

Short Communication

Validation of the Mindful Attention Awareness Scale in a cancer population

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Abstract

Objectives: This study examined the construct and criterion validity of the Mindful Attention Awareness Scale (MAAS) in cancer outpatients, using matched community members as controls. **Methods:** Cancer outpatients ($n = 122$) applying for enrollment in a mindfulness-based stress reduction (MBSR) program completed the MAAS and measures of mood disturbance and stress. Local community members ($n = 122$) matched to the patients on gender, age, and education level completed the same measures. **Results:**

The single-factor structure of the MAAS was invariant across the groups. Higher MAAS scores were associated with lower mood disturbance and stress symptoms in cancer patients, and the structure of these relations was invariant across groups. **Conclusions:** The MAAS appears to have appropriate application in research examining the role of mindfulness in the psychological well-being of cancer patients, with or without comparisons to nonclinical controls.

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Keywords: Cancer; Mindfulness; Mood disturbance; Stress

Introduction

Mindfulness refers to a receptive attention to and awareness of present events and experience [1]. Clinical interest in mindfulness and its enhancement stems, in large part, from research conducted over the past 25 years showing that mindfulness-based stress reduction (MBSR) programs have salutary effects on mental and physical health in a variety of medical, psychiatric, and general populations (see Ref. [2] for review). Among cancer patients, for example, MBSR has been shown to reduce mood disturbance and stress symptoms and effect positive immunological and endocrinological changes [3–6].

Despite this growing body of clinical research, there has, until recently, been no measure of the mindfulness construct and thus no way to assess whether MBSR interventions actually facilitate change in this quality of consciousness,

which is the central focus of these interventions. Brown and Ryan [1] developed a dispositional measure of mindfulness, termed the Mindful Attention Awareness Scale (MAAS), demonstrated its utility to predict motivational and well-being outcomes and showed that changes in MAAS-measured mindfulness pre- to postintervention were related to declines in mood disturbance and stress in a small sample of cancer patients in an MBSR program. However, the MAAS was formally validated in nonclinical (student and general adult) populations only [1]. This leaves open the question as to whether MAAS-assessed mindfulness has construct and criterion validity in clinical populations, comparable with that found in the populations in which the instrument was validated. This issue is important, given the recognized need for a valid measure of mindfulness for use in clinical MBSR and related research [2,7–9].

The present study was designed, first, to assess the construct validity of the MAAS in a clinical population. We compared the factor structure and internal consistency of the MAAS in two matched samples: (i) cancer outpatients with

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Table 1
Demographic and cancer-specific characteristics by group

Variable	Cancer			Community			P_{diff}
	M	S.D.	%	M	S.D.	%	
<i>Demographic characteristics</i>							
Gender (% female)			67.21			67.21	1.0
Age (years)	49.55	12.81		48.23	15.60		.47
Education (years)	14.96	3.12		14.75	3.22		.62
Marital status (% married)			73.33			65.29	.18
<i>Cancer characteristics</i>							
Diagnosis							
Breast			51.60			–	
Prostate			17.20			–	
Other			31.10			–	
Stage							
I			19.50			–	
II			53.70			–	
III			15.90			–	
IV			11.00			–	

$n = 122$ per group.

Stage information is based on $n = 82$.

heterogeneous diagnoses and (ii) adult controls drawn from the same local community. Second, we assessed the criterion validity of the MAAS among cancer patients and compared the utility of the MAAS to predict mood disturbance and stress across the matched samples. We expected to find an invariant factor structure and similarly high internal consistency across the two samples. We also predicted that the MAAS would be associated, invariantly across samples, with higher well-being.

Methods

Participants

Cancer outpatients ($N=245$) who self-referred to the MBSR program at the Tom Baker Cancer Centre in Calgary, Canada, completed all measures (see below) as part of a preintervention evaluation. Of those approached to participate, approximately 95% did so. A local community sample was then obtained from a list brokerage firm that matched the cancer sample on gender, age (± 10 years), and education level. Community members were asked to complete a mailed survey of “moods, symptoms of stress, and day-to-day experiences”. They were eligible to participate if they could read English and did not have a cancer diagnosis. A reminder phone call was placed if the survey was not returned within 2 weeks. Of the 416 eligible participants who were mailed a packet, 149 (35.8%) returned the materials. No participation incentive was offered to either sample.

To ensure final sample equivalence on the three matching criteria, a 1:1 matching of the 149 community participants with those in the cancer group was conducted. Participants who could not be matched, as well as those with substantial

missing data, were eliminated, leaving 122 participants in each group for analysis. Table 1 presents demographic information on the groups and, for the cancer sample, diagnostic and stage information. For preliminary analyses, cancer patients were grouped into three diagnostic categories—breast, prostate, and other, which included ovarian, lymphoma, colorectal, and a variety of other types.

Instruments

Mindful Attention Awareness Scale (MAAS) [1]

This 15-item scale measures the frequency of mindful states in day-to-day life, using both general and situation-specific statements. Based on a mean of all items, MAAS scores can range from 1 to 6. Higher scores indicate greater mindfulness. In a large U.S. adult sample [10], the average MAAS score was 4.22 (S.D.=0.63); in a small cancer sample [1], $M=4.27$, S.D.=0.64. Factor analyses of college and national adult sample data showed a single-factor structure [1].

Profile of Mood States (POMS) [11]

This 65-item instrument assesses mood disturbance and includes six subscales, including tension–anxiety, depression–dejection, and vigor. It is widely used in both cancer

Table 2
Factorial model results across group

Model	χ^2	P	CFI	RMSEA	$\Delta\chi^2$
1. Unconstrained	247.3	<.01	0.93	0.047	
2. Constrained factor loadings	263.8	<.01	0.93	0.046	16.5, <i>ns</i>

$\Delta\chi^2$ Is the difference between Models 1 and 2, $df=15$.

MAAS = Mindful Attention Awareness Scale; CFI = comparative fit index; RMSEA = root-mean-square error of approximation.

Table 3
Psychological characteristics by group

Variable	Cancer		Community		P_{diff}
	M	S.D.	M	S.D.	
MAAS	4.08	0.74	4.45	0.77	.0002
POMS					
Tension–anxiety	7.56	6.53	4.79	5.02	.0002
Depression–dejection	12.61	10.82	7.15	6.58	.0001
Anger–hostility	9.45	8.10	7.93	7.08	.12
Vigor	13.89	5.53	16.53	5.76	.0003
Fatigue	10.57	6.72	8.53	6.02	.01
Confusion	4.68	4.95	1.98	3.69	.0001
SOSI					
Peripheral	7.15	5.81	4.54	4.07	.0001
Cardiopulmonary	10.62	7.86	8.03	5.90	.004
Central nervous	3.58	3.31	2.93	2.93	.10
Gastrointestinal	7.89	5.87	5.74	5.02	.002
Muscle tension	10.96	7.56	8.14	6.61	.002
Habitual patterns	20.07	10.35	15.31	7.97	.0001
Depression	10.14	6.21	5.20	4.21	.0001
Anxiety	13.52	8.19	8.66	6.37	.0001
Emotional irritability	6.60	5.48	3.84	3.40	.0001
Cognitive disorganization	5.79	3.85	2.93	2.46	.0001

MAAS = Mindful Attention Awareness Scale; POMS = Profile of Mood States; SOSI = Symptoms of Stress Inventory.

groups [12] and general adult samples [11]. Across subscales, Cronbach's alphas ranged from .83 to .95 in the present cancer sample and .73 to .91 in the community group.

Symptoms of Stress Inventory (SOSI) [13]

This 95-item scale measures physical, psychological, and behavioral responses to stressful situations and includes 10 subscales, including central nervous system symptoms, muscle tension, and cognitive disorientation. The scale has been used with cancer patients [4] and community adults [14]. Across subscales, alphas ranged from .70 to .87 in the cancer sample and .67 to .84 in the community sample.

Finally, demographic information on gender, age, educational attainment, and marital status was collected.

Statistical analyses

The construct validity of the MAAS was examined using exploratory factor analysis (EFA). Confirmatory factor analysis (CFA) tested whether the scale factor structure revealed by EFA was invariant across samples. Structural equation modeling (SEM) assessed the criterion validity of the scale and the structural invariance of a mindfulness–well-being model across samples.

Results

Construct validity and factorial invariance of the MAAS

In each sample, EFA on the MAAS using the principal-factors method revealed a clear single-factor structure with

comparable item loadings across samples. Specifically, in the cancer/community samples, the first factor eigenvalues were 5.10/5.08 and the next largest eigenvalues were 0.87/0.84; Factor 1 accounted for 75%/78% of the total variation across factors. The factor loadings ranged from 0.31/0.32 to 0.85/0.79 ($M=0.52/0.57$). EFA using maximum likelihood estimation showed very similar results. The factorial invariance of the MAAS across samples was tested using CFA in AMOS 4.0 [15] with maximum likelihood estimation. Table 2, Model 1 shows that a single factor, two-group model with no constraints provided a satisfactory fit to the data. Based on comparison with a fully constrained model (Model 2), the test of Little [16] of factorial invariance showed no differences in factor loadings across groups. In each sample, all items loaded on the latent MAAS variable ($P_s < .05$). The internal consistency (Cronbach's alpha) of the scale was .87 in both samples.

Criterion validity of the MAAS and structural invariance of a mindfulness–well-being model

Table 3 presents the descriptive statistics and independent groups t test results on the psychological variables of interest for testing the criterion validity of the MAAS and the structural invariance of the MAAS–well-being relations across samples. The cancer patients showed lower MAAS scores and, across most of the POMS and SOSI subscales, higher mood disturbance and stress. However, in both cancer and community samples, respectively, higher MAAS scores were related to lower POMS ($r_s = -.39$ and $-.39$) and lower SOSI scores ($r_s = -.41$ and $-.42$; $P_s < .0001$). The POMS and SOSI scores were also correlated ($r_s = .70$ and $.76$, $P_s < .0001$) in the cancer and community samples, respectively.

Prior to conducting SEM to address the questions of interest to this section, preliminary analyses showed that POMS and SOSI scores did not differ across cancer stage nor in the three diagnostic groupings (breast, prostate, and other); therefore, the entire cancer sample was combined for SEM. Among the demographic variables, age was related to total POMS score in the community sample ($r = -.26$, $P < .01$), such that younger individuals were more distressed. No other demographic variables were related to the

Table 4
Structural model results across group

Model	χ^2	P	CFI	RMSEA	$\Delta\chi^2$
1. Unconstrained	484.3	<.01	0.93	0.057	
2. Constrained factor loadings	519.6	<.01	0.93	0.058	
3. Constrained factor loadings and regression paths	521.2	<.01	0.93	0.057	1.58, ns

$\Delta\chi^2$ is the difference between Models 2 and 3, $df=2$.

MAAS = Mindful Attention Awareness Scale; CFI = comparative fit index; RMSEA = root-mean-square error of approximation.

psychological variables in either sample.¹ Preliminary SEM found that the inclusion of age made a negligible difference to the model fit indexes and path coefficients of primary interest; to simplify presentation of the results, this variable was not further considered.

Using AMOS 4.0 software with maximum likelihood estimation, a two-group SEM was constructed that related a latent mindfulness variable to latent mood disturbance and stress symptoms variables. The latter variables, which included all measured subscales, were allowed to covary. To create multiple measured variables underlying a latent MAAS variable [17], three parcels were formed of five randomly selected items each [18]. Each parcel showed levels of internal consistency acceptable for randomly selected items ($\alpha s > .67$ in each sample). The two-group, unconstrained model fit satisfactorily (see Table 4, Model 1). Based on the comparison of a constrained factor loadings model (Model 2) with a fully constrained model (Model 3) [16], structural invariance across groups was found. SEM confirmed that higher scores on the MAAS were associated with lower mood disturbance and stress in both samples.

Discussion

This study indicates that the MAAS is appropriate for assessing mindfulness in cancer populations, given evidence for the scale's psychometric soundness in a cancer sample and equivalent factor structure to that of a general adult sample. As in past research [1], higher scores on this single-factor measure of mindfulness were associated with lower mood disturbance and stress. The structurally group-invariant relation found here between these variables suggests that lower levels of psychological well-being may be due, in part, to lower levels of mindfulness in both cancer and general populations.

Cancer patients represent an important population to examine the effects of mindfulness and its promotion, given the significant distress often associated with cancer diagnosis and treatment [19–21]. Future research should test the generalizability of the factor structure of the MAAS and its application to other clinical populations. Notably, mindfulness scores were lower in cancer patients than in community controls by approximately half a standard deviation, considered a medium-sized effect [22]. Most patients in the present sample were undergoing adjuvant cancer treatment, or had recently completed treatment. Thus, their attention may have been captured by the immediate crises of diagnosis and treatment, leaving fewer attentional resources for day-to-day life. It may also be that elevated stress and

mood disturbance conduces to lower mindfulness, given the attentional disruptions that may accompany distress [23,24]. Research has shown that the MAAS predicts well-being outcomes [1], but investigation into a possible bidirectional relation between mindfulness and well-being using longitudinal designs is warranted. With the introduction of a valid mindfulness measure, MBSR and other mindfulness researchers are now better equipped for this and a variety of other investigations.

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¹ Both samples were two thirds women, perhaps discouraging the detection of gender differences. This issue is particularly pertinent to the MAAS because it is the focus of the present study. However, in large samples that are more evenly gender balanced, differences in MAAS scores have generally not been detected [1].

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