxiety in individuals living with advanced

cancer. Although age and education have also been shown to influence risk for cognitive impairment and poorer QoL [8, 35], our study did not replicate these findings in working women with MBC.

Finally, our additional exploration analyses showed that financial difficulty was associated with elevated levels of anxiety in women not undertaking any form of paid work at the time of the study. In a study by Park et al. [7], it was shown that less financial comfort was predictive of anxiety in young women diagnosed with de novo breast cancer. Our finding may be explained by the fact that women in this sample were younger (current age: $M = 50.08$) increasing the likelihood that they will be affected by family responsibilities (i.e. supporting a dependent) and financial obligations such as a mortgage. In addition, we also found greater financial difficulty to be related to poorer quality of working life as well as worse depression and perceived cognitive function in women attending paid work (employed or self-employed). Perry et al. [21] reported a similar relationship between financial strain and depression in women with breast cancer and de Jong et al. [54] found poorer quality of working life to be associated with lower income in cancer survivors. It is plausible that our findings in working women may be connected to reduced career progression and work opportunities following MBC diagnosis. Our earlier work has shown career progression is at a standstill for many primary breast cancer survivors as a result of the effects from post-treatment sequelae [29]. Similar research should explore career development and opportunities in women living with MBC.

Limitations

This study was limited in that women were recruited from online advertisements placed on public and private support groups on social media platforms including Facebook, Twitter and Instagram and, therefore, may not be fully representative. The sample was also well-educated (65.9%) and Caucasian (94.3%), indicating women from BAME backgrounds were underrepresented. Another limitation is that women were asked to self-report their demographic and clinical information. Medical records should be obtained and checked to ensure the reliability of the information reported in future studies. Finally, our study was cross-sectional meaning that it only provides a single snapshot of women's experiences at the time of completing the study and thus could be influenced by current mood or situational events. We recommend future research to include longitudinal studies with follow-ups as well as qualitative data to provide a more in-depth understanding of women's experiences at work and the factors affecting perceived cognitive impairment and emotional vulnerability to depression. Research should also explore the relationship between objective

cognitive function and work-related outcomes including quality of working life in women living with a diagnosis of MBC.

Conclusion

This study investigated the relationship between quality of working life and global health, perceived cognitive vulnerability and emotional vulnerability in women living with MBC, as well as experience of employers and its association with quality of working life. To our knowledge, we are the first to show that experience of employers after MBC diagnosis (i.e. employer understanding and receptiveness) positively relates to women's quality of working life. Our findings also show that quality of working life significantly relates to global health and cognitive and emotional vulnerability, with results suggesting women with a greater quality of working life are at a reduced risk of developing a poorer QoL, cognitive vulnerability and emotional vulnerability to depression. Taken together, our novel findings emphasise the importance of good employer experience and quality of working life for women with MBC.

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Data availability The data supporting the findings of this study is not publicly available as participants did not agree to their data to be shared publicly. Participants of this study did, however, provide consent for the result to be written up for publication.

Declarations

Ethics approval This study was performed in line with the principles of the declaration of Helsinki. The study was approved by the Research Ethics Committee of the Department of Psychological Sciences, the College Research Ethics Committee at Birkbeck College, University of London, and the Economic and Social Research Council.

Consent to participate Informed consent was obtained from all individual participants included in the study.

Consent to publish Consent to publish was received from all individual participants included in the study.

Conflict of interest The authors declare no competing interests.

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