Running Head: Cognitive Function and Emotional Vulnerability in MBC

Anna Dobretsova, Department of Psychological Sciences, Birkbeck, University of London, London, UK.

Nazanin Derakshan, Department of Psychological Sciences, Birkbeck, University of London, London, UK, Centre for Building Resilience in Breast Cancer (BRiC), UK.

Corresponding author: Anna Dobretsova, annadobretsova@gmail.com

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Cognitive Function and Emotional Vulnerability in Metastatic Breast Cancer: Moderating Effects of Age and Social Support

Abstract

Objective. Previous literature has established a relationship between cognitive function and symptoms of anxiety, depression, and post-traumatic stress in primary breast cancer, but not in metastatic breast cancer (MBC). The current study examined the relationship between cognitive function and symptoms of anxiety, depression, and post-traumatic stress as well as the moderating effects of age, time since MBC diagnosis, and social support. **Methods.** Subjective and objective measures of cognitive function as well as self-reports of emotional vulnerability were completed by 59 women diagnosed with MBC who were recruited through social media and support groups. **Results.** Emotional vulnerability scores were associated with perceived measures of cognitive function. Additionally, low levels of perceived cognitive function were met with increased levels of depression with social support moderating this relationship buffering against depression. Age was found to moderate the relationship between cognitive function and post-traumatic stress with younger women at a greater risk of vulnerability. Out of all the emotional vulnerability measures, only anxiety negatively correlated with objective task performance. **Conclusions.** This study established a relationship between cognitive function and emotional vulnerability in MBC patients. It emphasised how vulnerable younger MBC women are to post-traumatic stress**,** and the importance of the combined effects of cognitive function and social support in buffering against depression. Our results have important implications for developing new interventions and treatment plans that consider the roles of these factors in ensuring a better quality of life in MBC.

Keywords: anxiety, depression, cognitive function, metastatic breast cancer, post-traumatic stress, social support

Background

In the last decades, breast cancer survival rates have increased due to early detection and improved treatment plans. Nevertheless, breast cancer recurrence and metastatic diagnoses remain high. In the US, the prevalence of metastatic breast cancer (MBC) was projected to increase by 31% from 2010 to 2020, with an estimated 34% of women living with MBC for five years or more.[1] Recent statistics from the UK estimate that 66% of women will survive for at least a year after being diagnosed with MBC, with a five-year survival rate of 26%.[2] Prolonged treatment and increased uncertainty regarding disease progression comes at a psychological cost to emotional and cognitive health in MBC patients. Nonetheless, the majority of the literature has examined emotional and cognitive function in women diagnosed with primary breast cancer, often excluding MBC participants, which is why the current study aimed to address this gap.

It has been established that high rates of depression and anxiety in women with a history of breast cancer can adversely impact quality of life, cancer progression and reoccurrence, as well as mortality rates.[3-5] According to a recent meta-analysis[4] with primary and metastatic breast cancer patients, depression independently predicted cancer specific mortality and breast cancer recurrence with increased risks of 29% and 24% respectively. Anxiety symptoms similarly increased the risk of cancer reoccurrence with psychological morbidity having the highest risk for breast cancer-related mortality.[4] Earlier, Giese-Davis et al.[5] reported that a decrease in depressive symptomatology in MBC patients predicted survival rates 14 years later. Therefore, it is crucial to identify and monitor factors that contribute and impact emotional vulnerability in patients diagnosed with MBC.

Previous research has linked factors such as age, time since diagnosis, and perceived social support with psychological disorders in MBC patients.[6-10] The majority of the studies conclude that younger and recently diagnosed women with MBC are more likely to present anxiety and depression symptomatology and are more vulnerable to post-traumatic stress.[6-9] Concerning social support, MBC patients that had a partner experienced fewer symptoms of depression and helplessness than single, separated, or divorced participants.[9] Furthermore, women who are socially isolated or report low levels of social support are at higher risk for anxiety and depression.[6,10]

In addition to increased emotional vulnerability, it has been established that cognitive function, specifically, attention, working memory, and executive function are impaired in breast cancer patients, particularly after systemic therapies.[11,12] With an increased survival rate, women with MBC live longer with cognitive impairments that often negatively affect their daily life and its quality.[3] Despite the importance of cognitive function on emotional health, there is hardly any research on cognitive function in MBC, with some statistics suggesting that cognitive problems are reported among 8-60% of the patients.[13-15]

Recent literature has revealed that cognitive deficits can arise prior to diagnosis and oncological treatment[16-18] and can persist in breast cancer survivors up to 20 years posttreatment.[19] A possible explanation rises from recent work establishing a firm relationship between cognitive impairments, post-traumatic stress, anxiety, and depression symptomatology.[15,18,20,21] Nevertheless, this relationship has not been established nor studied in MBC patients. In a study with breast cancer survivors of all stages, Boscher et al.[15] found that perceived cognitive function was highly associated with symptoms of anxiety, depression, and post-traumatic stress. Additionally, participants who reported having post-traumatic stress symptoms were twice as likely to report cognitive complaints.[15] Further evidence for the link between cognitive function and emotional vulnerability comes from studies implementing cognitive control training in breast cancer patients.[22,23] Swainston et al. [22] found that using adaptive cognitive training to target processing efficiency led to significant reductions in anxiety and rumination symptoms, which were sustained at a 15-month follow up. Similar findings by von Ah et al. [23] in early-stage breast cancer survivors, indicated that cognitive training improved symptoms of anxiety, mood disturbance, fatigue, and self-reported quality of life. Cognitive mechanisms governing working memory and processing efficiency are established determinants of emotional vulnerability and resilience[24] with vast implications for mental well-being in vulnerable populations with primary breast cancer.[20] An understanding of the relationship between cognitive function and emotional vulnerability in MBC, can open up opportunities such as cognitive control training that can reduce emotional vulnerability, improve quality of life, and potentially promote survival.

The current study aimed to substantiate the relationship between cognitive function and emotional vulnerability in women with MBC. We predicted that the subjective and objective cognitive function

measures will be associated with emotional vulnerability assessed by the self-reported anxiety, depression, and post-traumatic stress scores. Importantly, we predicted that factors such as current age, time since MBC diagnosis, and perceived social support will moderate the relationship between cognitive function and emotional vulnerability measures of depression, anxiety, and post-traumatic stress.

Methods

Recruitment and sample characteristics

A total of 73 women were recruited through social media advertisements on breast cancer support platforms including Building Resilience in Breast Cancer (BRiC) centre and Breast Cancer Now (UK). The inclusion criteria were women between the ages of 18-70 that were diagnosed with metastatic (stage IV) breast cancer, which included subjects that were undergoing treatment. The experiment could only be completed on a desktop computer or a laptop, thereby excluding two potential participants who responded to the advert. A total of 12 subjects did not participate in the experiment before the recruitment deadline, resulting in a convenience sample of 59 participants. The experiment data was collected between April and July 2020. The research project received ethical approval from the Department of Psychological Sciences Research Ethics Committee of Birkbeck University of London (192045).

Materials

Self-report Questionnaires

A demographics questionnaire consisting of 20 questions assessed the participants' characteristics (see Table 1). The adapted Impact of Events Scale-Revised (IES-R)[25] was used to assess post-traumatic stress symptoms in the last seven days regarding MBC diagnosis. The IES-R included 22-items measuring three subscales: Intrusion, Avoidance, and Hyperarousal assessed on a 5-point Likert scale. Higher scores on the IES-R indicated greater levels of traumatic stress.[25] The IES-R has been used to evaluate post-traumatic stress symptoms in response to MBC diagnosis[3] and was internally consistent in our sample ($\alpha = 0.90$).

Insert Table 1

Anxiety and depression symptomatology were measured using the Hospital Anxiety and Depression Scale (HADS)[26] based on 14-items measuring anxiety and depression subscales on a 4-point Likert scale. The HADS is a reliable measure of anxiety and depression symptoms in MBC patients[6-8] and was internally consistent in our sample ($\alpha = 0.88$).

Perceived social support was assessed using the Medical Outcome Survey, Social Support Survey (MOS-SSS)[27] consisting of 19 items that measured positive social interaction, emotional-informational, tangible, and affectionate support on a 5-point Likert scale. High scores on the MOS-SSS indicate better self-reported social support. The MOS-SSS was internally consistent in our sample ($\alpha = 0.96$) and been used with MBC patients to assess perceived social support.[3,6]

Perceived cognitive function was assessed using the Functional Assessment of Cancer Therapy-Cognitive Function v3 (FACT-Cog)[28] consisting of 37-items measured on a 5-point Likert scale, to assess four subscales: perceived cognitive ability, perceived cognitive impairment, comments from others, and impact of cognitive impairment on the quality of life. The total FACT-Cog score was the sum of the subscale scores and the remaining 4-items, with higher scores indicating better cognitive function. FACT-Cog was proven to be a reliable measure of perceived cognitive function in breast cancer patients[15,20] and was internally consistent in our sample ($\alpha = 0.97$).

Cognitive tasks

The Attention Network Task (ANT)[29] and an adaptive forward digit span task assessed attention, executive function, and working memory. The ANT measured alerting, orienting, and executive control functions using modified Flanker[30] and reaction time task with warning cues (for design see supplemental materials).[31] It involved four cue conditions (no cue, centre, double, and spatial) presented above or below the fixation cross for 100 ms and three types of Flanker (neutral, congruent, or incongruent) presented above or below for 1700 ms or until response. There were 24 practice trials with feedback and three experimental blocks of 96 trials (4 types of cue conditions x 2 target cue locations x 2 target Flanker directions x 3 Flanker conditions x 2 repetitions) with each trial lasting 4000 ms. A break of one minute was provided between blocks. The ANT alertness measure was calculated based on the mean reaction time (RT) difference on the no cue vs.

double cue conditions. Orienting was measured by subtracting the mean RT on the centre vs. spatial cue conditions. Executive functioning was calculated using the mean RT in response to the incongruent vs. neutral Flanker stimuli. The JavaScript for the ANT was taken from the Experiment Factory - an open-source software database.[32]

The digit span task (DTS) involved the presentation of three single digits and required the participant to correctly recall the forward order of the presented digits. After a correct digit recollection, the next trial had an additional digit. If a mistake was made, the next trial would have one digit less. The task included 14 forward trials with a maximum presentation of nine digits. To assess working memory capacity, maximum length (ML) and mean span (MS) scores were generated. ML was the highest number of digits remembered during the task, whereas MS scores corresponded to the fraction of accurately reported digits at each digit span.[33] The JavaScript for the forward block of the DST was taken from the Experiment Factory.[32]

Procedure

Participants were provided with an URL to the online experiment. After digitally signing the informed consent form, they were presented with the demographics questionnaire, followed by the FACT-Cog, IES-R, HADS, and the MOS-SSS questionnaires. Afterwards, the participants were presented with the instructions for the ANT task asking them to respond with the corresponding keyboard arrows to the direction of the target arrows in the Flanker stimuli as quickly and accurately as possible. After completing all the ANT trials, a break of one minute was provided before the digit span task commenced. During the digit span task, the participants used their computer mouse to select the corresponding digits on the presented number pad.

Statistical methods

The final data used for the analyses included participants who completed all the questionnaires (n = 59) and participated in the digit span task (n = 54) and the ANT (n = 52)[i]. Descriptive statistics were generated for all the variables used in the data analysis (see supplementary materials). Pearson's correlation analyses were conducted to determine the relationship between perceived and objective scores of cognitive function and measures of anxiety, depression, and post-traumatic stress. Moderation analyses were performed using

[i] Five participants did not finish the experiment as they only answered the questionnaires. Two participants' scores on the ANT were excluded from the analysis due to incorrect responses during all incongruent trials or failure to respond during the whole task.

Andrew Hayes PROCESS[34] to determine the moderating roles of current age, time since MBC diagnosis, and social support on the relationship between cognitive function and emotional vulnerability measures using mean-centred values. To correct for the homoscedasticity in the data, the standard errors were estimated using the Heteroscedasticity-Consistent Standard Error (HC1).

Results

Correlation Analysis

Pearson's correlation analysis demonstrated that measures of anxiety, depression, and post-traumatic stress were highly intercorrelated (see Table 2). Additionally, highly significant negative relationships were found between perceived cognitive function and all measures of emotional vulnerability. The FACT-Cog *Impact of Cognitive Impairments on Quality of Life* (QOL) subscale had the highest correlations with anxiety ($r(59) = -.63$, $p < .001$) and depression ($r(59) = -.64$, $p < .001$).

Insert Table 2

Perceived social support was significantly associated with depression ($r(59) = -.50$, $p < .001$), post-traumatic stress scores ($r(59) = -.29$, $p = .025$), and the FACT-Cog QOL subscale ($r(59) = .33$ $p = .010$) only. These findings suggest that high levels of social support are associated with lower depression and post-traumatic stress scores as well as with lesser impact of cognitive impairments on quality of life.

When looking at the objective measures of cognitive function such as the ANT and the digit span task, anxiety scores significantly correlated with the mean span (MS) ($r(59) = -.31$, $p = .025$) and the maximum length (ML) ($r(59) = -.32$, $p = .020$) digit span task measures (see descriptive statistics in the supplementary materials). These relationships were negative, suggesting that low MS and ML scores are associated with increased anxiety levels. No other significant relationships were found between performance on the ANT, the digit span tasks and the depression or post-post-traumatic stress scores. However, the FACT-Cog *Comments from Others* subscale significantly correlated with the ANT alertness measure ($r(52) = -.29$, $p =$

.032) and the relationship between *Perceived Cognitive Ability* subscale and digit task MS measure just missed significance ($r(54) = .25$, $p = .064$).

Moderation Analyses

Moderation analyses were conducted to determine whether age, time since MBC diagnosis, and perceived social support (MOS-SSS) moderated the relationship between perceived cognitive function and emotional vulnerability measures (see Table 3).

Insert Table 3

The first set of moderation analyses examined the moderating roles of age, time since MBC diagnosis and perceived social support on the relationship between perceived cognitive function and post-traumatic stress. Age was a significant moderator ($\beta = 0.01$, $t(55) = -2.10$, $p = .041$), with the simple slopes analysis demonstrating significant effects at younger (-1 SD = 40.8): $\beta = -.35$, $t(55) = -4.90$, $p < .001$, average ($M = 49.97$): $\beta = -.23$, $t(55) = -4.13$, $p < .001$, but not older age (+ 1 SD = 59.14): $\beta = -.11$, $t(55) = -1.26$, $p = .215$. The highest levels of post-traumatic stress were reported among younger women with low levels of cognitive function in contrast to older participants. Post-traumatic stress scores decreased at average and high levels of cognitive function with the lowest scores reported among older participants (see Figure 1a). Time since MBC diagnosis and social support were not significant moderators of perceived cognitive function and post-traumatic stress (see Table 3).

Insert Figure 1

The second set of moderation analyses tested whether age, time since MBC diagnosis, and perceived social support moderated the relationship between perceived cognitive function and self-reported anxiety measured by the HADS. The results demonstrated that neither social support, age, nor time since MBC diagnosis moderated the predictive relationship between perceived cognitive function and anxiety (see Table 3).

The third set of moderation analyses determined whether age, time since MBC diagnosis, and perceived social support moderated the relationship between perceived cognitive function and self-reported depression measured by the HADS. Social support was found to be a significant moderator of perceived cognitive function and depression (β = -.001, t(55) = -2.20, p = .032), with simple slopes analysis demonstrating significant effects at low (-1 SD = 53.06): β = -.036, t(55) = -3.18, p = .002, average (M = 73.5): β = -.055, t(55) = -5.02, p < .001, and high levels (+1 SD = 93.94): β = -.075, t(55) = -4.51, p < .001) of social support. As Figure 1b demonstrates, the highest depression scores were reported by the participants who indicated having low levels of social support and cognitive function, with depression scores lowest among participants who reported high levels of cognitive function and social support. This shows that the combined effect of social support and cognitive function is necessary for maintaining low depression levels. Age and time since MBC diagnosis were not significant moderators of perceived cognitive function and depression (see Table 3).

Discussion

The present study examined cognitive function and emotional vulnerability in women diagnosed with MBC to reduce the current research gap. It was hypothesised that the subjective and objective measures of cognitive function were associated with self-reported measures of emotional vulnerability of depression, anxiety, and post-traumatic stress. Importantly, we tested whether factors such as age, time since MBC diagnosis as well as perceived social support moderated the relationship between cognitive function and emotional vulnerability.

In line with our predictions, perceived cognitive function negatively correlated with self-reported levels of depression, anxiety, and post-traumatic stress. This relationship has been previously established in the primary breast cancer literature[15,18,20,21] but has never been examined in MBC patients. This is an important finding as it suggests that women with MBC who report lower levels of cognitive function are particularly vulnerable to developing psychopathology. This can be detrimental to MBC patients as symptoms of depression and/or anxiety have been linked to decreased survival rates and increased cancer-related mortality.[4,5] Therefore, it is crucial that physicians and breast cancer nurses not only regularly monitor and

educate their patients about possible anxiety and depression symptoms but implement interventions such as cognitive control training that have been found to improve cognitive function in breast cancer populations.[22,23]

Our first hypothesis was partially supported due to the lack of associations between objective measures of cognitive function and emotional vulnerability. The sole significant association was observed between anxiety and the digit span task, suggesting that fewer digits were recalled in participants with high anxiety scores. These results are consistent with literature indicating an association between anxiety and deficits in working memory supporting the role of cognitive function in emotional vulnerability.[22] A review article by Yang et al.[21] similarly reported few or no associations between self-reported measures of emotional vulnerability and objective scores on cognitive tests. It has been suggested that self-reported cognitive function represents psychological distress in relation to breast cancer diagnosis[21], which could explain why self-reported emotional vulnerability highly correlated with perceived but not objective cognitive function measures. Additionally, we did not find an association between self-reported and objective measures of cognitive function. It is possible that the cognitive measures were not sensitive enough to reflect cognitive deficits in MBC. In support of this argument, several studies indicate that breast cancer patients display subtle cognitive deficits or perform just as accurately on cognitive tasks as controls.[17,18,21] This has been explained by neuroimaging studies substantiating a pattern of neural compensatory effort indicative of effortful processing and hyperactivation in prefrontal brain areas involving attentional control and working memory when performing cognitive tasks, due to processing inefficiency.[11,35] This can, in part, explain why cognitive problems are highly reported in breast cancer populations without obvious impairments on cognitive tests.

The hypothesis that age, time since diagnosis with MBC, and perceived social support moderated the relationship between perceived cognitive function and emotional vulnerability was partially confirmed. Social support significantly moderated the relationship between perceived cognitive function and depression. As such, participants with low levels of social support and cognitive function reported the highest depression scores, whereas, at high levels of perceived social support and cognitive function, depression

scores were the lowest. This finding suggests that social support can act as a buffer for depression by promoting coping and adaptation as illustrated by the buffering hypothesis.[36] Another explanation suggests that social support can influence the patients' adjustment to MBC and cognitive function, thereby reducing depression. These findings demonstrate how important social support is in vulnerable populations such as MBC, as literature has linked high levels of depression to increased mortality and disease progression.[4,5] In addition, our results demonstrate the equally critical role of cognitive function in optimising the benefits of social support when protecting against depressive symptoms. Furthermore, age was found to be a significant moderator of the effect of cognitive function on post-traumatic stress symptoms. This is consistent with the literature as younger women with MBC are more likely to report cognitive problems and be at risk for post-traumatic stress.[6,15,21] This is an important finding as it highlights how younger patients are more likely to be affected by changes in cognitive function than older patients, which could further contribute to the psychological distress in MBC.

Time since MBC diagnosis was not found to be a significant moderator of cognitive function and emotional vulnerability. Additionally, age did not moderate the relationship between cognitive function and anxiety or depression scores. This contradicts previous literature as younger and recently diagnosed MBC patients are more likely to report cognitive complaints and develop psychopathology.[6-8,15] Possible explanations for these inconsistencies could include our small sample size and little variability in the age and time since MBC diagnosis variables (see Table 1). Additionally, social support did not moderate the relationship between cognitive function and anxiety or post-traumatic stress. While low social support has been linked to anxiety risk in primary and metastatic breast cancer,[6,10] limited information is available on its relationship with post-traumatic stress symptoms. In particular, depression has been most associated with social support as single or separated MBC patients are more likely to report low mood and hopelessness.[9] Therefore, further research is needed to determine how social support is related to post-traumatic stress, anxiety, and cognitive function in MBC patients.

Limitations and Suggestions for Future Research

The current study was limited because it did not use a demographically matched healthy control group to determine group differences on self-reported and objective measures of cognitive function and emotional vulnerability. Additionally, a larger sample size would have improved the external validity and the statistical power of the study. The convenience sample obtained for this study was obtained through social media and support groups and required the use of a computer to complete the experiment. Consequently, this could have restricted women of certain ages and socioeconomic groups from participating. Future research can extend and enrich our findings by employing a mixed methods design with qualitative data appreciating the lived experience of women with MBC. Our results highlight the need for neuroimaging methods in MBC research to determine the extent of cognitive impairments supporting emotional regulation and cognitive control.

Clinical Implications and Conclusion

The current study was conducted during the peak of the COVID-19 pandemic, so the findings of this study should be perceived with caution as certain measures may have been influenced by the pandemic.

Nevertheless, our research demonstrated a clear relationship between perceived cognitive function and measures of emotional vulnerability such as depression, anxiety, and post-traumatic stress. We have highlighted how younger MBC patients are more vulnerable to the effects of cognitive function on post-traumatic stress, as well as how the combined effects of cognitive function and social support can buffer against the effect of cognitive function on depression symptoms. These results are crucial for health professionals and researchers as new interventions and treatment plans can be developed in line with our findings to improve the quality of life and psychological health of MBC patients, promoting survival and a better quality of life.

Conflict of Interest

The authors declare no conflict of interest.

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Data Availability Statement

Due to ethical restrictions the data that support the findings of this research study are not publicly available. The data can be made available upon request from the corresponding author.

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Table 1. Participant Characteristics of Metastatic Breast Cancer (MBC) Sample

	***M* ± *SD* or *n* (%)**	**Range**
Age at Study Participation (years)	49.97 ± 9.17	34-69
50	29 (49)	
≥50	30 (51)	
Time between Primary and MBC Diagnosis (months)	54.35 ± 51.89	1-204
Time since MBC Diagnosis (months)	36.32 ± 39.68	1-201
Diagnosis of *de novo* MBC	10 (17)	
Number of Metastases		
1	28 (47)	
2	22 (37)	
≥3	9 (15)	
Location of Metastases		
Bone	49 (83)	
Liver	21 (36)	
Lungs	16 (27)	
Brain	4 (7)	
Other	10 (17)	
Treatment Received for Primary Breast Cancer		
Surgery	47 (80)	
Hormonal	42 (71)	
Targeted therapy	24 (41)	
Chemotherapy	20 (34)	
Radiation	6 (10)	
Other	7 (12)	
Treatment Received in the Last 3 Months		
Hormonal	42 (71)	
Targeted therapy	25 (42)	
Chemotherapy	20 (34)	
Radiation	6 (10)	
Other	9 (15)	
None	1 (2)	
Currently Working	30 (51)	
(hours)	30.63 ± 8.57	15-40
≤20 hours	6 (10)	
>20 hours	24 (41)	

Marital Status		
Married	35 (59)	
Single	9 (15)	
Divorced	5 (8)	
Separated	3 (5)	
Widowed	3 (5)	
Other	4 (7)	
Alcohol Consumed	36 (61)	
Units per Week	6.81 ± 5.49	1-24

Table 2. Correlations between Questionnaires Measuring Perceived Cognitive Function and Emotional Vulnerability.

		1.	2.	3.	4.	5.	6.
1.	Total HADS	-					
2.	Anxiety	.92**	-				
3.	Depression	.84**	.57**	-			
4.	Traumatic Stress (IES-R)	.66**	.63**	.52**	-		
5.	Perceived Social Support (MOS-SSS)	-.30*	-.09	-.50**	-.29*	-	
6.	Perceived Cognitive Function (FACT-Cog)	-.63**	-.59**	-.51**	-.51**	.15	-

† HADS Total: Hospital Anxiety Depression Scale Total score; IES-R: Impact of Events Scale – Revised, MOS-SSS: Medical Outcome Study – Social Support Scale; FACT- Cog: Functional Assessment of Cancer Therapy – Cognitive Scale Total score

* Correlation is significant at the .05 alpha level (two-tailed)
** Correlation is significant at the .001 alpha level (two-tailed)

Table 3. Moderation Analyses of Age, Time since MBC Diagnosis, and Social Support on the Relationship between Perceived Cognitive Function and Traumatic stress, Anxiety, and Depression Outcome Measures.

Dependent Variable	**Independent Variable**	**Interaction**	***B***	***SE B***	***t***
Traumatic Stress (Total IES-R)	FACT-Cog	FACT-Cog x MOS-SSS	0.0006	0.002	0.27
		FACT-Cog x Age	0.013	0.006	2.10*
		FACT-Cog x Time since MBC Diagnosis	0.001	0.001	0.55
Anxiety (HADS-A)	FACT-Cog	FACT-Cog x MOS-SSS	0.0000	0.001	-0.09
		FACT-Cog x Age	0.002	0.002	0.72
		FACT-Cog x Time since MBC Diagnosis	-0.0003	0.0004	-0.96
Depression (HADS-D)	FACT-Cog	FACT-Cog x MOS-SSS	-0.001	0.0004	-2.20*
		FACT-Cog x Age	-0.001	0.002	-0.63
		FACT-Cog x Time since MBC Diagnosis	0.0002	0.0003	0.58

† IES-R: Impact of Events Scale – Revised Total score; HADS: Hospital Anxiety and Depression Scale; MOS-SSS: Medical Outcome Study – Social Support Scale Total score; FACT-Cog: Functional Assessment of Cancer Therapy – Cognitive Scale Total score

***** Correlation is significant at the .05 alpha level (two-tailed)

Figure 1. Line Chart of Simple Slopes Analysis with a) Age at Study Participation as the Moderator of Cognitive Function and Traumatic Stress and b) Social Support as the Moderator between Cognitive Function and Depression