

# Daily well-being of cancer survivors: the role of somatic amplification

Mary Jon Barrineau<sup>1\*</sup>, Steven H. Zarit<sup>1</sup>, Heather A. King<sup>2</sup>, Erin S. Costanzo<sup>3</sup> and David M. Almeida<sup>1</sup>

<sup>1</sup>Department of Human Development and Family Studies, Penn State University, University Park, PA, USA

<sup>2</sup>Center for Health Services Research in Primary Care, Health Services Research and Development Service, Department of Veterans Affairs Medical Center/Durham, NC, USA

<sup>3</sup>Department of Psychiatry, Carbone Cancer Center, University of Wisconsin-Madison, Madison, WI, USA

\*Correspondence to:

Department of Human Development and Family Studies, Penn State University, University Park, PA, USA.  
E-mail: mzb181@psu.edu

## Abstract

**Objective:** The current study examined the role that somatic amplification plays in placing cancer survivors at an increased risk of impairments in daily well-being, specifically severity of physical symptoms, positive affect and negative affect.

**Methods:** Participants were drawn from Midlife Development in the United States National Study of daily health and well-being (MIDUS) and the National Study of Daily Experiences (NSDE, Project 2). One hundred eleven individuals with a cancer history were compared with a matched comparison group of individuals who did not have a cancer history.

**Results:** Results show that across both groups, somatic amplification is associated with higher negative affect and higher severity of physical symptoms. However, results also show that a somatic amplification by cancer status interaction predicts severity of physical symptoms. The significant interaction indicates that in the comparison group, level of physical symptom severity is the same regardless of whether the individual is high or low on somatic amplification. However, in the group of individuals with a cancer history, individuals who are high on somatic amplification report more severe physical symptoms than individuals who are low on somatic amplification.

**Conclusions:** These findings suggest that heightened attention to minor bodily symptoms impacts individuals with a cancer history differently than individuals who have not experienced cancer, and therefore, may have important implications for the manner in which continued care is provided to cancer survivors.

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## Introduction

According to the National Cancer Institute, an individual is considered a cancer survivor from the time of diagnosis through the end of life [1]. As of January 2012, an estimated 13.7 million cancer survivors in the USA accounted for approximately 4% of the population [2]. It has also been estimated that the number of cancer survivors will increase by 31% in the next 10 years [1]. With the cancer survivorship population growing so rapidly, it is important to understand their unique challenges because the cancer experience does not end with the completion of treatment. Perhaps most importantly, cancer survivors may be at risk for developing psychological and physiological late or long-term effects from cancer treatment [3]. It has been reported that 25% of cancer survivors were at or above the clinical level of depression and 20% reported still experiencing at least one cancer related symptom [4]. Additionally, research has shown that more than 80% of breast cancer survivors 1 year after diagnosis reported fatigue, 72% reported trouble sleeping, 58% reported pain and finally, 44% reported dyspnea [5]. A

smaller percentage of breast cancer survivors also reported nausea, vomiting, constipation, diarrhea and loss of appetite. Finally, quality of life among breast cancer survivors was most severely impacted by fatigue, insomnia, pain and dyspnea [5].

In addition to experiencing symptoms directly related to their illness, cancer survivors may also be hypervigilant in recognizing other physical symptoms even minor ones, which may result in somatic amplification. Somatic amplification is broadly defined as a heightened sensitivity to minor somatic symptoms that are not typically indicative of a more serious illness [6]. Somatic amplification has three main components: hypervigilance, the tendency to concentrate on weak sensations and the tendency to react to symptoms in a way that makes them more alarming [7]. Although the minor somatic symptoms do not indicate the presence of a serious disease, somatic amplification can largely impact the individual through an association with mental health outcomes. For example, in 115 patients with upper-respiratory-tract infections, amplification was associated with depression, anxiety and hostility [7]. In cancer patients, somatic symptoms and somatic

amplification were associated with depression and anxiety [8,9]. Additionally, in colorectal cancer patients, somatization was associated with lower physical health quality of life [10].

Previous research has also compared the experiences of cancer survivors to individuals who do not have a cancer history, with these comparisons most often resulting in documentation of cancer survivors experiencing impairments in well-being compared with others. Compared with matched controls, cancer survivors were more likely to experience impairments in mental health (i.e., greater anxiety and depressive symptomatology), mood (higher negative affect and lower positive affect) and some aspects of psychological well-being (i.e., less environmental mastery, less positive relations with others and less self-acceptance) [11]. Furthermore, colorectal cancer patients' reports of their physical, role, cognitive and global health functioning were slightly worse than reports from the general population [12]. Additionally, breast cancer survivors 3 years post-diagnosis, had slightly worse physical functioning than the general population [5]. Research has also documented that cancer survivors have significantly poorer scores on all eight subscales (physical functioning, role physical, bodily health, general health, vitality, social functioning, role emotional and mental health) of the Medical Outcomes Study Short Form-36 compared with individuals without a cancer history [13]. The experiences of cancer survivors have also been investigated on a daily level. Costanzo, Stawski, Ryff, Coe and Almeida (2012) found that cancer survivors experienced similar numbers of daily stressors (e.g., arguments and work deadlines) as non-survivors, but showed a tendency to appraise their stressors as more severe and disruptive. While stressors were associated with increased negative affect, decreased positive affect and increased physical symptoms, cancer survivors showed a more pronounced increase in negative affect in response to stressors compared with individuals with no cancer history [14].

Considering the association between somatic amplification and well-being may help to clarify an additional mechanism that places cancer survivors at an increased risk of impairments in well-being. The current study seeks to extend previous research by assessing the association between somatic amplification and measures of well-being where impairments have previously been documented in cancer survivors. The specific aims and objectives of the study are the following: (1) to examine if mean levels of daily experiences of physical symptom severity, positive affect and negative affect vary between cancer survivors and individuals who have no cancer history, (2) to examine and understand how somatic amplification is associated with daily well-being, and (3) to examine how somatic amplification may impact daily well-being differently in cancer patients compared with individuals who have no cancer history.

## Method

### Ethics statement

The ethical approval for the original collection of these data was provided by the Social and Behavioral Science Review Board at the University of Wisconsin-Madison and the Institutional Review Board at the Pennsylvania State University.

### Sample

Participants were drawn from the second waves of the Midlife Development in the United States National Study (MIDUS II) and the National Study of Daily Experiences (NSDE II), which is part of the larger MIDUS II. MIDUS I was completed in 1995–1996 and included 7108 participants from four different subsamples: the national probability sample, the metropolitan over sample, the siblings sample and the twins sample. As a follow-up to MIDUS I, MIDUS II was collected between 2002 and 2006 and included the NSDE, which assessed the manner in which demographic factors impact an individual's daily exposure and reactivity to stressors [15]. NSDE contained 2022 respondents who were recruited after they completed the MIDUS II data collection. As part of the NSDE, participants completed daily telephone interviews about their experiences for eight consecutive days. On average, participants completed 7.4 out of a possible eight interviews [16]. Although data from NSDE were primarily utilized as the outcome measures in the current analyses, MIDUS II data were used to determine demographic information for the matching algorithm, cancer status and level of somatic amplification.

The analytic sample for the present study was comprised of a cancer survivor group and a matched control group. Individuals in the analytic sample participated in both the MIDUS II assessment and the NSDE II. Individuals were included in the cancer survivor group if they answered in the affirmative to the question 'Have you ever had cancer?' in the MIDUS II study. In the current study, we utilized the National Cancer Institute's and National Coalition for Cancer Survivorship's definition of a cancer survivor to include individuals who have been diagnosed from the time of diagnosis through the remainder of their life [17]. An algorithm developed by Costanzo and colleagues [11] was used to match cancer survivors and controls on age within 3 years, sex and education level (less than high school, high school, some college, college or advanced degree). In the current study, there were 111 cancer survivors and 111 matched controls. In each group, 63% of the participants were female, approximately 93% were Caucasian, and the mean age was 65 years (range of 35–83). Additionally, the mean level of education was some college, with a range from junior high education to an advanced degree.

Individuals with a cancer history were also asked to report on time since their diagnosis and the type of cancer they were diagnosed with. These cancer survivors had a median time since of diagnosis of 11 years, with a range of 1 to 59 years. Cancer sites included breast (29.7%), prostate (20.7%), colon (14.4%), cervical (9.0%), leukemia or lymphoma (9.0%), uterine (2.7%), ovarian (2.7%), lung (1.8%), other (15.3%) and unknown (0.9%).

## Measures

### Somatic amplification

Somatic amplification [7] was collected through telephone interviews in MIDUS II and consists of five items to assess the individual's awareness of bodily symptoms. The items are as follows: 'I am often aware of various things happening in my body', 'I hate to be too hot or too cold', 'sudden loud noises really bother me', 'I am quick to sense hunger contractions in my stomach' and 'I have a low tolerance for pain'. Participants rated their level of somatic amplification on a four-point numerical rating scale, where 1 = not at all true and 4 = extremely true. The total somatic amplification score is obtained by averaging scores on the five items. In the analytic sample for the current study, Cronbach's alpha for the scale was .60.

### Positive and negative affect

As part of the NSDE daily telephone interviews, participants were asked to report how much of the day they had experienced 13 positive mood states (e.g., cheerful, calm and peaceful, and close to others) and 14 negative mood states (e.g., nervous, everything was an effort and angry). The positive and negative affect items were measured using items from a variety of validated measures: the Positive and Negative Affect Schedule [18], the Affect Balance Scale [19], the General Well-Being Schedule [20], the Center for Epidemiological Studies Depression Scale [21], The University of Michigan's Composite International Diagnostic Interview [22], the Health Opinion Survey [23] and the Manifest Anxiety Scale [24]. Both the positive and negative mood states were rated on a five-point numerical rating scale, with higher scores indicating more positive affect or more negative affect. In the analytic sample, both positive and negative affect demonstrated high reliability with Cronbach's alphas of .94 and .84, respectively.

### Severity of physical symptoms

During the NSDE daily telephone interviews, participants also reported whether they experienced each of 28 symptoms and for each symptom they experienced, they rated the severity of the symptom. The list of physical symptoms and the scale for severity ratings were an adaptation from Larsen and Kasimatis [25]. Examples of the physical

symptoms assessed include muscle soreness, fatigue, nausea and dizziness. Severity was rated on a 10-point numerical rating scale, with higher scores indicating more severe symptoms.

### Neuroticism

In the MIDUS II baseline assessment, participants were asked how much each of four adjectives described them: moody, worrying, nervous and calm. The adjectives for the personality traits were selected from a variety of trait lists and inventories [26–29]; additional items were also generated for certain scales. The degree to which each adjective described them was rated on a four-point numerical rating scale where 1 = a lot and 4 = not at all. The items for moody, worrying and nervous were recoded so that higher numbers always indicated higher standing in each dimension. Cronbach's alpha for the analytic sample was .73.

### Procedure/analysis plan

The first analyses assessed if cancer survivors and individuals without a cancer history were significantly different on levels of somatic amplification, positive and negative affect, neuroticism or severity of physical symptoms. Second, a series of multilevel models were run on each of the daily outcomes by using SAS Proc Mixed (SAS Institute Inc., Cary, NC, USA). The first set of models tested whether somatic amplification predicted severity of physical symptoms, negative affect and positive affect in both groups. The second set of models tested whether a somatic amplification by cancer status interaction predicted severity of daily physical symptoms, negative affect and positive affect. Neuroticism was significantly correlated with each of the outcome variables and somatic amplification and therefore, was controlled in each model. Correlations are presented in Table 1.

## Results

### Outcome variables in cancer survivors compared with individuals with no cancer history

Before testing the association between somatic amplification and the measures of daily well-being, *t*-tests were

**Table 1.** Correlations between somatic amplification, measures of well-being and neuroticism

	P.A.	N.A.	S.A.	Neuro	P.S.S.
PA	1.00	-.601**	-.172*	-.447**	-.257**
N.A.		1.00	.247**	.401**	.288**
S.A.			1.00	.259**	.242**
Neuro				1.00	.259**
P.S.S.					1.00

P.A., positive affect; N.A., negative affect; S.A., somatic amplification; neuro, neuroticism; P.S.S., physical symptom severity.

\**p* < .05.

\*\**p* < .01.

conducted to determine if cancer survivors differed from individuals with no cancer history on measures of severity of physical symptoms, negative affect, positive affect and somatic amplification. Results indicate that while the differences between the cancer survivors and individuals with no cancer history were in the expected direction, the difference was only significant for positive affect ( $t(222)=4.287, p=.04$ ). Mean levels for each group are reported in Table 2.

### Prediction of outcomes by somatic amplification in the full sample

The first set of models tested whether somatic amplification predicted severity of physical symptoms, positive affect or negative affect. In both groups, somatic amplification significantly predicted severity of physical symptoms ( $\beta=.52$ , standard error (SE)=.20,  $p<.05$ ) and negative affect ( $\beta=.07$ , SE=.03,  $p<.05$ ). Across both groups, higher levels of somatic amplification were associated with more severe physical symptoms and higher levels of reported negative affect. However, somatic amplification did not predict positive affect. Model statistics are presented in Table 3.

### Prediction of outcomes with the somatic amplification by cancer status interaction

The second set of models in the analysis plan tested whether the association between somatic amplification and severity of physical symptoms, positive affect and negative affect varied by cancer status. The somatic amplification by cancer interaction did not predict positive or negative affect. However, the somatic amplification by cancer status interaction was associated with severity of physical symptoms ( $\beta=-.95$ , SE=.37,  $p=.01$ ). Figure 1 represents the graphical depiction of the somatic amplification by cancer status interaction in predicting severity

**Table 2.** Mean levels of measures by group

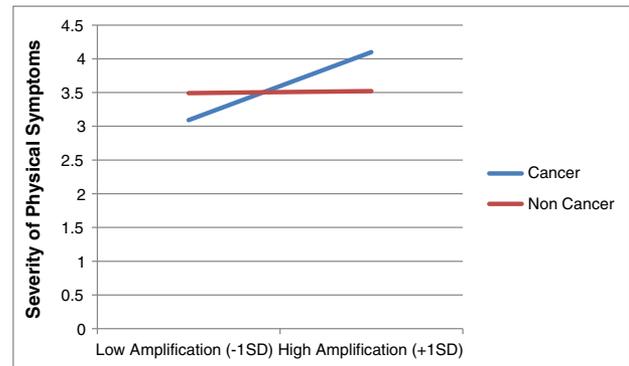
Measure	Group	
	Cancer	Non-cancer
Physical symptom severity	3.7	3.44
Daily negative affect	.19	.16
Daily positive affect	2.67*	2.84
Somatic amplification	2.44	2.42

\* $p<.05$ .

**Table 3.** Multilevel models with somatic amplification predicting well-being

	Estimate	Standard error
Positive affect	-.08	.08
Negative affect	.07*	.03
Physical symptom severity	.52*	.20

\* $p<.05$ .



**Figure 1.** Somatic amplification by cancer status interaction predicting symptom severity

of physical symptoms. In the comparison group of individuals with no cancer history, level of physical symptom severity is the same regardless of whether the individual is high or low on somatic amplification. However, in the cancer survivor group, individuals who are high on somatic amplification report more severe physical symptoms than cancer survivors who are low on somatic amplification. Model statistics are presented in Table 4. Within the cancer group, we further considered whether the median number of years since cancer diagnosis was associated with an individual's level of somatic amplification. However, there were no significant differences between individuals above and below the median on time since diagnosis in terms of somatic amplification.

## Discussion

The findings demonstrate that the association between somatic amplification and physical symptom severity varies across groups. In the no cancer history comparison group, level of somatic amplification does not have an impact on the severity of physical symptoms reported, whereas in the cancer survivor group, higher levels of somatic amplification are significantly associated with an increase in the severity of physical symptoms reported. Although somatic amplification is a heightened sensitivity to minor somatic symptoms that are not typically indicative of a more serious illness or problem [6] and therefore does not directly relate to cancer, the significant interaction between cancer status and somatic amplification in predicting physical symptom severity suggests that somatic amplification results in different consequences for cancer survivors.

**Table 4.** Multilevel models with somatic amplification by cancer status interaction well-being

	Estimate	Standard error
Positive affect	.15	.16
Negative affect	-.04	.05
Physical symptom severity	-.95*	.37

\* $p<.05$ .

Previous findings have documented that compared with individuals without a cancer history, cancer survivors often exhibit impairments in measures of well-being [11–13] and findings from the current study suggest that one source of compromised well-being may be somatic amplification. Leventhal's Illness Representations Model (1997) proposes that individuals who are diagnosed with a chronic illness develop cognitive and emotional schema, also known as illness representations, that are likely to influence how they adjust to the trajectory of their illness. It is through these illness representations that individuals interpret and understand their somatic symptoms [30]. Petrie and Weinman (2006) note that based on their representation, a patient may misattribute treatment side effects or other symptoms to their illness even when there is no relationship. Therefore, for individuals with a cancer history, the basis of amplification may be rooted in their illness representation or belief that minor bodily symptoms are related to cancer recurrence, which leads to psychological distress [31]. For example, Humphris, Rogers, McNally, Lee-Jones, Brown and Vaughan (2003) found that in two samples of orofacial cancer patients, fear of recurrence was significantly associated with anxiety at all study occasions [32]. Additionally, at the assessment 3 months posttreatment, there was a significant association between fear of recurrence and depression [32]. Although the current study does not measure fear of recurrence or a similar construct, the minor bodily symptoms measured as somatic amplification might cognitively be associated with a fear of recurrence, and therefore, the presence of physical symptoms have a deeper meaning for cancer survivors than individuals without a cancer history.

Although the findings from the current study show differences between the cancer survivors and no cancer history groups when somatic amplification is considered, findings do not support the belief that individuals with a cancer history will be significantly different than the comparison group on measures of well-being when sources of impairment are not considered. While the results from the current study do not replicate the findings of previous studies on some measures of well-being (i.e., significant differences in negative affect), the results do highlight one important distinction between the cancer survivors and no cancer history groups: individuals with a cancer history report significantly lower levels of positive affect. This finding is robust in that it replicates previous findings [11] but on a much smaller sample, which underscores the need to consider positive affect and the impact of decreased positive affect more often in research.

### Implications

The current study is the first of its kind to consider the role that somatic amplification may have in placing cancer survivors at increased risk for distress and impairments in

daily well-being. Reducing an individual's heightened sensitivity to minor bodily symptoms may help the survivor learn which symptoms indicate a complication or cancer recurrence and need attention and which symptoms do not. This understanding may also have important implications for the manner in which medical care is provided to cancer survivors. In 2006, the Institute of Medicine recommended that every cancer patient receive an individualized survivorship care plan focused on monitoring and maintaining health [33]. The Institute of Medicine notes that quality survivorship care should include four main components: (1) prevention of new and recurrent cancers, (2) surveillance of cancer spread and other late effects, (3) interventions for consequences related to cancer symptoms and treatments and (4) coordination between specialists to guarantee adequate care. An implicit component of all four recommendations is education because cancer survivors need to know and understand what symptoms should be reported if they are experienced [34]. Findings from the current study may assist with the educational components of a survivorship care plan because cancer survivors may be less likely to equate minor bodily symptoms with severe physical symptoms if they had a clearer understanding of what symptoms might be indicative of a cancer recurrence. Therefore, it is equally important for physicians to have a clear understanding of the role that somatic amplification plays in impacting the daily well-being of cancer survivors, so that they can provide the necessary education through the survivorship care plan. Although the report on care survivorship planning does not specifically address somatic amplification, education on understanding the difference between minor bodily symptoms and the symptoms that a survivor should be vigilant about is simply an additional dimension of monitoring health.

One barrier to this type of education related to monitoring symptoms is that physicians are often concerned that it will lead at least some patients to become more anxious and focus more on their somatic symptoms. While physicians noted that care plans would be beneficial to their patients, they also indicated that they would not want to provide such plans to all their patients [34]. Specifically, physicians felt that patients who were already anxious might become more anxious by having a document outlining all the possibilities of recurrence and late symptoms; instead of learning to attend more reliably to which symptoms are important, they may become more focused on all symptoms regardless of how minor the symptom appears. The physicians present a legitimate concern, and therefore, additional studies are needed to determine what type of professional and patient education will be most useful for working with anxious patients. Future work should also consider the optimal ways of controlling tendencies toward somatic amplification in cancer patients. With the proper approach, additional education

may reduce anxiety by helping survivors understand that not all bodily symptoms need to be reported because most are not indicative of a cancer recurrence.

### Limitations

Although MIDUS is a nationally representative sample that allowed for a match comparison group, the study is a survey of midlife and aging and not a survey of cancer. Therefore, disease-related and treatment-related information is somewhat limited. Additionally, all measures utilized in the current study were self-report measures, and it is possible that individuals who are likely to report traits of somatic amplification are also more likely to report more severe physical symptoms or more negative affect. As previously mentioned, neuroticism was associated with each of the outcome variables and somatic amplification, and although we did statistically control for that personality trait, it is possible that the variables included in the analyses and the reporting tendencies of the participants are linked through a process or mechanism that is not available in the data. Even after controlling for the personality trait, the bias of only using self-report measures is still possible.

The time since diagnosis for the cancer survivors is also fairly long and varied, and therefore, provides some difficulty in interpreting the results. The range of time since diagnosis is 1 to 59 years, and it is not clear if there is a point in that range at which individuals are at a greater risk of experiencing the negative impacts of somatic amplification.

### Future directions

Future work should further explore the association of somatic amplification and daily well-being in contexts outside of self-report measures, such as considering

objective measures of health or physical capabilities of the individual with a cancer history. As previously mentioned, although the current study controlled for one personality trait, neuroticism, it is still possible that individuals who are more likely to report traits of somatic amplification are also more likely to report more severe physical symptoms or more negative affect.

Additionally, the main analyses of the current study were between group analyses, and therefore, future work could consider differences within the cancer survivor group. Somatic amplification seems to function similarly to a personality trait, but it is also important to know if disease specific information or demographic characteristics are correlates of somatic amplification for cancer patients. A deeper understanding of what characteristics predict somatic amplification would have important intervention implications for helping to reduce psychological distress following a cancer diagnosis.

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### Conflict of interest

The authors do not have any potential conflicts of interest.

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