


# Individualized, Single Session Yoga Therapy to Reduce Physical and Emotional Symptoms in Hospitalized Hematological Cancer Patients

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Jennifer S. Mascaro, PhD<sup>1</sup> , Alessia V. Waller, BA, MSc<sup>1</sup>, Laurie Wright, PA<sup>1</sup>, Terri Leonard, MA<sup>1</sup>, Carla Haack, MD<sup>1</sup>, and Edmund K. Waller, MD, PhD, FACP<sup>1</sup>

## Abstract

**Objective:** Inpatient treatment of hematological cancer is among the most physically and mentally arduous cancer treatments, and it is associated with a number of common physical, emotional, and social symptoms that can negatively affect quality of life (QOL) for years following treatment. While treating symptoms during hospitalization holds promise for improving long-term QOL, successful approaches likely require multidisciplinary interventions. In this article, we describe a 4-year effort in program enhancement that incorporated an adjunctive single yoga therapy session during treatment for hematological malignancies. **Methods:** Hospitalized patients receiving treatment for hematological cancer (N = 486) were provided a 40-minute individualized yoga therapy session. We evaluated feasibility and acceptance by quantifying the percentage of patients who discontinued the yoga session due to pain, discomfort, or another reason, and by comparing the intervention population to the demographic makeup of the unit more generally. Patient-reported symptoms were obtained before and after each session, and we evaluated acute symptom change for the entire sample and in subsamples that are less likely to use mindfulness-based interventions such as yoga. **Results:** The majority of sessions (87%) were completed, and the majority of unfinished sessions were interrupted by a medical procedure or because the patient fell asleep. No session was stopped early due to patients' reported pain. Significant decreases were reported in all symptoms, with the greatest decrease in fatigue and anxiety. **Conclusions:** Yoga therapy was a feasible and effective nondrug adjunct intervention for hospitalized patients receiving treatment for hematological cancer, including bone marrow transplantation.

## Keywords

anxiety, cancer, cancer fatigue, hematological cancer, oncology, psychological health, stem cell transplantation, symptom management, yoga

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## Background

Approximately 1.3 million people in the United States are currently diagnosed or are in remission from hematological cancers such as leukemia, lymphoma, and myeloma, and these cancers account for over 10% of new cancer diagnoses in the United States each year.<sup>1</sup> Treatments for hematological cancers (chemotherapy, radiotherapy, and/or bone marrow or stem cell transplantation) often involve a lengthy hospitalization and a plethora of common side effects that are sometimes as detrimental to patients' quality of life (QOL) as the cancer itself. The most common include physical (fatigue, pain, sleep disturbance), psychological (anxiety, depression),

and social (loneliness, negative self-image, loss of control, and privacy) sequelae.<sup>2</sup> While rates of emotional distress and physical limitations are acutely elevated in the 100 days following treatment,<sup>3,4</sup> the majority of survivors regain high levels of physical function 5 years out of treatment.<sup>5</sup> However, socioemotional symptoms appear to be more difficult to

<sup>1</sup>Emory University, Atlanta, GA, USA

### Corresponding Author:

Jennifer S. Mascaro, Division of Family and Preventive Medicine, Emory University School of Medicine, 1841 Clifton Road NE, Suite 507 Atlanta, GA 30329, USA.

Email: [jmascar@emory.edu](mailto:jmascar@emory.edu)



remediate, and long-term medical uncertainty and fear of relapse leave a majority of blood cancer survivors with lingering emotional distress<sup>5,6</sup> and restricted social function.<sup>3,7</sup>

With rapid advancement in survival rates after treatment for blood cancer,<sup>8,9</sup> deterioration in physical and emotional health of patients has the potential to negatively affect their QOL for years following treatment<sup>7</sup> and affects survival.<sup>10-12</sup> The impact on mortality may be due in part to elevated levels of  $\beta$ -adrenergically induced pro-inflammatory processing associated with depression,<sup>13</sup> fatigue,<sup>14</sup> and with reduced QOL for patients with blood cancers.<sup>15</sup> For example, depressed patients receiving stem cell transplant have a 3-fold increased risk of dying at 6 and 12 months after transplantation.<sup>12</sup> Improving emotional and social symptoms during treatment may be critical for well-being and survival, and a recent National Institutes of Health report indicates that intervening on physical and socioemotional health during treatment for blood cancer has promise for improving long-term well-being.<sup>2</sup>

Recent meta-analytic research indicates the use of psychological interventions, exercise, and combinations of these 2 treatment modalities as superior to pharmacologic treatment of side effects such as fatigue.<sup>16</sup> Moreover, one estimate found that integrative approaches to well-being during cancer treatment reduced medication costs by an average of \$469 per patient in a large urban hospital.<sup>17</sup> In-person formats appear to be the most effective, and exercise programs are most effective when delivered during primary treatment.<sup>16</sup> Together, these data indicate that incorporating integrative interventions, especially those combining psychological and physical exercise, during treatment for blood cancer may mitigate symptom burden, preserve functioning and QOL, reduce medication costs, and improve mortality.<sup>18-21</sup> However, negative findings from patient-administered exercise and stress management programs highlight the difficulty in implementing interventions during treatment, as successful interventions likely require extensive interventionist input, as well as sensitive and rigorous measurement to identify and quantify their impact.<sup>22</sup>

Yoga may be a safe and effective approach to reducing side effects during treatment. One of the most frequently used integrative therapies,<sup>23</sup> yoga is highly adaptable to patient experience and context. As it is practiced in North America, yoga usually combines physical postures and movements (*asanas*) with breathing exercises (*pranayamas*) and meditation.<sup>24</sup> Yoga practices are well tolerated<sup>25,26</sup> and have been shown to be effective for improving sleep,<sup>27</sup> peripheral muscular strength,<sup>28</sup> and QOL,<sup>29</sup> and for reducing fatigue,<sup>30</sup> pain,<sup>31</sup> nausea,<sup>32</sup> and inflammatory signaling<sup>33</sup> in cancer survivors, and it is recommended as adjunctive support during stem cell transplant.<sup>34</sup> However, despite the apparent promise of yoga for symptom management, the majority of studies have examined its impact for patients

with breast and ovarian cancer.<sup>30</sup> Less is known about the feasibility, acceptability, or efficacy of yoga for patients with hematologic cancers. Moreover, few studies have examined facility-based yoga for the inpatient treatment of fatigue and QOL.<sup>30</sup> A 2014 Cochrane review found only one study for inclusion out of 149 potentially relevant references, and the review concluded that the use of yoga for symptom management during or after hematological malignancies remains unclear due to the small sample size (N = 20) and high risk of bias.<sup>35</sup> However, pilot data attest to the feasibility and safety of facility-based yoga during cancer treatment for both adult<sup>36</sup> and pediatric inpatients.<sup>37</sup> In advance of a more definitive clinical trial evaluating facility-based yoga for symptom management during treatment, here we describe a program enhancement study that examined whether individualized yoga therapy can be feasibly integrated into a standard medical setting and with standard medical care and treatment for patients with blood cancers, whether it is acceptable to patients, and whether a single session affects physical and emotional symptoms.

## Methods

Between October 2013 and August 2017, hospitalized patients with blood or lymphatic cancer were selected for yoga therapy by nursing staff based on their high morbidity and/or discomfort, and patients were offered the yoga intervention as an optional part of their standard treatment for symptom management. Because data were anonymized and gathered for program evaluation and enhancement, the institutional review board determined that it did not warrant review and that patient consent was therefore not necessary. The clinical setting for yoga was an in-patient hematology/bone marrow transplant (BMT) unit with 24 beds that primarily cares for patients receiving autologous and allogeneic hematopoietic stem cell transplantation. The median length of stay for patients admitted to the unit is 17 days, and patients' friends and family members are encouraged to stay in the patients' rooms to provide emotional support and assist in activities of daily life, including walking daily up to 1 mile. The majority of patients who participated were experiencing significant emotional distress and pain, including the need for parenteral narcotics. Demographics of the patients who received the yoga therapy intervention were similar to the total population of patients treated on this inpatient unit (Table 1). The majority of patients were middle-aged adults and undergoing BMT.

A multicomponent 40-minute yoga therapy session was conducted in the hospital room with patients reclined in bed or seated in a chair, often with family members/caregivers participating. Yoga therapy consisted of a combination of guided standardized practices chosen by patient/therapist consensus and taken from the Yoga Therapy in Cancer and Chronic Illness (YCAT) protocol,<sup>36,38</sup> including body

**Table 1.** Patient Characteristics and Diagnosis.

	Yoga-Treated Patients	All Patients	P
A <sup>a</sup>			
Age			.83
<25	6%	5%	
26-50	30%	30%	
>50	64%	65%	
Sex			<.001
Female	63%	40%	
Male	37%	60%	
Race			<.001
White	56%	78%	
African-American	37%	17%	
Other	7%	5%	
B <sup>b</sup>			
Lymphoma	34%		
Leukemia	16%		
Multiple myeloma	34%		
Miscellaneous	15%		

<sup>a</sup>Patient population receiving single session yoga intervention compared with patient demographics from the entire unit in 2015, as well as results of  $\chi^2$  tests of goodness of fit.

<sup>b</sup>Diagnoses of patient populations receiving yoga. Miscellaneous included sickle cell and myelodysplastic syndromes. The transplant patients received melphalan 140 or 200 mg/m<sup>2</sup> (myeloma patients), busulfan/cyclophosphamide/etoposide (non-Hodgkin lymphoma) bcnu, etoposide, cytosine arabinoside melphalan (BEAM; Hodgkin lymphoma) or fludarabine/melphalan (acute myeloid leukemia/chronic myelomonocytic leukemia) or total body irradiation, cyclophosphamide (all patients). Sickle cell transplant patients received busulfan and fludarabine with ATG. Myelodysplastic syndrome transplant patients received fludarabine/melphalan.

awareness, breath awareness, adaptive movement, and relaxation imagery practice. All movement was coordinated with breathing and modified and adapted for chair or bed practice. These included low repetition of gentle, slow, seated spinal flexion and extension; seated spinal twists, rotations, and forward bends; head, neck, shoulder rotations; wrist, hand, and elbow rotations; and feet, ankle, knee rotations. The yoga therapist was International Association of Yoga Therapy (IAYT)-certified. All IAYT-certified yoga therapists have either attended an accredited school or have been able to demonstrate at least 1000 hours of coursework and practicum including mentorship in the learning and application of yoga principles and practice to individuals and groups with specific illness or symptoms. In addition to this certification, the yoga therapist for this study has an additional 500 hours of training specific in yoga therapy methods adapted for individuals in treatment or recovery from cancer YCAT program.

The therapist sat in a chair next to the patient, who was typically lying in bed or seated in a chair, and provided verbal instructions according to a standardized script directing patients to become aware of aspects of breath and physical

sensations in the body. Adaptive chair-based movement was verbally guided and simultaneously modelled in view of the patient. Prior to and immediately after each session, the yoga therapist collected patient-reported symptoms using a modified symptom checklist derived from a validated tool for patient-reported outcomes, the Functional Assessment of Cancer Therapy-BMT (FACT-BMT) version 4.<sup>39</sup> Patients reported symptom change on a Likert-type scale of 0 to 4, with 0 being “Not at all” and 4 being “Very much.” The symptoms reported were lack of energy, pain, nausea, bothered by side effects, sadness, and nervousness.

Feasibility and acceptance were quantified as the percentage of patients who discontinued the yoga session due to pain, discomfort, or another reason. In addition, we conducted  $\chi^2$  tests to evaluate whether yoga participants were representative of the overall transplant unit patient population (aggregated during 2015). We examined whether specific age, sex, or racial groups were less likely to use yoga than would be expected based on the unit demographics. To examine whether patient symptoms were improved by a single yoga session, we conducted Wilcoxon signed rank tests on each of the 6 symptoms based on the nonparametric nature of the data. We conducted the same tests in the subset of patients who identified as African American and male, both populations that are less likely to use mindfulness-based interventions like yoga,<sup>30,40,41</sup> in order to examine whether these subgroups reported benefits of yoga when analyzed separately.

## Results

Of the 558 yoga therapy sessions attempted, 486 (87%) were completed. Seventy-two (13%) sessions were unfinished either because the patient fell asleep, because the session was interrupted by a medical procedure, or because the patient did not want to continue due to frustration or anxiety. No session was stopped early due to a patient’s reported pain. The majority of patients were receiving BMT (83%), with the remaining 17% receiving chemotherapy. The proportion of patients participating in a single session of yoga therapy who were women (63%) was significantly greater than would be expected based on the 2015 unit demographics,  $\chi^2(2, N = 709) = 36.7, P < .001$  (Table 1). Similarly, the proportion of patients participating in yoga who identified as African American (37%) was also greater than would be expected  $\chi^2(2, N = 689) = 37.8, P < .001$ . The proportion of patients of each age bracket was not significantly different than would be expected. Breathing awareness was the most used yoga therapy practice and was used in 98% of sessions. Body awareness was used in approximately 92%, guided relaxation in 63%, and movement in 21%. The relatively less frequent use of movement therapy was due to patient preference attributable to lack of energy, illness, or pain.

A total of 354 (73%) sessions were completed with pre- and post-assessments for analysis. In 132 (27%) of

completed sessions, the patient fell asleep immediately after the session, precluding a post-assessment. Wilcoxon signed rank tests indicated that all self-reported symptoms were significantly lower after the yoga session (Table 2, Figure 1) (Fatigue [Lack of energy]:  $Z = -9.23$ ,  $P < .0001$ ,  $r = .50$ ; Nausea:  $Z = -6.57$ ,  $P < .0001$ ,  $r = .35$ ; Pain:  $Z = -6.67$ ,  $P < .0001$ ,  $r = .36$ ; Bothered by side effects:  $Z = -6.64$ ,  $P < .0001$ ,  $r = .36$ ; Sadness:  $Z = -7.11$ ,  $P < .0001$ ,  $r = .38$ ; and Nervousness:  $Z = -9.61$ ,  $P < .0001$ ,  $r = .52$ ). Self-reported symptoms were also significantly lower after the yoga session when only analyzing the subset of patients who identified as African American ( $n = 131$ ) (Fatigue:  $Z = -5.37$ ,  $P < .0001$ ,  $r = .51$ ; Nausea:  $Z = -4.46$ ,  $P < .0001$ ,  $r = .41$ ; Pain:  $Z = -3.83$ ,  $P < .001$ ,  $r = .35$ ; Bothered by symptoms:  $Z = -3.56$ ,  $P < .001$ ,  $r = .33$ ; Sadness:  $Z = -3.96$ ,  $P < .0001$ ,  $r = .36$ ; and Nervousness:  $Z = -5.47$ ,  $P < .0001$ ,  $r = .50$ ). Similarly, all symptom changes were significant when analyzing only male patients ( $n = 131$ ) (Fatigue:  $Z = -5.53$ ,  $P < .0001$ ,  $r = .50$ ; Nausea:  $Z = -3.89$ ,  $P < .0001$ ,  $r = .34$ ; Pain:  $Z = -3.46$ ,  $P < .001$ ,  $r = .31$ ; Bothered by symptoms:  $Z = -4.80$ ,  $P < .0001$ ,  $r = .43$ ; Sadness:  $Z = -4.45$ ,  $P < .0001$ ,  $r = .40$ ; and Nervousness:  $Z = -5.77$ ,  $P < .0001$ ,  $r = .52$ ).

## Discussion

Mind-body interventions delivered during treatment for blood cancer may be a promising approach to reduce acute physical and emotional symptoms and improve long-term QOL. As a first step in implementing facility-based yoga, we evaluated the feasibility, acceptability, and acute impact of a single-session yoga program for inpatients. Preliminary data indicate that the program was highly acceptable and safe. While no session was stopped due to patient pain, 2 patients reported that they were too anxious or frustrated to finish the session.

As an individualized therapeutic intervention, 4 different methods of yoga practice were offered to patients, and the therapist's choice depended on patient preference, physical ability, and level of energy. Because the majority of the patients identified for yoga were either suffering bone or body pain from the cancer pathology, nausea, fatigue, or other symptoms from the intense treatment or the engraftment process, movement, even adaptive chair movement, was rarely a first choice of treatment for patients. Since our primary aim was to assess the feasibility of yoga delivered during treatment for patients with relatively high levels of negative symptoms, we chose to prioritize patient choice and an individualized approach to the yoga therapy. We believe that these data will help with the planning of future clinical trials by pointing to specific content within therapeutic yoga that is most feasible. However, given the importance of movement for this population, future research should also examine ways to feasibly incorporate movement components into yoga therapy and into treatment more generally. Since BMT treatment protocol requires patients to

walk or ambulate laps around the floor in order to stimulate cell growth, yoga movements could be incorporated into this prescriptive physician-ordered and nurse-monitored stimulation package. While the movement portion of the intervention was conducted with fewer patients, the current data indicate that adaptive movements coordinated with breath could be safely practiced in the bed or in a chair by 1 in 5 patients, and that it may be incorporated into treatment protocol if led by a qualified yoga therapist.

Of note, there was a higher proportion of women and African American patients participating in yoga than would be expected by the observed demographics of the entire unit. The former finding is consistent with National Health Interview Survey data, which found that of the nearly 70 000 participants surveyed, representing approximately 170 million adults, men were half as likely to engage in mindfulness-based practices such as yoga.<sup>40</sup> Similarly, men make up only about 30% of the participants enrolled in randomized controlled trials of mindfulness-based interventions.<sup>41</sup> However, these data are not consistent with the common finding that non-Hispanic white participants are more likely to practice mindfulness-based activities than non-Hispanic black participants<sup>40</sup>; in fact, African American patients were relatively overrepresented in the population participating in yoga compared with the demographics of the unit as a whole. It is difficult to interpret these data since patients were recruited for yoga based on the nursing staff's assessment of need, and future studies should carefully evaluate the acceptability of yoga across diverse patient populations. Importantly, both male and African American patient groups reported significant benefits from yoga here, indicating that that yoga improved well-being for a majority of patients, even those who do not traditionally tend to engage with it. This finding is important, especially given research indicating that African American cancer survivors may suffer disproportionately higher cancer morbidity and mortality and experience significantly lower physical and emotional QOL.<sup>42</sup>

We also found that a single session of yoga was associated with immediate reductions in all queried symptoms, with the largest effects on fatigue and nervousness. Cancer-related fatigue is among the most commonly described symptoms experienced by hematological cancer patients over the course of treatment, and it is associated with significant morbidity, functional impairment, and reduction in QOL.<sup>22</sup> Caused by both the cancer itself and by aggressive treatments, cancer-related fatigue is frequently experienced disproportionate to exertion and is often not relieved by rest, making it distinct from and relatively intractable compared with non-cancer fatigue.<sup>43</sup> In addition, cancer-related fatigue has a profound deleterious emotional, psychological, and social impact, as it interferes with daily activities and QOL<sup>43</sup> and can ultimately reduce compliance with treatment.<sup>44</sup> While pharmacologic management of fatigue during stem cell transplant appears somewhat efficacious, the primary

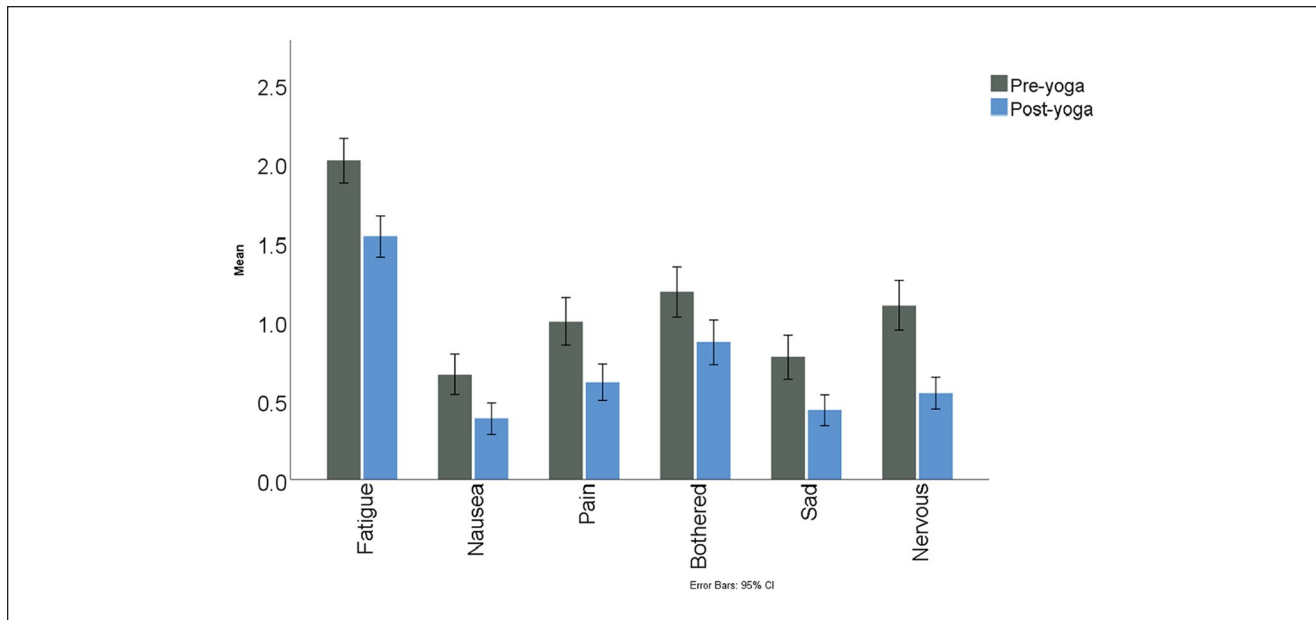
**Table 2.** Descriptive Statistics of Pre- and Post-Yoga Symptoms for the Entire Patient Population, for the African American (AA), and for the Male Patients, as Well as the Results of Wilcoxon Signed Rank Tests and the Associated Effect Sizes ( $r$ , Calculated as the Z Statistic Divided by the Square Root of the Number of Observations).

		Mean (SD)	Range	Z	$r$
Fatigue	All	Pre	1.99 (1.27)	0-4	
		Post	1.56 (1.18)	0-4	-9.23
	AA	Pre	1.90 (1.22)	0-4	
		Post	1.37 (1.06)	0-4	-5.37
	Male	Pre	2.04 (1.32)	0-4	
		Post	1.57 (1.23)	0-4	-5.53
Nausea	All	Pre	0.66 (1.16)	0-5	
		Post	0.41 (0.93)	0-4	-6.57
	AA	Pre	0.72 (1.22)	0-5	
		Post	0.37 (0.82)	0-3	-4.46
	Male	Pre	0.51 (1.07)	0-5	
		Post	0.26 (0.75)	0-4	-3.89
Pain	All	Pre	0.98 (1.34)	0-4	
		Post	0.65 (1.08)	0-4	-6.67
	AA	Pre	0.90 (1.28)	0-4	
		Post	0.60 (1.03)	0-4	-3.83
	Male	Pre	0.93 (1.26)	0-4	
		Post	0.67 (1.11)	0-4	-3.46
Bothered by symptoms	All	Pre	1.15 (1.43)	0-4	
		Post	0.85 (1.26)	0-4	-6.64
	AA	Pre	1.19 (1.44)	0-4	
		Post	0.89 (1.27)	0-4	-3.56
	Male	Pre	1.17 (1.35)	0-4	
		Post	0.83 (1.20)	0-4	-4.8
Sadness	All	Pre	0.77 (1.25)	0-4	
		Post	0.45 (0.87)	0-4	-7.11
	AA	Pre	0.73 (1.17)	0-4	
		Post	0.39 (0.78)	0-4	-3.96
	Male	Pre	0.71 (1.17)	0-4	
		Post	0.31 (0.71)	0-4	-4.45
Nervousness	All	Pre	1.09 (1.41)	0-4	
		Post	0.56 (0.94)	0-4	-9.61
	AA	Pre	0.91 (1.35)	0-4	
		Post	0.40 (0.85)	0-4	-5.47
	Male	Pre	1.10 (1.41)	0-4	
		Post	0.50 (0.88)	0-4	-5.77

agents used (erythropoietin and methylphenidate) carry a risk of nonserious adverse events and safety concerns.<sup>45</sup> For all of these reasons, the beneficial effect of yoga on cancer-related fatigue we observed is particularly encouraging.

The acute impact of single-session yoga on psychological symptoms is also promising. Epidemiological studies find that survivors of almost all types of cancer have significantly poorer mental health<sup>46</sup> and

health-related QOL<sup>47</sup> than nonsurvivors. One year after diagnosis, the prevalence of depression in cancer survivors is estimated to be between 8% and 15%.<sup>48</sup> The rates of depression among cancer patients actively undergoing treatment is higher,<sup>49</sup> and an astounding 73% of cancer patients with depression do not receive any treatment for their depression.<sup>50</sup> Both depression and QOL during and after cancer treatment predict mortality, independent of,



**Figure 1.** Average self-reported symptom scores before and after yoga. All symptom changes were significant at  $P < .0001$ .

and sometimes better than,<sup>51</sup> clinical variables.<sup>52</sup> Identifying and effectively implementing evidence-based interventions to improve psychosocial well-being is imperative to advancing cancer care, and the data described here indicate that facility-based mind-body interventions may be one effective approach.

While yoga had the largest impact on cancer-related fatigue among patients who completed the follow-up assessment, nearly one third of patients who completed the yoga therapy sessions were asleep at the end of the session, highlighting the possibility that yoga therapy could be effective for improving sleep during treatment. Sleep disturbances are prevalent among patients undergoing stem cell and BMT and appear to be most problematic and distressing during the inpatient stage of treatment.<sup>2</sup> Given the associations between poor sleep quality during transplant and depression, anxiety, and enhanced inflammatory processing,<sup>53</sup> identifying approaches to improve sleep outcomes are vital, especially during hospitalization. Future research should examine the efficacy of facility-based yoga to improve sleep outcomes during hospitalization, as well as the long-term impact that improved sleep may have on emotional, social, and clinical outcomes.

## Conclusions

This program enhancement study indicates that integration of yoga therapy into our clinical practice is both feasible and acceptable for patients. There was widespread participation in the intervention across race, gender, age, morbidity, and treatment regime, and patients reported immediate

improvements in all symptoms, with the greatest improvement in fatigue and nervousness.

## Study Limitations

While the data presented here indicate that facility-based, single-session yoga therapy was safe, well tolerated, and effective in improving acute physical and emotional symptoms, this study was not designed or powered to definitively test safety or efficacy. Neither was it designed to make generalizable conclusions. A second limitation of the study is that patients were identified by nursing staff based on their high symptom burden rather than being chosen at random, and we did not quantify or investigate patients who either were not offered or who refused yoga sessions. Future research is warranted to more definitively determine the magnitude and sustainability of the effect of yoga on QOL for patients with blood cancer, to examine the optimal “dose” and delivery, and to generate generalizable conclusions about the efficacy of mind-body interventions for symptom management during treatment.

## Clinical Implications

The 4-year program enhancement effort described here indicates that yoga was safely and effectively incorporated into inpatient treatment for blood cancer. Patients reported that the program was helpful to them, and the single sessions were highly tolerated and acceptable. Moreover, patients reported acute benefits in all symptoms about which they were questioned, with the largest benefits in

cancer-related fatigue and anxiety. Given improved clinical outcomes for patients experiencing fewer side effects during and after treatment for blood cancers, as well as the cost savings of integrative approaches to QOL for oncology inpatients,<sup>17</sup> these data warrant a future rigorous trial to examine the efficacy of facility-based yoga during treatment for both the acute management of symptoms and for improving long-term outcomes.

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### ORCID iD

Jennifer S. Mascaro  <https://orcid.org/0000-0002-6199-8455>

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