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ORIGINAL ARTICLE

Ambivalence over emotional expression and physical functioning and limitations: mediating and moderating effects of PTSD symptoms and acculturation among Chinese breast cancer survivors

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Abstract

Objective The psychosocial correlates of physical functioning and limitations are not well-known among Chinese breast cancer survivors. Previous research suggests a link between ambivalence over emotional expression (AEE) and physical functioning. The current study built upon this research by examining post-traumatic stress symptoms (PTSS) as a mechanism. Further, we also examined the moderating effects of mainstream cultural orientation. To this end, we tested study hypotheses using moderated mediation models.

Methods Participants were 96 Chinese-speaking breast cancer survivors in the USA. Participants were diagnosed within the past five years with stages 0–III breast cancer. Participants completed questionnaires related to AEE, PTSS, SF-36 physical functioning, and role limitations due to physical health subscales, and acculturation.

Results Results from moderated mediation models provided support for study hypotheses. AEE was positively related to overall PTSS and its three subscales (i.e., re-experiencing symptoms, avoidance, and arousal). Further, PTSS and the three subscales were negatively related to physical functioning and positively related to role limitations due to physical health. The indirect effects of AEE on physical functioning and role limitations due to physical health through PTSS and the three subscales were significant. Moderated mediation models showed that the indirect effects of AEE on physical functioning through PTSS and the re-experiencing subscale were stronger for those high, compared to low, in mainstream culture orientation.

Conclusion Those with high AEE experience had worse physical functioning and greater role limitations due to increased PTSS. However, the indirect effects were stronger for those who endorse greater mainstream culture. Implications for results suggest that interventions aimed at addressing AEE and PTSS may help alleviate physical health problems especially those high in mainstream culture orientation.

Keywords Ambivalence over emotional expression · Physical functioning · Post-traumatic stress symptoms · Acculturation · Cancer survivors

Diminished physical functioning is a common experience among cancer survivors given that approximately 53% of adult cancer survivors report some type of limitation to physical health [1]. The resulting frustrations and lifestyle changes resulting from physical limitations vary across the breast cancer phase spectrum [2], and levels of physical functioning tend to be lower among survivors compared to healthy women [3]. Fortunately, an established area of research aims to develop rehabilitation interventions targeting physical functioning mainly through health-related behaviors, such as physical activity and exercise [4]. Less known, however, are psychological contributions to physical functioning and role limitations due to physical health among cancer survivors, and there is a paucity of research examining physical functioning among

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Asian cancer survivors. In response to these gaps in the literature, we aimed to examine the psychological contributions and mechanisms to physical functioning among Chinese breast cancer survivors.

AEE and physical functioning

Ambivalence over emotional expression (AEE) is defined as the internal tension an individual experiences when faced with the simultaneous desire to openly express and withhold their emotions [5]. Breast cancer survivors may experience AEE when interacting with others about their condition, especially in the context of minimizing burden to loved ones or feeling shamed about their condition [6]. Based on the theory of personal strivings, humans have an innate need to express emotions, and the act of suppressing emotions can be problematic. The competing goals between the innate need to express and the hesitation to express for fear of negative reactions can cause psychological distress. This highlights an important phenomenon for breast cancer survivors as breast cancer patients report higher levels of AEE than healthy controls [7], and mounting evidence suggests that AEE predicts greater depressive symptoms, worse quality of life, and greater post-traumatic stress symptoms among breast cancer survivors [8–10].

There is a paucity of research, however, examining the relationship between AEE and physical functioning among Chinese breast cancer survivors. The limited research in this area appears mixed. While one study found that defensively inhibiting emotions was related to worse physical health among chronic kidney disease patients [11], another study did not find a relationship between AEE with physical functioning or role limitations among gastrointestinal cancer patients [12]. Given the mixed findings, we sought to clarify the effect of AEE on physical functioning and limitations.

PTSS as a mediator in relationship between AEE and physical functioning

The current study also aimed to examine post-traumatic stress symptoms (PTSS) as a mediator in the relationship between AEE and physical health and limitations. Post-traumatic stress disorder (PTSD) is categorized as an anxiety disorder in the Diagnostic and Statistical Manual of Mental Disorders—IV (DSM-IV-TR) marked by three symptom clusters—re-experiencing symptoms (e.g., flashbacks), avoidance (e.g., avoiding people, places, or object that reminds of the traumatic event), and changes in arousal, cognition, and mood (e.g., hypervigilance) [13]. A diagnosis of cancer is recognized as a traumatic event that can elicit the aforementioned three symptom clusters. Following a traumatic event, such as a cancer diagnosis, individuals typically show three types of responses: (1) overgeneralizing the event or the occurrence (overaccommodation), incorporating the event as evidence of existing pre-conceived notions (assimilation), or adjusting existing beliefs to incorporate the traumatic event (accommodation) [14]. When the maladaptive responses related to overaccommodation and assimilation interfere with daily living, psychopathology is present.

The conceptual overlap between AEE and PTSS symptoms suggests that individuals with high AEE are more likely to experience intrusive thoughts [10]. Indeed, resolving past traumas and adverse events requires emotional processing evidenced by therapies that target accommodation of the traumatic event which encourage patients to openly express thoughts and emotions (e.g., cognitive processing therapy, prolonged exposure therapy). The elevated intrusive thoughts may cause allostatic load that interferes with physical functioning and increase limitations. Studies find that PTSS relate to greater somatic problems [15], worse physical functioning among breast cancer survivors [16], and greater role limitations due to physical health [17]. As individuals with PTSS tend to have higher anxiety sensitivity, subtle cues in the environment activate the central nervous system. Chronic CNS activation decreases immune system functioning and causes bodily strain which likely exacerbates pre-existing health problems resulting from cancer and cancer treatment. Thus, we aim to examine how PTSS mediate the relationship between AEE and physical functioning and limitations.

Culture as a modifier

Culture can influence the AEE, PTSS, and physical functioning and limitations pathway. Chinese cultural norms encourage emotion-focused coping strategies, such as emotional suppression to maintain social harmony, contrary to Western-focused emotional expression [18, 19]. Following these norms, Asians are more likely to engage in inwardly directed emotion-focused coping [20] and experience AEE compared to white/European Americans [21]. The cultural significance of expressing emotions highlights the importance of studying AEE among Chinese breast cancer survivors as the significance of AEE differs across levels of cultural identification. A recent study showed that the effect of AEE on depression was stronger for Chinese breast cancer survivors endorsing greater Western cultural values [9]. Thus, the second aim of the current study was to examine the moderating effects of culture. We expect that the indirect effect of AEE on physical functioning through PTSS will be greater among individuals who identify with the mainstream culture.

Purpose of the study

The current study examined the relationships among AEE, PTSS, physical functioning and limitations, and cultural orientation among Chinese American breast cancer survivors. Specifically, the following hypotheses were proposed:

(1) AEE would be positively related to PTSS.
(2) PTSS would be negatively related to physical functioning and positively related to role limitations due to physical health.
(3) PTSS would mediate the relationship between AEE and physical functioning and role limitations due to physical health.
(4) The indirect effect in Hypothesis 3 would be moderated by mainstream culture orientation.

Methods

Participants

The participants included in this study were drawn from the baseline of a larger study that examined the effects of an expressive writing intervention on mental health among Chinese breast cancer survivors [10]. The current sample included all 96 participants from the larger baseline study. Table 1 displays participant characteristics. Participants were, on average, 54.54 years old ($SD = 7.91$) and had spent 19.02 years in the US ($SD = 9.52$). Most participants were married (71.9%) and possessed a high school degree or greater (81.2%). Less than half (33.4%) of the participants reported a household income greater than $45,000.

Participants were recruited from local Chinese American community organizations in Southern California (e.g., the Herald Cancer Association). Community organization staff members provided information to potential participants about the present study at cultural events, educational conferences, and support groups. Study inclusion included (1) being diagnosed of breast cancer at stages 0 to III within 5 years and (2) fluent in speaking, reading, and writing in Chinese. Interested participants were contacted and screened by community research staff via phone to determine eligibility. Once verbal consent was provided, paper–pen questionnaires and consent forms were mailed to the participants. They were instructed to return the completed questionnaires with the signed consent form in a sealed return envelope. Participants were given US $20 for their participation at the baseline, and this study was approved by the Institutional Review Board.

Table 1 Characteristics of participants ($n = 96$)

	N (frequency %)/*mean* (*SD*)
Demographic variables	
Age (years)	54.54 (7.91)
Time in US (years)	19.02 (9.52)
Marital status	
Married	69 (71.9%)
Single/separated/divorced/widowed	27 (28.1%)
Education level	
Middle school or below	18 (18.8%)
High school	28 (29.2%)
Associate degree	24 (25.0%)
College degree or above	25 (26.0%)
Unknown	1 (1.0%)
Average annual household income	
< $15,000	26 (27.1%)
$15,000–$45,000	26 (27.1%)
$45,000–$75,000	18 (18.8%)
> $75,000	14 (14.6%)
Unknown	12 (12.5%)
Cancer- and treatment-related variables	
Stage at diagnosis	
Stage 0	13 (13.5%)
Stage I	29 (30.2%)
Stage II	40 (41.7%)
Stage III	13 (13.5%)
Unknown	1 (1.0%)
Treatment	
Surgery	91 (94.8%)
Radiation	36 (37.5%)
Chemotherapy	57 (59.4%)
Time since diagnosis (months)	19.24 (10.93)

Measures

All measures were presented to participants in Chinese. If existing validated Chinese versions of the measures were not available, measures were forward–back translated by an independent bilingual research team member from English to Chinese to retain semantic equivalence. Unless otherwise specified, this procedure was used on the following measures.

AEE AEE was measured using the Ambivalence over Emotional Expressiveness Questionnaire (AEQ) [22]. The AEQ was discussed in a focus group format in a community sample, and four items were removed based on feedback from the focus group that they were not relevant for the population (i.e., "I try to control my jealousy concerning my boyfriend/girlfriend even though I want to let them know I'm hurting," "I try to hide my negative feelings around others, even though

I am not being fair to those close to me," "I would like to be more spontaneous in my emotional reactions but I just can't seem to do it," and "I would like to express my affection more physically but I am afraid others will get the wrong impression."). The final questionnaire included 24 items (e.g., "I want to express my emotions honestly but I am afraid that it may cause me embarrassment or hurt") that participants rated on a Likert scale from 1 (strongly disagree) to 5 (strongly agree). The measure demonstrated adequate reliability in the current study (Cronbach's $\alpha = 0.95$).

Acculturation Acculturation was measured using the Stephenson Multigroup Acculturation Scale (SMAS) [23]. The original SMAS is a 32-item bi-dimensional self-report questionnaire that measures dominant and non-dominant cultural orientation. To decrease participant burden, a revised short-form 10-item measure was used based on discussion within the research team. Participants rated on a Likert scale from 0 (false) to 3 (true) how true each of the statements were for five non-dominant cultural items (e.g., "I speak my native language with my friends and acquaintances from my country of origin") and five dominant cultural items (e.g., "I have many (Anglo) American acquaintances"). The non-dominant (Cronbach's $\alpha = 0.84$) and dominant (Cronbach's $\alpha = 0.96$) subscales demonstrated adequate reliability.

Post-traumatic stress symptoms (PTSS) Post-traumatic stress symptoms (PTSS) were measured using the PTSD Symptom Scale—Self-Report Version (PSS-SR) [24]. The PSS-SR is a 17-item self-report questionnaire that taps into the three symptom clusters (i.e., re-experiencing symptoms, arousal, and avoidance) identified in the DSM-IV. The participants rated on a Likert scale from 0 (not at all) to 3 (almost always) the frequency of re-experiencing symptoms (four items; e.g., "Having bad dreams or nightmares about the trauma"), avoidance symptoms (seven items; e.g., "Trying not to think about, talk about, or having feelings about the trauma"), and arousal items (six items; e.g., "Feeling irritable or having fits of anger") in the past month. At the end of the questionnaire, the participants were also asked to identify if the symptoms interfered with a number of social, educational, or occupational domains (e.g., work, schoolwork, relationships with family). A total scale score was computed to represent overall severity of PTSS. The total measure (Cronbach's $\alpha = 0.94$) and the three subscales (re-experiencing Cronbach's $\alpha = 0.86$; avoidance Cronbach's $\alpha = 0.85$; arousal Cronbach's $\alpha = 0.86$) demonstrated adequate reliability. Following DSM-IV criteria and scoring in Foa et al. [24], the participants were considered likely to have a PTSD diagnosis if they reported one or more symptoms in the re-experiencing cluster, three or more symptoms in the avoidance cluster, two or more symptoms in the arousal cluster, and impairment in at least one social, educational, or occupational domain.

Physical functioning and limitations Physical functioning and limitations were measured using the Short-Form Health Survey (SF-36) [25] "Physical Functioning" and "Role Limitations due to Physical Health" subscales. For the Physical Functioning subscale, the participants were asked to rate on a Likert scale from 1 (yes, limited a lot) to 3 (no, not limited at all) the extent to which physical activities were limiting daily activities (10 items; "Lifting or carrying groceries"). Higher scores reflected better physical functioning. For the Role Limitations due to Physical Health subscale, the participants rated on a five-point Likert scale from 1 (all the time) to 5 (none of the time) the frequency of four statements related to role limitations (e.g., "Accomplished less than you would like as a result of physical problems"). Items were reverse-coded such that higher scores reflected greater role limitations. The Physical Functioning (Cronbach's $\alpha = 0.89$) and Role Limitations due to Physical Health (Cronbach's $\alpha = 0.95$) demonstrated adequate reliability.

Data analysis plan

Mediation and moderated mediation analytic procedures were used to test the study hypotheses. Specifically, tests of indirect effects used the PROCESS macro [26]. A 10,000-bootstrapped sample was used to create nonparametric estimates of the indirect effect. Confidence intervals were examined, and if zero was not within the upper and lower 95% limit, then a significant indirect effect was observed. Moderated mediation was determined using "model 7" in the PROCESS macro. Following the recommendations of Hayes [27], the index of moderated mediation determined moderated mediation. Briefly, the index of moderated mediation quantifies the indirect effect of a simple mediation model across a moderator. In other words, this index captures the extent to which culture modifies the indirect effect of AEE on physical functioning (or role limitations due to physical health) through PTSS. Similar to evaluating indirect effects, moderated mediation is present if the bootstrapped estimate of the index of moderated mediation does not contain zero in the confidence intervals. This approach differs from examining the significance of the weight for the interaction term in the first stage of mediation, which only quantifies the relation between the predictor and the mediator across the moderator. Covariates included age and stage of breast cancer diagnosis as they were significantly correlated with the outcome variables based on bivariate correlations.

Results

Table 2 displays descriptive statistics and bivariate correlations. Related to PTSS, mean scores on the PSS-SR were

Table 2 Bivariate relationships, means, and standard deviations

		1	2	3	4	5	6	7	8	9	10
1	AEE										
2	PTSS total	0.48*									
3	PTSS re-exp	0.39*	0.89*								
4	PTSS avoid	0.46*	0.92*	0.71*							
5	PTSS arousal	0.45*	0.94*	0.80*	0.75*						
6	Physical functioning	−0.23*	−0.51*	−0.48*	−0.44*	−0.50*					
7	Role limitations	0.20	0.49*	0.44*	0.46*	0.45*	−0.67*				
8	Mainstream	−0.16	−0.06	0.05	−0.12	−0.07	0.12	−0.26*			
9	Heritage	−0.08	−0.18	−0.19	−0.12	−0.20	−0.02	−0.02	0.03		
10	Age	−0.19	−0.08	0.03	−0.13	−0.10	−0.25*	0.02	0.12	0.03	
11	Stage	−0.05	0.25*	0.30*	0.19	0.22*	−0.16	0.17	0.20	0.08	−0.10
	Mean	1.96	14.71	3.63	5.60	5.48	69.30	42.17	1.05	2.77	54.54
	SD	0.95	10.47	2.77	4.39	4.26	22.60	30.28	0.82	0.64	7.91

AEE, ambivalence over emotional expression; *PTSS*, post-traumatic stress symptoms; *PTSS total*, total composite score of PTSS; *Re-exp*, PTSS re-experiencing symptoms subscale; *Avoid*, PTSS avoidance symptoms subscale; *Role limitations*, role limitations due to physical health; *Stage*, stage at cancer diagnosis (range = 0–3)

*$p < 0.05$

14.71 ($SD = 10.47$) with 62.5% ($n = 60$) meeting criteria for PTSD diagnosis based on DSM-IV criteria without considering dysfunction and 51% ($n = 49$) meeting criteria for a PTSD diagnosis considering dysfunction.

Figure 1 displays the results of the simple mediation relating AEE, PTSS, physical functioning (Fig. 1a), and role limitations due to physical health (Fig. 1b). Results showed that PTSS mediated the relationship between AEE and physical functioning and role limitations due to physical health. First, AEE was related to greater PTSS, which was related to worse physical functioning and greater role limitations due to physical health. Thus, results provided support for the first (i.e., AEE would be positively related to PTSS) and second (i.e., PTSS would be negatively related to physical functioning and positively related to role limitations due to physical health) hypotheses. Further, the indirect effect was significant suggesting that greater PTSS accounted for the relationship between AEE and physical functioning and role limitations due to physical health providing support for the third hypothesis (i.e., PTSS would mediate the relationship between AEE and

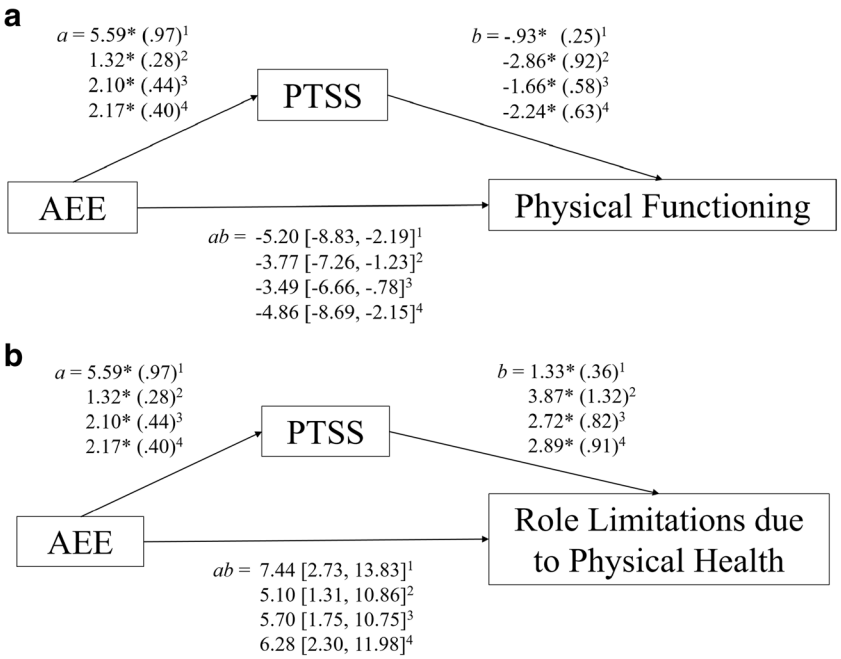

Fig. 1 Simple mediation models displaying direct and indirect effects of AEE (ambivalence over emotional expression), PTSS (post-traumatic stress symptoms; total and subscales), and physical functioning (**a**) and role limitations due to physical health (**b**). Regression weights are unstandardized. Footnotes distinguish the four different models where the mediator is: *1*, PTSS total score; *2*, PTSS re-experiencing subscale; *3*, PTSS avoidance subscale; *4*, PTSS arousal subscale. Parentheses display standard errors. Brackets display upper and lower 95% confidence intervals. *$p < 0.05$

physical functioning and role limitations due to physical health). Exploratory mediation analyses disaggregating PTSS into its three subscales (i.e., re-experiencing, avoidance, and arousal) showed the same pattern of results.

Table 3 shows the results of the moderated mediation model with mainstream culture as the moderator. The indirect effect of AEE on physical functioning and role limitations due to physical health through PTSS was moderated by mainstream culture orientation providing support for the fourth hypothesis (i.e., the indirect effect in hypothesis 3 would be moderated by mainstream culture orientation). Figure 2 shows the indirect effect as a linear function of mainstream culture orientation. The plots suggest that the magnitude of the indirect effect of AEE on physical functioning (Fig. 2a) and role limitations due to physical health (Fig. 2b) increases as levels of mainstream culture orientation increases. Exploratory analyses disaggregating PTSS into the three subscales revealed moderated mediation for the re-experiencing subscale (Table 3; Fig. 3). The same pattern emerged whereby the magnitude of the indirect effect of AEE on physical functioning (Fig. 3a) and role limitations due to physical health (Fig. 3b) increased as levels of mainstream culture increased.

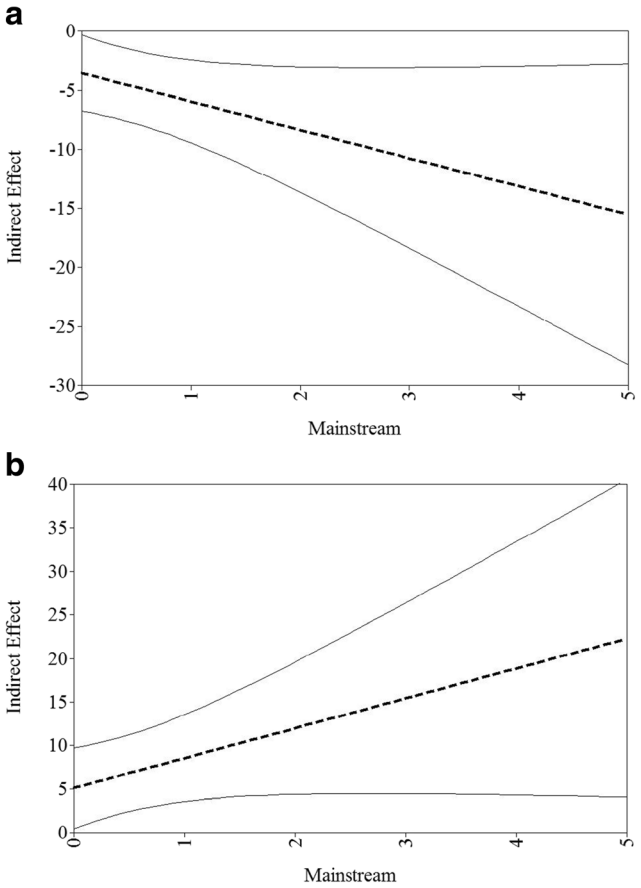

Fig. 2 Plot of conditional indirect effect of AEE on physical functioning (**a**) and role limitations due to physical health (**b**) through PTSS. Dotted lines represent indirect effect estimates, and solid lines represent upper and lower 95% confidence intervals

Discussion

There are approximately 5 million Chinese living in the US, and migration from China outpaced Mexico in 2013 [28]. As the Chinese population in the US continues to grow, there is a need to consider the psychosocial and cultural influences of the psychological and physical health of Chinese breast cancer survivors. Thus, the primary goal of the current study was to examine the mediating role of PTSS in the effect of AEE on physical functioning and limitations as well as the moderating effect of culture in the mediation pathway. In a sample of 96 Chinese American breast cancer survivors, the study

Table 3 Index of moderated mediation estimates

Model	Estimate	*SE*	*LL CI*	*UP CI*
	Moderator:Mainstream			
AEE ➜ PTSS tot ➜ PF	− 2.40	1.41	− 5.71	− 0.12
AEE ➜ Re-exp ➜ PF	− 3.38	1.60	− 7.40	− 0.92
AEE ➜ Avoid ➜ PF	− 1.01	1.06	− 3.63	0.74
AEE ➜ Arousal ➜ PF	− 1.73	1.29	− 4.80	0.43
AEE ➜ PTSS tot ➜ RL	3.44	1.72	0.55	7.39
AEE ➜ Re-exp ➜ RL	4.65	1.92	1.59	9.43
AEE ➜ Avoid ➜ RL	1.60	1.55	− 1.35	4.82
AEE ➜ Arousal ➜ RL	2.30	1.60	− 0.35	6.16

Estimates for index of moderated mediation are based on 10,000 bootstrap samples using model 7 in PROCESS macro

LL, 95% confidence interval lower limit; *UL*, 95% confidence interval upper limit; *CI*, confidence interval; *AEE*, ambivalence over emotional expression; *PTSS tot*, post-traumatic stress symptoms total score; *Re-exp*, post-traumatic stress symptoms re-experiencing subscale; *Avoid*, post-traumatic stress symptoms avoidance subscale; *Arousal*, post-traumatic stress symptoms arousal subscale; *PF*, physical functioning; *RL*, role limitations due to physical problems

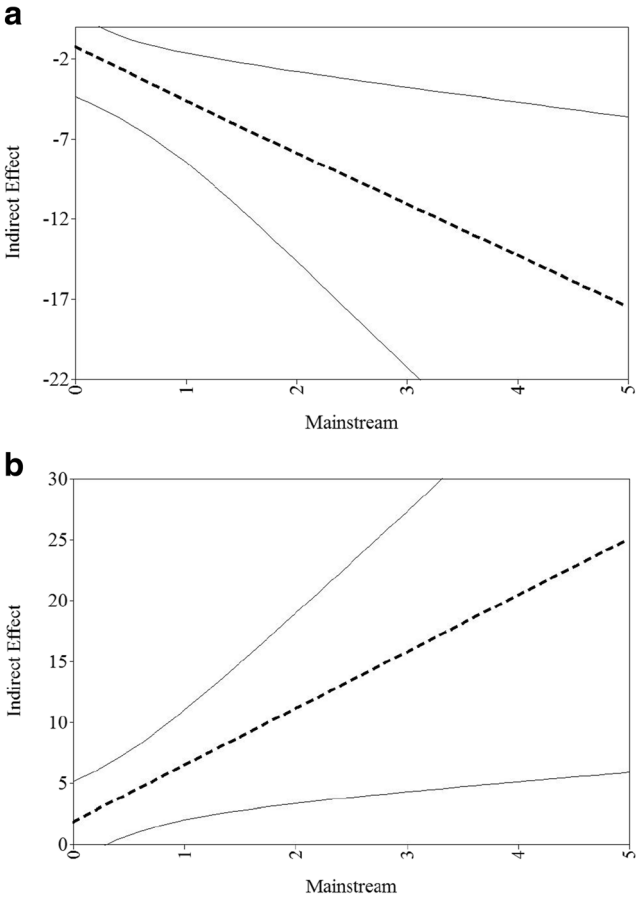

Fig. 3 Plot of conditional indirect effect of AEE on physical functioning (**a**) and role limitations due to physical health (**b**) through PTSS re-experiencing symptoms. Dotted lines represent indirect effect estimates, and solid lines represent upper and lower 95% confidence intervals

hypotheses were supported by results from simple and moderated mediation models. Results showed that higher levels of AEE predicted greater PTSS (hypothesis 1), and PTSS predicted less physical functioning and greater physical limitations (hypothesis 2). Further, PTSS mediated the relationship between AEE and physical functioning and limitations (hypothesis 3), and the indirect effect varied across levels of mainstream culture (hypothesis 4).

The significant mediating role of PTSS highlights the importance of studying psychosocial determinants of physical functioning. First, results suggest that AEE is related to problematic psychological and health-related problems. Breast cancer survivors are more prone to AEE compared to healthy individuals potentially due to their cancer diagnosis [7] and likely create barriers to reaching out for emotional support. Chinese breast cancer survivors with high AEE may be at risk for lower survival rates given that social support is related to increased longevity among cancer survivors [29]. Second, the study is among the first to show that PTSS account for the relationship between AEE and physical symptoms. Interestingly, all three dimensions of PTSS were significant mediators. AEE involves a process of appraising social situations whereby individuals negotiate personal desires to express emotions while evaluating potential risks. The dynamic process of evaluating social threats and withholding emotional expression may lead to chronic stress and exacerbate PTSS that manifest in physical symptoms. This is consistent with research suggesting a relationship between PTSD and anxiety disorders among breast cancer patients [30].

The moderating effect of mainstream culture highlights the importance of considering culture in emotional expression. The indirect effect of AEE on physical functioning and limitations through PTSS was strongest for those high, compared to low, in mainstream culture. Indeed, AEE is more psychologically distressing for those endorsing cultural values emphasizing individualism [9]. However, our results build upon previous research to show that the extent to which PTSS account for the physical consequences of AEE differs across cultural endorsement. Interestingly, mainstream culture only moderated the relationship between AEE and the re-experiencing symptom subscale. This suggests that individuals who endorse Western values and suppress their emotions are also at greater risk for negative thoughts about past traumatic events further supporting the notion that the adaptiveness of emotional suppression depends on cultural values. Further, the nonsignificant interactions with the other subscales suggest that culture more likely modifies the relationship between AEE and the re-experiencing symptom cluster, compared to the avoidance or arousal symptom clusters.

Research and practical implications

Rehabilitation interventions among cancer survivors have mainly focused on physical aspects of health by utilizing physical activity and exercise intervention. However, our results point to a greater need for interventions that target psychological contributors of physical functioning and limitations. One promising area of intervention is expressive writing, which involves disclosing emotions about stressful or traumatic events through writing. Expressive writing has been particularly helpful in improving psychological well-being for amyotrophic lateral sclerosis (ALS) patients [31] and Asian breast cancer survivors [21]. Further, expressive writing has been shown to relate to improved physical health indicators, such as lowered blood pressure, fewer self-reported physical symptoms, and improved organ functioning [32]. Future research should examine the effects of expressive writing on physical functioning among Chinese cancer survivors and the potentially moderating roles of AEE and acculturation.

An area for future research considers stigma as a cultural-based barrier that may facilitate AEE and discourage help-seeking behavior. Breast cancer survivors may be less likely to emotionally express as a result of their medical condition, but

they also may be struggling with internal psychological distress around discussing their condition as a result of stigma. Cancer survivors who have not integrated the condition into their identity may be at higher risk of psychological problems [33].

Descriptive statistics for the PTSS measure showed that the current sample had higher risk for PTSS than the general population. Based on DSM-IV criteria, 51% of the sample is at risk for clinical levels of PTSD. However, it is important to note that it may be an overestimation because a "Criterion A" event was not clinically assessed. A recent meta-analysis found that the prevalence of PTSD among breast cancer patients based on self-report measures ranged from 7 to 15.1% [34]. Thus, the potential rate of PTSD in this current sample of Chinese breast cancer survivors was more than three times the prevalence rate among a population of breast cancer patients. This finding highlights the importance of considering the mental health of Chinese breast cancer survivors as high levels of AEE may also place them at greater risk of not only not receiving needed mental health services but also having decreased physical functioning as our data suggest.

Limitations

The current study has several limitations. First, the cross-sectional nature of the data does not allow us to tease apart the temporal nature of the relationships. Future research should use longitudinal study designs to examine the relationship between AEE, PTSS, and physical functioning and limitations. Second, the study does not assess important contextual characteristics that influence emotion processing. For instance, AEE is typically studied as a trait, yet future research should examine momentary experiences of AEE as emotional expression is more likely to occur with some rather than others and in some environments compared to others. Third, the study relied on self-report measures of physical functioning, limitations, and PTSS which may be subject to reporting biases. Future studies should consider observer reports from family members or caregivers and conduct clinical interviews to obtain more reliable reports of physical functioning, limitations, and mental health. Fourth, a uni-dimensional conceptualization of AEE was used. Chen et al. [6] conducted an exploratory factor analysis of the Ambivalence over Emotional Expression Questionnaire in a sample of Chinese living in China and found a two-factor solution (emotional suppression and emotional rumination). Future studies should consider further validating the AEE and consider a two-factor solution. Fifth, PTSS were conceptualized using DSM-IV criteria. While we do not expect results to differ significantly with the latest DSM-V symptom cluster revision, future studies may examine the unique contribution of the "Negative Cognitions and Mood" symptom cluster in the relationship between AEE and physical functioning. Lastly, the sample included Chinese breast cancer survivors living in America. Although we expect a similar pattern of results among breast cancer survivors living in China, this conclusion requires further research.

Conclusions

The current study extends prior research by testing the mediating effects of PTSS in the relationship between AEE and physical functioning and limitations as well as the moderating mediated effects of acculturation. Consistent with cultural values of maintaining social harmony, the deleterious effects of AEE on physical functioning and limitations due to PTSS were stronger among those with higher, compared to lower, mainstream culture orientation. Our findings highlight the importance of culture in the emotion regulation process among Chinese breast cancer survivors.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest. Primary author has full control of all primary data and is willing to provide data upon request for reviewers.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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

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