

Mindfulness, Experiential Avoidance, and Recovery From Hematopoietic Stem Cell Transplantation

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Published online: 9 January 2019

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Abstract

Background Mood disturbance, pain, and fatigue are prevalent and distressing concerns for patients with hematologic cancer recovering from hematopoietic stem cell transplantation (HSCT). The way in which individuals approach difficult thoughts and emotions may affect symptoms and functioning. Specifically, mindfulness has been associated with more optimal psychological and physical functioning, whereas experiential avoidance has been associated with poorer outcomes.

Purpose The primary objective was to determine whether mindfulness and experiential avoidance measured prior to HSCT were associated with recovery of psychological and physical functioning following HSCT. We also evaluated dimensions of mindfulness to determine which were most robustly associated with outcomes.

Methods Participants completed measures of mindfulness and experiential avoidance prior to HSCT. Depression and anxiety symptoms and pain and fatigue interference with daily activities were assessed prior to HSCT and 1, 3, and 6 months post-HSCT.

Results Participants who reported better ability to describe their internal experiences and who were better able to act with awareness experienced less depression, anxiety, and fatigue interference following HSCT. Participants who were nonjudgmental and nonreactive toward thoughts and emotions experienced less depression and anxiety following HSCT, but these traits were not associated with pain or fatigue interference. Being a good observer of internal experiences was not associated with outcomes, nor was experiential avoidance.

Conclusions Results suggest that most facets of mindfulness may optimize psychological functioning following HSCT, and the ability to describe one's internal experience and to focus on the present moment may have a beneficial influence on physical functioning.

Key words Mindfulness • Experiential avoidance • Hematopoietic stem cell transplant • Depression • Pain • Fatigue

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Introduction

Hematopoietic stem cell transplantation (HSCT) is a rigorous therapy used to treat hematologic diseases, including leukemias and myelodysplasias, lymphomas, and multiple myeloma. Treatment involves full (myeloablative) or partial (nonmyeloablative) ablation of the bone marrow with chemotherapy and/or radiation therapy followed by infusion of autologous (self) or allogeneic (donor) hematopoietic cells. Although HSCT can improve survival, it is a difficult treatment that carries with it a high risk of morbidity and mortality [1]. Patients experience severe acute side effects including nausea and vomiting, diarrhea, fatigue and malaise, and painful mucositis, typically requiring supportive care in the hospital. Treatment-related side effects such

as fatigue and debility can persist for months or even years [2–4]. HSCT recipients may develop complications of infection and graft-versus-host disease that can be severe, persistent, and may even cause death [4–6].

Cancer diagnosis and treatment have been conceptualized as traumatic stressors [7], resulting in feelings of fear, helplessness, and even horror [8–10]. Given the significant risks and severe and persistent nature of the treatment effects, patients with HSCT are likely to be at especially high risk for this type of response, and it is not surprising that this patient population experiences a particularly high level of psychological distress and related sequelae [11, 12]. The way in which individuals approach and manage difficult thoughts, emotions, and physical sensations has been shown to hinder or facilitate psychological functioning, including the development of traumatic stress symptoms, and to affect the experience and expression of physical symptoms [12–16]. The present study evaluated two behavioral approaches to difficult or painful internal experiences in patients with HSCT: mindfulness and experiential avoidance. These processes may be especially important in this vulnerable patient population.

Mindfulness involves being aware and accepting of the flow of one's current experience, including feelings, thoughts, and bodily sensations, without reacting or judgment. It has been defined as “paying attention in a particular way: on purpose, in the present moment, and nonjudgmentally” [17] and “accepting and allowing what is” rather than focusing on achieving specific goals [18]. Factor analyses of several commonly used mindfulness measures contributed to the definition and assessment of mindfulness by identifying five dimensions: describing inner experience (using words to label internal experience), observing inner and outer experience (noticing and attending to experience), acting with awareness (attending to present moment activities), nonjudgment of inner experience (accepting thoughts and emotions), and nonreactivity to inner experience (allowing the flow of thoughts and emotions without getting caught up in them) [19, 20]. This accepting, flexible approach to one's experience has been found to reduce distress and improve functioning and well-being [21–24].

Experiential avoidance involves conscious or unconscious efforts to escape the experience of difficult emotions, thoughts, memories, and bodily sensations [25]. Not surprisingly, there is an inverse relationship between mindfulness and experiential avoidance [26]. Disengaging from distressing internal experiences can reduce distress temporarily. However, over time, the avoided emotions and thoughts typically reappear and become intrusive [27, 28]. In fact, the attempt to avoid or suppress difficult thoughts can conversely increase those thoughts and the accompanying emotions [28–31]. Indeed, previous

research has shown that experiential avoidance underlies anxiety, depression, and posttraumatic stress symptoms and is associated with poor overall emotional and psychological well-being [32, 33].

“Third-wave” behavioral psychotherapies, including mindfulness-based cognitive therapy (MBCT; [18]), Acceptance and Commitment Therapy (ACT; [34]), and Dialectical Behavioral Therapy (DBT; [35]) use acceptance-based strategies to cultivate mindfulness and reduce experiential avoidance. These approaches target patients' behavioral responses to internal private experience (e.g., thoughts and bodily sensations) rather than attempting to change the form or frequency of the experience. Outside of the clinic setting, Kabat-Zinn's popular mindfulness-based stress reduction program (MBSR; [17]) teaches mindfulness through body awareness, mindfulness meditation, and yoga. These approaches have been very effective in reducing anxiety and depression and bolstering psychological well-being [22, 34, 36]. Among individuals with cancer, mindfulness-based interventions have been shown to improve depression, anxiety, fatigue, sleep, and overall physical functioning in randomized trials [15, 23, 24].

In addition to their utility as psychotherapeutic targets, mindfulness and experiential avoidance have been examined as personal dispositions that vary across individuals [31, 37–39], and this was the focus of the present investigation. Prior work has shown that patients with breast cancer who were more mindful report less psychological distress, including less depression and anxiety, and have overall better physical functioning, including less fatigue [26]. Similarly, mindfulness was associated with less stress and uncertainty in young adults who had completed cancer treatment [40]. In contrast, experiential avoidance has been associated with greater anxiety and depression among women with breast cancer, with indirect effects on physical, emotional, and functional well-being mediated by depression [25]. Related constructs, including suppression of thoughts and emotions, have also been linked to anxiety, depression, and fatigue in patients with breast cancer [13, 26, 41]. Avoidant coping strategies, including mental disengagement or distraction, behavioral disengagement, and denial have similarly been associated with anxiety and poorer emotional and functional well-being in patients with gynecologic cancer [42]. However, these measures focus on a specific strategy or behavioral aspect of avoidance and do not capture the broader construct of experiential avoidance.

Considering Cordova's framework of cancer as a traumatic stressor [7] in the context of this intensive, high-risk treatment suggests that this patient population may be especially sensitive to the benefits of mindfulness and adverse effects of experiential avoidance. However,

no prior work, to the best of our knowledge, has evaluated mindfulness and experiential avoidance as risk and resilience factors in patients with HSCT. The current study therefore addressed these questions. The study also extends prior work that has been primarily cross-sectional by utilizing a longitudinal design to begin to evaluate the temporal dynamics of the relationships between these behavioral approaches and psychological and physical functioning.

The primary objective was to determine the extent to which mindfulness and experiential avoidance measured prior to transplant predicted recovery of physical and psychological functioning at 1, 3, and 6 months following transplant. We focused on the first 6 months post-HSCT because that is when side effects are most significant and when the most marked recovery occurs. It was hypothesized that transplant recipients who reported using more mindfulness and less experiential avoidance pre-HSCT would experience fewer depression and anxiety symptoms and less pain and fatigue interference with their daily activities post-HSCT. We also evaluated whether mindfulness and experiential avoidance predicted the trajectory of recovery of these outcomes, although we did not have specific hypotheses about differences in change over time. The study extends prior work in other cancer populations by utilizing a prospective, longitudinal design to better evaluate the temporal dynamics of these relationships. A secondary objective was to evaluate which aspects of mindfulness were most robustly associated with patient outcomes.

Methods

Participants

Participants were adults receiving hematopoietic stem cell transplants and follow-up care at the University of Wisconsin Carbone Cancer Center who were participants in a larger prospective, longitudinal study designed to investigate the extent to which psychosocial risk and resilience factors predicted immune, clinical, and quality of life recovery from hematopoietic stem cell transplant. All procedures performed were in accordance with the American Psychological Association ethical standards and with the 1964 Helsinki declaration and its later amendments. Informed consent was obtained from all participants. Prior to transplant, participants completed a battery of self-report assessments evaluating psychological adjustment and quality of life dimensions and provided a blood specimen for evaluation of circulating immune markers. Assessments were also completed at 1, 3, and 6 months post-transplant. A subset of participants also completed long-term follow-up

evaluations at 1, 3, and 6 years post-transplant as part of the parent study, but these were not used in the present analyses. Participants completed each assessment at a clinic visit or were mailed the questionnaires if they were not available at a clinic visit. Reminder phone calls were made to participants who did not return materials promptly. Information about treatment, complications, and outcomes was abstracted from participants' medical records at each of the study assessment points.

Mindfulness and experiential avoidance measures were not part of the initial study battery but were added later based on their potential utility in understanding risk and resilience factors for this patient population. Thus, participants included in the present study were a subset of those in the larger study who completed the mindfulness and experiential avoidance measures. Participants who completed the pretransplant assessment and at least one post-transplant assessment were included ($N = 111$) from a larger sample of 530 participants. Due to study attrition, missing data, or mortality, data were available from fewer patients at the 1 month ($n = 100$), 3 month ($n = 85$), and 6 month ($n = 76$) follow-up time points. Those who did not complete the study had higher scores on two scales on the Five Facet Mindfulness Questionnaire (*acting with awareness* and *non-judgment of inner experience*), $p < .05$. There were no other significant differences between those who completed the study and those who did not on predictor or outcome measures.

Patients were diagnosed with leukemia (34.2%), lymphoma (30.6%), multiple myeloma (28.8%), or another hematologic disease (6.3%) and the study included recipients of both autologous ($N = 60$) and allogeneic ($N = 51$) stem cells. They ranged from 27 to 74 years old with a median of 58 years old. Demographic and clinical summaries are provided in [Table 1](#).

Measures

Mindfulness

The 39-item Five Facet Mindfulness Questionnaire (FFMQ) was used to assess individual differences in the general tendency to be mindful in everyday life. Five dimensions of mindfulness were assessed as follows: describing, observing, acting with awareness, nonjudgment of inner experience, and nonreactivity to inner experience [19]. Participants rated how accurately each statement characterized themselves from 1 (never or very rarely true) to 5 (very often or always true). Example items include “I watch my feelings without getting lost in them” (nonreactivity) and “I can usually describe how I feel at the moment in considerable detail (describing).” This measure had good reliability in the present study, $\alpha = .77-.89$.

Table 1 Clinical information and demographic characteristics of the patient sample ($N = 111$)

	<i>n</i> (%)
Diagnosis	
Leukemias	38 (34.2)
CML	2 (1.8)
CLL	3 (2.7)
ALL	6 (5.4)
AML	19 (17.1)
MDS	7 (6.3)
Lymphomas	34 (30.6)
Hodgkin	6 (5.4)
Non-Hodgkin	26 (23.4)
Multiple myeloma	32 (28.8)
Other	7 (6.3)
Graft Type	
Autologous	60 (54.1)
Allogeneic	51 (45.9)
Ablative, Related Donor	19 (17.1)
Ablative, Unrelated Donor	16 (14.4)
Non-Ablative, Related Donor	9 (8.1)
Non-Ablative, Unrelated Donor	4 (3.6)
Sex	
Male	60 (54.1)
Female	51 (45.9)
Ethnicity	
Caucasian	108 (97.3)
African American	1 (.9)
Asian American	1 (.9)
Declined to respond	1 (.9)
Relationship Status	
Married	89 (80.2)
Single	9 (8.1)
Divorced/Separated	10 (9.0)
Widowed	2 (1.8)
Declined to respond	1 (.9)
Education	
High School or Less	25 (22.5)
Some College/Trade School	37 (33.3)
College Graduate	31 (27.9)
Post-Graduate Degree	18 (16.2)
Annual Household Income	
<\$25,000	4 (3.6)
\$25,001-\$55,000	40 (36)
\$55,001-\$85,000	30 (27)
\$85,001-\$100,000	15 (13.5)
>\$100,000	17 (15.3)
Declined to respond	5 (5.5)

Experiential avoidance

The 15-item Brief Experiential Avoidance Questionnaire (BEAQ) was used to assess individual differences in the tendency to avoid unwanted thoughts, emotions, memories, and bodily sensations [43]. Participants rated how accurately each statement characterized themselves on a 6-point scale from 1 (strongly disagree) to 6 (strongly agree). Example items include “When unpleasant memories come to me, I try to put them out of my mind” and “I work hard to keep out upsetting feelings.” This measure had good reliability in the present study, $\alpha = .83$.

Psychological functioning

The 20-item general depression scale of the Inventory of Depression and Anxiety Symptoms (IDAS) was used to assess DSM-V-based symptoms of depression [44]. Participants rated the extent to which they experienced each of the symptoms in the past 2 weeks from 1 (not at all) to 5 (extremely). This measure had good reliability in the present study, $\alpha = .92$. Somatic anxiety symptoms were assessed with the 8-item panic subscale of the IDAS. This measure had good reliability in the present study, $\alpha = .85$. Cognitive symptoms of anxiety, specifically, the extent to which participants experienced intrusive thoughts about their experience with cancer, were evaluated with the 8-item intrusion subscale of the Impact of Event Scale–Revised (IES-R) [45]. This measure had good reliability in the present study, $\alpha = .89$.

Physical functioning

The 7-item interference subscale of the Brief Pain Inventory (BPI) was used to assess pain interference with everyday activities [46]. Participants rated the extent to which pain interfered with each of 7 aspects of everyday life, including mood, mobility, and personal relationships from 0 (does not interfere) to 10 (completely interferes). This measure had good reliability in the present study, $\alpha = .95$.

The 7-item interference subscale of the Fatigue Symptom Inventory (FSI) was used to assess fatigue interference with everyday activities [47]. Participants rated the extent to which fatigue interfered with aspects of everyday life including mood, activities of daily living, and relationships from 0 (no interference) to 10 (extreme interference). This measure had good reliability in the present study, $\alpha = .94$.

As part of the larger study, participants also completed the Positive and Negative Affect Schedule (PANAS; [48]), the Psychological Well-Being scale (PWB; [49]), the Posttraumatic Growth Inventory (PTGI; [50]), the Social Provisions Scale (SPS; [51]), the Pittsburgh Sleep Quality Index (PSQI; [52]), and the Functional Assessment of Cancer Therapy (FACT; [53]) prior to

HSCT. The PANAS, PTGI, PSQI, and FACT were given at posttransplant follow-up assessments. Typical time for completion was 30–45 min for the pretransplant battery and 20–30 min for the posttransplant assessments.

Statistical analyses

Analyses were conducted using STATA statistical software. Repeated measures regression models were used to examine the extent to which mindfulness and experiential avoidance measured pretransplant predicted psychological and physical functioning outcomes, as well as change over time in these measures, across the four assessment points. Separate models were run for each mindfulness subscale and for experiential avoidance. The models included all available data points, including those from participants with some missing data. Time since transplant (the assessment point) was entered as a categorical variable in all models to adjust for the effects of time and to account for nonlinear changes of outcome variables over time. Time estimates are the average difference from the reference time category (pretransplant). Transplant graft type (allogeneic or autologous), participant age, and sex were included as covariates in all models as these variables are known to influence psychological and physical function posttransplant. Initial models tested both the main effects of mindfulness or experiential avoidance and the interaction between these measures and time since transplant to determine whether mindfulness or experiential avoidance predicted psychological and physical functioning and changes in functioning over time. When interaction terms were not significant, they were removed from the models. To enhance interpretability of the model coefficients, predictors and outcome variables were standardized.

Due to multiple tests (30 across all predictors and outcomes), we used the Benjamini and Hochberg False Discovery Rate (FDR) procedure to control for both the false discovery rate and the family-wise error rate. In brief, the FDR procedure involves ranking p values from smallest to largest and requires increasingly low p values to reject the null hypothesis as the p value rank decreases [54].

Results

Means, standard deviations, and ranges for mindfulness subscales and experiential avoidance are displayed in Table 2. Scores were compared with those from the four samples in a construct validation study of the FFMQ, including nonmeditating students, nonmeditating community adults, nonmeditating highly educated

Table 2 Means and standard deviations for mindfulness and experiential avoidance measured pretransplant

	<i>n</i>	<i>M</i>	<i>SD</i>	Range
Mindfulness				
Describing	107	29.06	5.65	14–40
Acting with Awareness	108	30.89	5.05	15–40
Nonjudging of Inner Experience	106	31.71	5.24	18–40
Nonreactivity to Inner Experience	107	22.65	4.59	11–34
Observing	106	26.27	6.11	12–39
Experiential Avoidance	93	39.75	10.82	18–69

adults, and a meditating sample [20]; scores in this patient sample were generally similar to the nonmeditating adult samples. Because only four participants in our sample reported any meditation practice, our sample was also largely a nonmeditating sample. Scores in this patient sample were slightly lower than scores from other patient and community samples for experiential avoidance [43].

Most FFMQ scales were moderately correlated with the BEAQ, with correlations ranging from $r = -.18$ to $-.34$. The exception was the observing scale, which was not correlated with the BEAQ, $r = .05$.

Mindfulness and psychological functioning

There were no statistically significant interactions between mindfulness and time since transplant in the initial models, indicating relatively stable effects of mindfulness on psychological functioning over time. Interaction terms were therefore removed from final models. Table 3 summarizes the main effects of pretransplant mindfulness facets on psychological functioning outcomes across the four assessment points. After covarying for time since transplant, transplant type, participant age, and sex, four of the five facets of mindfulness assessed pre-HSCT significantly predicted post-HSCT psychological functioning outcomes. Higher *acting with awareness* scores predicted less depression, less somatic anxiety, and fewer intrusive thoughts about cancer. Similarly, *non-judging* predicted less depression and fewer intrusive thoughts, but was not associated with somatic anxiety. *Describing* and *nonreactivity* significantly predicted less depression and less somatic anxiety, but not intrusive thoughts. *Observing* was not associated with any psychological functioning outcomes.

Mindfulness and physical functioning

There were no significant interactions between mindfulness and time since transplant in the initial models analyzing physical functioning. Interaction terms were therefore removed from final models. Table 4

Table 3 Results from repeated measures regression models examining relationships between pretransplant FFMQ subscales, experiential avoidance, and psychological functioning outcomes

	Depression (IDAS)			Somatic anxiety (IDAS)			Intrusive thoughts (IES-R)		
	Coef.	<i>z</i>	<i>p</i>	Coef.	<i>z</i>	<i>p</i>	Coef.	<i>z</i>	<i>p</i>
Mindfulness									
Describing	−.368	−4.68	<.001*	−.209	−2.61	.009*	−.150	−2.12	.034
Acting with Awareness	−.392	−5.04	<.001*	−.331	−4.32	<.001*	−.186	−2.63	.008*
Nonjudging of Experience	−.279	−3.37	.001*	−.073	−0.88	.378	−.218	−3.09	.002*
Nonreactivity to Experience	−.242	−2.94	.003*	−.208	−2.62	.009*	−.071	−0.99	.322
Observing	−.025	−0.37	.709	.051	0.60	.548	.086	1.16	.245
Experiential Avoidance	.110	1.22	.222	.034	0.40	.692	.108	1.46	.143

**p* value is statistically significant after FDR procedure.

Outcomes were assessed pre-HSCT and 1, 3, and 6 months post-HSCT. All models covaried for time since transplant, transplant type, age, and sex. Mindfulness scores, experiential avoidance scores, and psychological functioning outcomes were standardized. Therefore, coefficients represent the change in standard deviation units of the psychological functioning outcome measure per standard deviation difference in the mindfulness or experiential avoidance scales.

Table 4 Results from repeated measures regression models examining relationships between pretransplant FFMQ subscales, experiential avoidance, and physical functioning outcomes

	Pain Interference (BPI)			Fatigue Interference (FSI)		
	Coef.	<i>z</i>	<i>p</i>	Coef.	<i>z</i>	<i>p</i>
Mindfulness						
Describing	−.157	−2.01	.044	−.180	−2.35	.019*
Acting with Awareness	−.169	2.16	.031	−.199	−2.61	.009*
Non-judging of Experience	−.059	−0.73	.466	−.121	−1.54	.123
Non-reactivity to Experience	−.096	−1.23	.220	−.114	−1.49	.136
Observing	.033	0.42	.677	.023	0.29	.768
Experiential Avoidance	.044	0.52	.605	.096	1.16	.247

**p* value is statistically significant after FDR procedure.

Outcomes were assessed pre-HSCT and 1, 3, and 6 months post-HSCT. All models covaried for time since transplant, transplant type, age, and sex. Mindfulness scores, experiential avoidance scores, and physical functioning outcomes were standardized. Therefore, coefficients represent the change in standard deviation units of the physical functioning outcome measure per standard deviation difference in the mindfulness or experiential avoidance scales.

summarizes the results of repeated measures regression models examining the main effects of pretransplant mindfulness facets on physical functioning outcomes across the four assessment points. After covarying for time since transplant, transplant type, participant age, and sex, two of the five facets of mindfulness assessed pre-HSCT significantly predicted post-HSCT physical functioning outcomes. Higher *describing* and *acting with awareness* scores predicted less pain and fatigue interference with daily activities, but the relationship with pain interference was not significant after applying the FDR procedure. *Nonjudging*, *nonreactivity*, and *observing* did not significantly predict any physical functioning outcomes.

Experiential avoidance and psychological and physical functioning

There were no significant interactions between experiential avoidance and time since transplant in the initial models. Interaction terms were therefore removed from final models. Tables 3 and 4 summarize the results of repeated measures regression models examining the main effects of pretransplant experiential avoidance on psychological and physical functioning outcomes across the four assessment points. After covarying for time since transplant, transplant type, participant age, and sex, experiential avoidance did not significantly predict any psychological or physical functioning outcomes.

We reran all models removing four participants who reported any meditation practice, and there were no changes in the results.

Discussion

Our findings showed that patients with hematologic cancer who were more mindful prior to HSCT had better psychological and physical functioning in the initial months following HSCT, suggesting that mindfulness may confer resilience and facilitate recovery in the context of this intense treatment regimen. This is consistent with findings from studies of other cancer populations showing that patients who are more mindful have more optimal psychological and physical functioning overall [26, 40]. In contrast to predictions based on the extant literature, experiential avoidance was not associated with psychological or physical functioning outcomes. This is the first study to evaluate individual differences in both of these approaches among individuals undergoing HSCT.

Our evaluation of different dimensions of mindfulness suggests that most facets are likely to be beneficial with respect to psychological functioning. Specifically, patients with a better ability to describe inner experience, attend to the present moment, take a nonjudgmental stance toward their experience, and allow thoughts, feelings, and sensations to come and go without reacting prior to HSCT reported less depression and less anxiety, both with respect to somatic anxiety symptoms and intrusive thoughts, during the recovery from HSCT. In contrast, links between mindfulness and physical functioning appeared to be limited to two specific factors: those reporting greater ability to describe internal experience and attend to the present moment experienced less interference in functioning due to fatigue. It may be that patients who can describe internal experiences are better able to communicate with their care providers and elicit supportive interventions. In a similar manner, patients who are better able to describe their emotions may also be more effective in obtaining support. Acting with awareness may cultivate the ability to act constructively in stressful situations [55]. Similarly, it could be that the ability to act with awareness of physical symptoms allows patients to more optimally modulate their rest and activity level and attend to symptoms in a way that improves functioning.

The only facet of mindfulness that did not predict any psychological or physical functioning outcomes was the ability to observe internal and external experiences. This finding is consistent with prior research indicating that the observing facet functions differently for individuals who are meditators when compared with nonmeditating samples [20]. Baer and colleagues theorize that

observation and attention to internal experience may be ineffective or even maladaptive unless individuals are trained to observe experiences with an accepting, nonjudgmental, and nonreactive stance toward them.

In contrast with prior research linking experiential avoidance to less optimal psychological and physical functioning in individuals with cancer [13, 25, 26, 41], we did not see any associations in this sample. It may be that the relationship between avoidance and symptoms functions differently during the acute recovery from HSCT, measured here, when symptoms are most intense but can also be transient and intermittent. As noted previously, some types of avoidance strategies, such as distraction, can be beneficial with acute psychological and physical symptoms [27, 56]. It would be valuable to determine whether experiential avoidance shows a different relationship with more persistent symptoms among long-term HSCT survivors. Experiential avoidance scores in this patient sample were slightly lower than other community and patient samples [43]. It is unclear why this was the case, but the lower scores may have influenced the results. Finally, the present study used a brief assessment of experiential avoidance; exploring relationships between different dimensions of avoidance and physical and psychological outcomes with the more comprehensive Multidimensional Experiential Avoidance Questionnaire [57] may be fruitful.

In sum, our results suggest a relationship between attending to one's thoughts, emotions, and bodily sensations without judgment or reactivity and more optimal psychological and physical functioning in the physically and psychologically demanding and life-threatening context of HSCT. Considering the framework of cancer and treatment as a traumatic stressor [7], this type of approach to the painful and difficult internal experiences that inevitably occur may foster resilience. The prospective, longitudinal design builds upon prior cross-sectional studies and suggests that mindfulness predicts beneficial outcomes over a sustained period of time. Limitations of the study include the racial and ethnic homogeneity of our sample, which restricts the generalizability to more diverse populations. It is also important to acknowledge that this was an observational study, and without manipulating mindfulness at the outset, one cannot definitively be certain of causality. We evaluated mindfulness and experiential avoidance only at the pretransplant assessment point. Although these measures are conceptualized as relatively stable dispositions [31, 37–39], it would be valuable for future work to determine whether they change over the course of the posttransplant recovery, to what extent they covary or interact with one another over time, and whether they vary with specific disease- or treatment-related stressors. Very few participants in our study reported

any experience with meditation, and we did not collect data on type or extent of practice. Evaluating whether relationships between mindfulness and functioning vary based on experience with mindfulness and meditation would be a valuable addition to the literature. Finally, although the patient population was limited to only those receiving HSCT, it included individuals with several types of cancer, and there was a large age range that might lead to variation in personal reactions to treatment and recovery.

In conclusion, results of the current study highlight the potentially salubrious effects of mindfulness for patients with hematologic cancer undergoing HSCT, with particular emphasis on one's ability to describe internal experience and act with awareness in the present moment given the association seen between these factors and less interference of psychological and physical symptoms. Approaching the difficult thoughts, emotions, and physical symptoms that inevitably arise in the course of the treatment and recovery with an open, aware, and nonjudgmental perspective may be particularly valuable for patients recovering from this demanding treatment.

Funding This research was supported by grants K07 CA136966 and R21 CA133343 (to E. S. Costanzo) and P30 CA014520 (UW Carbone Cancer Center Support Grant) from the National Cancer Institute (NCI); the Clinical and Translational Science (CTSA) program through the NIH National Center for Advancing Translational Sciences (NCATS) grant UL1 TR000427; the Forward Lymphoma Foundation; and a Hilldale Undergraduate Research Award (to A. G. Larson and E. S. Costanzo).

Compliance with Ethical Standards

(Author's) or Authors' Statement of Conflict of Interest and Adherence to Ethical Standards Authors Anna G. Larson, Keayra J. Morris, Mark B. Juckett, Christopher L. Coe, Aimee T. Broman, and Erin S. Costanzo declare that they have no conflict of interest.

Ethical Approval This study was approved by the University of Wisconsin Institutional Review Board. All procedures performed in studies involving human participants were in accordance with the American Psychological Association ethical standards and with the 1964 Helsinki declaration and its later amendments. This article does not contain any studies with animals performed by any of the authors.

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

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