Psychological Assessment

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Online First Publication, February 14, 2011. doi: 10.1037/a0021338

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1040-3590/11/$12.00 DOI: 10.1037/a0021338

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Interest in mindfulness-based interventions for children and adolescents is burgeoning, bringing with it the need for validated instruments to assess mindfulness in youths. The present studies were designed to validate among adolescents a measure of mindfulness previously validated for adults (e.g., Brown & Ryan, 2003), which we herein call the Mindful Attention Awareness Scale—Adolescent (MAAS–A). In 2 large samples of healthy 14- to 18-year-olds ($N = 595$), Study 1 supported a single-factor MAAS–A structure, along with acceptably high internal consistency, test–retest reliability, and both concurrent and incremental validity. In Study 2, with a sample of 102 psychiatric outpatient adolescents age 14–18 years, participants randomized to a mindfulness-based stress reduction intervention showed significant increases in MAAS–A scores from baseline to 3-month follow-up, relative to nonsignificant score changes among treatment-as-usual participants. Increases in MAAS–A scores among mindfulness-based stress reduction participants were significantly related to beneficial changes in numerous mental health indicators. The findings support the reliability and validity of the MAAS–A in normative and mixed psychiatric adolescent populations and suggest that the MAAS–A has utility in mindfulness intervention research.

Keywords: mindfulness, Mindful Attention Awareness Scale, validation, adolescents

With increased interest in mindfulness-based and mindfulness-integrated interventions for medical, psychiatric, and healthy stressed populations (Baer, 2003; Brown, Ryan, & Creswell, 2007) has come a recognition of the importance of assessing the phenomenon itself. There are several reasons for such assessment (Brown & Cordon, 2009), including the basic scientific principle that a phenomenon can be studied only if it can be properly defined and measured. Behavioral scientists have conceptualized mindfulness in two predominant ways. Langer and colleagues (e.g., Langer, 1989; Langer & Moldoveanu, 2000) have defined it as an open, assimilative "wakefulness" to cognitive tasks, in which thought is used flexibly to create new categories, draw distinctions, and seek multiple perspectives.

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We thank Debra Poole for invaluable assistance in designing Study 1, which was partially funded by Central Michigan University.

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A related but distinct conceptualization of mindfulness, which is the focus of the present research, emphasizes attention rather than thought and has been defined as a sustained, receptive attention to present events and experience (Brown & Ryan, 2003). Although this form of mindfulness has been considered a natural propensity of the human organism (e.g., Brown & Ryan, 2003; Goldstein, 2002; Kabat-Zinn, 2003), there is considerable agreement that it can be enhanced through training. To date, most research on mindfulness has been conducted with adult normative and clinical populations, and, concomitantly, the available psychometric instruments have been validated with adults only. However, there is a growing body of research investigating the use of mindfulness interventions in adolescent normative and clinical populations (e.g., Biegel, Brown, Shapiro, & Schubert, 2009; Bootzin & Stevens, 2005; Semple, Lee, Rosa, & Miller, 2010; Zylowska et al., 2008). Thus, it is becoming more important to have reliable and valid assessments of the mindfulness construct for use with adolescents.

A number of self-report measures of mindfulness for use with adults have been published in recent years. These instruments vary considerably in dimensionality, from one factor (e.g., Freiburg Mindfulness Inventory; Walach, Buchheld, Buttenmuller, Kleinknecht, & Schmidt, 2006) to five factors (Five Facet Mindfulness Questionnaire; Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006). These differences in operationalization stem from differing theoretical bases. For example, the multifactor Kentucky

Inventory of Mindfulness Skills and Five Facet Mindfulness Questionnaire were derived from a skills-based model of mindfulness practice in dialectical behavior therapy (Linehan, 1993), and other measures, such as the two-factor Philadelphia Mindfulness Scale (Cardaciotto, Herbert, Forman, Moitra, & Farrow, 2008) and the single-factor Freiburg Mindfulness Inventory, focus on the conjoining of attitude (acceptance) and attention found in Kabat-Zinn's (e.g., 1990) mindfulness-based stress reduction practice model. The various measures correlate with each other, but, given the varying theoretical bases and dimensionalities of these scales, it is not surprising that the degree of convergence varies between scales. Most extant measures of mindfulness were constructed for use with individuals untrained in mindfulness. Thus, it is likely that a rudimentary form of mindfulness is assessed by these measures.

The focus of the present investigation, the Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003), differs in its origins from other measures in that it was derived both from historical and contemporary Buddhist scholarship on the subjective nature and behavioral expression of mindfulness and also from clinical theory and research on the practice and enhancement of mindfulness (e.g., Kabat-Zinn, 1990). The MAAS was developed with guidance from teachers and advanced students of mindfulness who reflected the considerable agreement between scholarly and clinical domains of inquiry that mindfulness is fundamentally a quality of attention (e.g., Brown et al., 2007; Carmody, 2009; Lutz, Dunne, & Davidson, 2007).

In normative waking states, attention and awareness, the two components of consciousness, operate in an interactive fashion to promote adaptive functioning. Scholars have noted, concordant with this, that mindfulness in daily life involves both attention and (meta-) awareness (e.g., Analayo, 2003; Bodhi, 2000). Seeking to describe mindfulness in day-to-day life and operationalize it through the MAAS, we defined it as a receptive state of attention that, informed by an awareness of present experience, simply observes what is taking place (e.g., Brown & Cordon, 2009; Brown & Ryan, 2003). This emphasis on *presence* reflects one of the core descriptions of mindfulness in the scholarly literature (e.g., Bodhi, 2000; Gethin, 2001). Mindfulness is an exemplar of the experiential mode of conscious processing (Teasdale, 1999) that can be contrasted with the conceptually driven mode of processing, wherein occurrences are habitually filtered through appraisals, evaluations, and other forms of cognitive manipulation (Brown & Cordon, 2009). Mindfulness can be understood in both trait and state forms. The former, which is the focus of the present validation effort, involves a more frequent receptive attention to internal and external stimuli as they occur.

Developed for adult normative and clinical populations, the MAAS is currently among the most commonly used self-report measures of mindfulness. The scale has been validated among college students, community adults (Brown & Ryan, 2003; MacKillop & Anderson, 2007), and individuals with cancer (Carlson & Brown, 2005). Semantic equivalence of the scale items has been demonstrated cross culturally (between Americans and Thais; Christopher, Charoensuk, Gilbert, Neary, & Pearce, 2009) and between those untrained and trained in mindfulness (Brown & Ryan, 2003). The MAAS is not unduly subject to social desirability biases (Brown & Ryan, 2003). The scale appears to be sensitive to mindfulness training, with significantly higher scores among those trained in mindfulness than in age- and gender-matched controls (Brown & Ryan, 2003); MAAS scores have also shown significant increases over the course of MBSR training (Shapiro, Brown, & Biegel, 2007).

The MAAS takes an indirect assessment approach, in that items refer to the absence of mindful attention in various circumstances (see also Baer, Smith, & Allen, 2004; Baer et al., 2006). This approach has also been taken to assess medical treatment adherence (e.g., Haynes et al., 1980), where directly phrased items can trigger self-presentation and other response biases. In the assessment of mindfulness, Brown and Ryan (2003) argued, statements reflecting less mindlessness are likely more accessible to people untrained in mindfulness, given that mindless states are much more common than mindful states (McIntosh, 1997; Varela, Thompson, & Rosch, 1991). Also, mindfulness is readily characterized by the absence of cognitive operations that are highly familiar. Consistent with this, Bodhi (1984, pp. 81–82) noted that "mindfulness is thus a matter not so much of doing but of undoing: not thinking, not judging, not associating, not planning, not imagining, not wishing" (see also Packer, 2002).

Thus, the indirect assessment approach may be more "diagnostic" of mindfulness than are direct claims to mindfulness, particularly for respondents untrained in it. Brown and Ryan (2003) found that the indirect approach showed higher criterion validity than the latter; when the MAAS and an alternate form of the scale composed of directly worded items were correlated with a variety of personality, self-concept, and well-being indicators, the MAAS typically showed stronger relations in expected directions, with some differences in correlation magnitude of 10 points or more. However, the MAAS and its alternate form are highly correlated (.70; Brown & Ryan, 2003), which provides evidence that mindfulness assessed indirectly by the MAAS has the same conceptual meaning as a direct measure of mindfulness. This is important because some trait measures are unipolar (i.e., their meaning is limited to one direction; Grossman, 2008; Reise & Waller, 2009; Van Dam, Earleywine, & Danoff-Burg, 2008). The convergence of direct and indirect assessment approaches reviewed here indicates that the MAAS measures the presence and absence of mindfulness, not simply the latter.

The MAAS has been shown to predict a number of subjective and objective outcomes in several life domains (for a review, see Brown et al., 2007), including better regulation of attention, as indicated by fewer attention-task-based errors and quicker reaction time (Cheyne, Carriere, & Smilek, 2006), and more adaptive behavior regulation, reflected in more choiceful behavior (and higher emotional well-being) measured through day-to-day experience sampling over several weeks (Brown & Ryan, 2003). Also reflecting better behavior regulation, higher MAAS scorers showed better judgment and decision-making-based performance on gambling tasks (Lakey, Campbell, Brown, & Goodie, 2007).

The MAAS has predicted better self-reported mental health in healthy, stressed adults (Shapiro et el., 2007) and lower susceptibility to depressive relapse/recurrence up to a year after mindfulness training, as assessed by clinicians blind to MAAS scores (Michalak, Heidenreich, Meibert, & Schulte, 2008). The MAAS has also predicted lower susceptibility to social stress, including lower self-reported anxiety and hostility; higher love and commitment after romantic partner conflict (Barnes, Brown, Krusemark, Campbell, & Rogge, 2007); and lower emotional and physiologi-

cal (cortisol) response to a primary form of stress termed social evaluative threat (Brown, Weinstein, Creswell, & Holt, 2010). Finally, in a recent investigation relevant to physical health, O'Loughlin and Zuckerman (2008) found that higher MAAS scorers showed a higher concordance between their symptom awareness and physiological activity, namely, levels of salivary dehydroepiandrosterone, a natural steroid implicated in physical health and immune functioning. This result suggested that those higher in MAAS mindfulness showed greater sensitivity to their physiological health.

In efforts to uncover the neural correlates of such adaptive functioning, MAAS scores have been correlated with cortical and limbic markers of emotional reactivity, including less amygdala activation at rest (Way, Creswell, Eisenberger, & Lieberman, 2010) and during emotional threat (Creswell, Way, Eisenberger, & Lieberman, 2007). MAAS scores have also been positively related both to higher activations in regions of the prefrontal cortex during emotional threat and to a dampening of amygdala activation through the higher prefrontal cortex activation in a way theorized to reflect better emotion regulation (e.g., Creswell et al., 2007).

Building on evidence for the reliability and validity of the MAAS, the present research was designed to validate the MAAS in adolescent normative and psychiatric populations. This effort is important to ensure that the instrument is appropriate to adolescent cognitive capacities and reading level, that it can be assessed reliably, and that it demonstrates construct validity in this age group. Two studies are presented: The first study, which used a large sample of normative adolescents, tested the factor structure of a version of the MAAS slightly adapted to adolescent respondents that we herein call the Mindful Attention Awareness Scale—Adolescent (MAAS–A). We also assessed a variety of indices of its reliability and validity. The second study tested the utility of the MAAS–A among adolescent psychiatric outpatients randomized to mindfulness-based or treatment-as-usual interventions. In particular, we examined whether the MAAS–A was sensitive to reported changes in mindfulness and whether such changes were related to changes in mental health indices over the course of the intervention and follow-up period.

Study 1

Study 1 sought to test the reliability and validity of the MAAS–A in a normative sample of adolescents age 14 to 18 years. We first examined the structural validity of the measure with factor analysis and then examined various indices of the scale's reliability and validity. We expected that, in line with several validation efforts with adult populations (e.g., Brown & Ryan, 2003; Carlson & Brown, 2005; MacKillop & Anderson, 2007), the MAAS–A would show a single-factor structure and acceptable internal consistency, test–retest reliability, and both criterion validity and incremental validity with several mental health-relevant and adaptive functioning constructs. Given the considerable range of mental health and behavior regulation variables with which mindfulness has been associated among adults (e.g., Brown & Ryan, 2003), we attempted to broadly assess these domains using well-validated scales tapping cognitive, affective, and behavioral dimensions of functioning.

Method

Participants. Participants were 602 adolescents sampled from eight midwestern public schools. Of these, seven were removed from analyses; three cases were excluded because the respondents did not report their age and four 19-year-old respondents were excluded due to age. Of the remaining 595 respondents, 64.7% were female (n = 385); the overall mean age was 16.73 years (SD = 1.18; range = 14–18 years). Most (89.1%) self-identified as Caucasian, and the remainder (10.8%) self-identified as African American/Black, Asian/Middle Eastern, American Indian, Hispanic/Latino, Pacific Rim/Hawaiian, or Other. One respondent did not report ethnicity. All measures were completed in a single 40-min session during class time. Participation was voluntary, and a very small number of students engaged in alternative, paper-based tasks that were part of normal academics (e.g., reading and writing). For purposes of exploratory and confirmatory factor analyses, the sample was randomly split into two approximately equally sized groups after stratification by age (five age groups, 14–18 years). Sample A (n = 294) was used for exploratory factor analysis, and Sample B (n = 301) was used for confirmatory factor analysis.

Measures. The MAAS (Brown & Ryan, 2003) assessed trait mindfulness with items such as "I find myself preoccupied with the future or the past" and "I find myself doing things without paying attention." Although all 15 items were administered, one item ("I drive places on 'automatic pilot' and then wonder why I went there") was removed from the primary analyses because of its inappropriateness for younger adolescents. The Flesch–Kincaid grade level for readability of the scale instructions and 14 items is 6.6. As with the adult version of the scale, responses were made on a 6-point scale, ranging from 1 (*almost always*) to 6 (*almost never*); higher scores reflected higher trait mindfulness. In adult samples, reported internal consistency estimates (Cronbach's alpha) have consistently been above .80 (e.g., Brown & Ryan, 2003).

The 50-item *Adolescent Personal Style Inventory* (Lounsbury et al., 2003) is a Big Five personality inventory used to measure Openness to Experience (O), Conscientiousness (C), Extraversion (E), Agreeableness (A), and Neuroticism (N) on a 5-point Likert scale (1 = *strongly disagree* to 5 = *strongly agree*). In this sample, Cronbach's alphas were .80 (O), .85 (C), .87 (E), .77 (A), and .90 (N).

The 20-item *Positive and Negative Affect Schedule* (PANAS; Watson, Clark, & Tellegen, 1988) assessed affective arousal on a 5-point Likert scale (1 = *very slightly or not at all* to 5 = *extremely*). Several studies have supported the factor structure and utility of the PANAS with adolescents (e.g., Lonigan, Hooe, David, & Kistner, 1999). In this sample, Cronbach's alphas were .85 (positive affect) and .85 (negative affect).

The *Brief Multidimensional Students' Life Satisfaction Scale* (Seligson, Huebner, & Valois, 2002) has five items, each representing a major life satisfaction domain: family, friends, school, self, and living environment. Example items include "I would describe my satisfaction with my school experience as . . ." and "I would describe my satisfaction with my self as . . ." Ratings were made on a 7-point Likert scale (1 = *terrible* to 7 = *delighted*) and were combined into a single score (sample α = .73).

To provide global indices of well-being, we used two single-item measures. First, a sense of *wellness* was estimated with a

single, original item: "In the past 30 days, how many days have you felt so poorly [either physically or mentally] that you either stayed home from school or felt that you should stay home from school?" Second, *happiness* was measured with this item: "Taking all things together, would you say you are: very happy, quite happy, not very happy, or not happy at all?" (adapted from Abdel-Khalek, 2006). Abdel-Khalek reported strong correlations between single-item and an established multi-item happiness measures. The wellness and happiness items were square root transformed to correct positively skewed distributions.

Substance use coping. Respondents estimated the degree to which they used alcohol, cigarettes, and/or recreational drugs to cope with negative emotions with a single original item: "Please estimate the degree to which you used cigarettes, alcohol, or recreational drugs to cope with bad moods or difficult circumstances during the past 30 days." Responses were made on a scale of 1 (*not at all*) to 5 (*constantly/always*). This item was natural log transformed to correct a positively skewed distribution.

Finally, the 12-item Healthy Self-Regulation subscale of the *Mindful Thinking and Action Scale for Adolescents* (MTASA; West, 2008; West, Penix-Sbraga, & Poole, 2005) assessed self-regulation with items such as "I recognize when I'm upset and calm myself" and "I can stop myself from saying mean things." Responses were made on a 5-point scale (1 = *never* to 5 = *almost always*). Pilot data from three preliminary studies with adjudicated adolescents suggests that this subscale is sensitive to mindfulness training (Himelstein, 2009; West & Kram, 2008). In this study, the Healthy Self-Regulation subscale was administered in the context of the full 32-item MTASA. The sample subscale alpha was .84.

Results and Discussion

Exploratory and confirmatory factor analyses. To first explore the factor structure of the MAAS–A, we used the maximum likelihood method of parameter estimation with Sample A, given the small, normally distributed item pool (Cudeck, 2000). Analyses were performed in SPSS 15. The Kaiser measure of sampling adequacy was .86. Inspection of eigenvalues and the scree plot revealed a large gap between the first and remaining factors (factor 1 eigenvalue = 4.55; factor 2 eigenvalue = 1.15). The first factor accounted for 32.52% of the total variation across factors. Table 1 presents the 14-item MAAS–A and selected item-level statistics. The average factor loading was .51 (range = .28–.76). Item 6 loaded less than .30, but in the analysis of broadband constructs such as the present one, smaller factor loadings are not atypical (Hoyle, 2000; cf. Brown & Ryan, 2003). Exploratory factor analysis with the principal-factors method of estimation also showed a strong single-factor solution and very similar factor loadings and item–total correlations. The Cronbach's alpha for Sample A was .82.

We performed confirmatory factor analysis with Sample B using maximum likelihood estimation of the single-factor model. With AMOS 16, the model fit indices indicated that the correspondence between the single-factor model and the sample covariance matrix was satisfactory, $\chi^2(77) = 141.55$, $p < .001$, comparative fit index = .94, incremental fit index = .94, parsimonious comparative fit index = .79, root-mean-square error of approximation = .05, CI [.04, .07]. All 14 items of the scale were significantly related to the latent factor ($ps < .001$). Cronbach's alpha for Sample B was .84.

Test–retest reliability and agreement. The temporal stability of the scale was examined in an independent sample of 131 adolescents over a 3- to 4-week period ($n = 103$ [78.6%] female; $n = 114$ [87.0%] Caucasian; mean age = 16.56 years, $SD = 1.28$, range = 14–18 years). To assess test–retest reliability and agreement, we conducted a variance components analysis using SPSS 15. The intraclass correlation was .79 ($p < .0001$). Test–retest score agreement—that is, whether individuals generally receive the same (nonsignificantly different) scale scores over repeated assessment—was high, $t(130) = 1.12$, $p > .27$ (Time 1 mean = 3.82; Time 2 mean = 3.76). Internal consistency of the scale was

Table 1
Means, Standard Deviations, Factor Loadings, and Item–Total Correlations for the MAAS–A (Study 1)

Scale item	*M*	*SD*	F	I-T
1. I could be experiencing some emotion and not be conscious of it until some time later.	4.0	1.2	.48	.44
2. I break or spill things because of carelessness, not paying attention, or thinking of something else.	4.3	1.4	.47	.43
3. I find it difficult to stay focused on what's happening in the present.	3.9	1.3	.63	.58
4. I tend to walk quickly to get where I'm going without paying attention to what I experience along the way.	3.4	1.4	.40	.38
5. I tend not to notice feelings of physical tension or discomfort until they really grab my attention.	3.8	1.3	.40	.39
6. I forget a person's name almost as soon as I've been told it for the first time.	3.9	1.7	.28	.24
7. It seems I am "running on automatic" without much awareness of what I'm doing.	4.0	1.3	.76	.68
8. I rush through activities without being really attentive to them.	3.9	1.2	.64	.55
9. I get so focused on the goal I want to achieve that I lose touch with what I am doing right now to get there.	3.7	1.3	.53	.47
10. I do jobs or tasks automatically, without being aware of what I'm doing.	3.8	1.2	.47	.42
11. I find myself listening to someone with one ear, doing something else at the same time.	3.0	1.2	.32	.29
12. I find myself preoccupied with the future or the past.	3.1	1.4	.47	.43
13. I find myself doing things without paying attention.	3.6	1.2	.72	.65
14. I snack without being aware that I'm eating.	4.2	1.6	.58	.50

Note. All values are based on Sample A data ($n = 294$). Scale instructions were "Below is a collection of statements about your everyday experience. Using the 1–6 scale below, please indicate how frequently or infrequently you currently have each experience. Please answer according to what *really reflects* your experience rather than what you think your experience should be." The accompanying 6-point scale was 1 (*almost always*), 2 (*very frequently*), 3 (*somewhat frequently*), 4 (*somewhat infrequently*), 5 (*very infrequently*), 6 (*almost never*). MAAS–A = Mindful Attention Awareness Scale—Adolescent; *SD* = standard deviation; F = factor loadings, I-T = corrected item–total correlations.

acceptably high at both Time 1 and Time 2 ($\alpha = .85$ and $\alpha = .88$, respectively).

Relations to demographic, personality, well-being, and adaptive functioning measures. MAAS–A scores were slightly higher for male adolescents ($M = 3.93$, $SD = 0.74$) than for female adolescents ($M = 3.72$, $SD = 0.75$), $t(593) = 3.30$, $p < .001$. However, the effect size (Cohen, 1988) of this gender difference was small ($d = 0.28$). MAAS–A scores did not differ by age ($r = -.05$, $p > .27$) nor by race/ethnicity (Caucasians vs. others), $t(592) = 0.39$, $p > .69$.

The left side of Table 2 presents the zero-order correlations of the MAAS–A with the personality, well-being, and adaptive functioning variables assessed in this study. Among the Big Five personality traits, neuroticism has been consistently related to poorer psychological well-being (Diener, Suh, Lucas, & Smith, 1999). The MAAS–A was moderately related to lower neuroticism. The MAAS–A was positively related to agreeableness and conscientiousness and, more weakly, to openness to experience. It was unrelated to extraversion. These correlations closely parallel those reported by Brown and Ryan (2003) in adult samples. With regard to well-being and adaptive functioning, Table 2 shows that the MAAS–A was related to higher life satisfaction, happiness, positive affect, and wellness and was related to lower negative affect. The scale was also positively related to healthy self-regulation and a lower tendency to use substances to cope with stress.

Incremental validity. We examined whether the correlations found between the MAAS–A and the well-being and adjustment variables would remain significant after controlling for gender in all models, given gender differences in various indicators of well-being (e.g., Nolen-Hoeksema & Rusting, 1999). In separate regression analyses, we also controlled for age because preliminary analyses showed that age was related to several well-being indicators. The right side of Table 1 presents the partial correlations of the MAAS–A with the criterion variables after controlling for the effects of gender and age. As shown in Table 2, controlling for both variables made little difference to the MAAS–A well-being relations.

The results of this study supported our predictions concerning the MAAS–A. They showed a clear single-factor structure, high internal consistency, and acceptable test–retest reliability and agreement. As predicted, the scale also showed significant correlations with a variety of indicators of psychological well-being and adaptive functioning, even after controlling for demographic characteristics that past or the present research indicated were related to higher or lower well-being. This pattern of findings on the MAAS–A is consistent with research on the MAAS in adult samples (e.g., Brown & Ryan, 2003) and lends support to the reliability and validity of the MAAS–A.[1]

Study 2

Our purpose in Study 2 was to examine the utility of the MAAS–A in a clinical context. With a sample of adolescent psychiatric outpatients randomly assigned to receive either a mindfulness intervention or treatment as usual, we investigated whether (a) the coherence of the scale (internal consistency) would be supported in this population; (b) the MAAS–A would demonstrate sensitivity to increases in mindfulness over time among those receiving mindfulness training; and (c) changes in MAAS–A scores over the course of the intervention and follow-up period would be related to changes in scores on a battery of mental health measures. Support for these three questions would help to support the validity of the MAAS–A for investigations of mindfulness as an active ingredient in mindfulness-based interventions for adolescents, as has been done in adult populations (Brown & Ryan, 2003; Orzech, Shapiro, Brown, & McKay, 2009; Shapiro et al., 2007).

Method

Participants. Participants in the intent-to-treat (ITT) sample were 102 adolescents age 14–18 years (mean = 15.35 years, $SD = 1.20$) recruited from an outpatient Child and Adolescent Psychiatry Department in a national health management organization. Seventy-four participants completed assessments at all three time points. The ITT sample was predominantly female (73.5%), and most participants were Caucasian (45.1%) or Hispanic/Latino/Latina (28.4%). The remainder were Asian (5.9%), African American (2.9%), Native American (1%), or of mixed racial/ethnic descent (16.7%). All disorders in the sample were based on Axis I diagnoses from the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text rev.; American Psychiatric Association, 2000); the most common were mood disorders (49%) and anxiety disorders (30.4%). Other disorders (e.g., adjustment disorder, substance abuse) were found in 24.5% of the sample. Most participants (56.9%) were also diagnosed with V-codes (e.g., parent–child relational problems and/or problems related to abuse or neglect). There was considerable comorbidity in the sample. Further details on the participants, patient flow through the study, and study procedures are found in Biegel et al (2009).

Study design and procedures. The study used a 2 (experimental vs. wait-list control group) × 3 (pretest, posttest, and 3-month follow-up) mixed factorial design, in which participants were randomly assigned to a mindfulness-based stress reduction program (MBSR; Kabat-Zinn, 1990; $n = 50$) or to treatment as usual (TAU; $n = 52$). The MBSR intervention was offered as an adjunct to psychiatric treatment, so all participants continued their usual psychological care (i.e., MBSR + TAU). Posttest measures were obtained from all available participants 8 weeks later (immediately following MBSR program completion) and at 3 months following the posttest.

The 8-week, manualized MBSR intervention was focused on formal and informal mindfulness practices in which participants learned the deployment of mindful attention (i.e., attending to experience as it is occurring in the present moment in a nonevaluative and nondiscursive way). Formal mindfulness practices included body scan meditation, sitting meditation, hatha yoga, and walking meditation. Their purpose was to cultivate the capacity to

[1] We repeated all analyses in Study 1 with 16- to 18-year-olds using the 15-item (adult version) MAAS, which includes an item pertaining to driving that was deleted to create the MAAS–A. The factor analytic, reliability, and validity results were highly consistent with both the present results and the MAAS validation results of Brown and Ryan (2003), and they provide a basis for using the adult version MAAS with adolescents age 16 years and older. Details on these analyses are available from the first author.

Table 2
Correlations of the MAAS–A With Personality, Well-Being, and Adaptive Functioning Variables Before and After Controlling for Other Constructs (Study 1)

Scale	Zero-order correlation	Correlation controlling for	
		Gender	Age
APSI Neuroticism	−.42****	−.41****	−.43****
APSI Extraversion	.08	.09*	.08
APSI Openness to Experience	.09*	.09*	.09*
APSI Agreeableness	.23****	.27****	.24****
APSI Conscientiousness	.23****	.25****	.23****
PANAS Positive Affect	.22****	.20****	.21****
PANAS Negative Affect	−.41****	−.39****	−.41****
BMSLSS Life Satisfaction	.34****	.33****	.33****
Wellness	.30****	.28****	.30****
Happiness	.23****	.22****	.22****
Substance use coping	−.23****	−.23****	−.22****
MTASA Healthy Self-Regulation	.39****	.39****	.39****

Note. N = Samples A and B combined; n varied from 560 to 593. MAAS–A = Mindful Attention Awareness Scale—Adolescent; APSI = Adolescent Personal Style Inventory; PANAS = Positive and Negative Affect Schedule; BMSLSS = Brief Multidimensional Students' Life Satisfaction Scale; MTASA = Mindful Thinking and Action Scale for Adolescents.
* $p < .05$. **** $p < .0001$.

be mindful during practice sessions and in daily life. Informal practice concerned bringing mindful attention to selected routine, day-to-day activities. The weekly sessions also included didactic presentations, group sharing, and instruction in at-home mindfulness practice assignments. The standard adult MBSR course was adapted to the needs of adolescents (Biegel, 2005, 2009). Adaptations included reductions in the length of practice sessions and a shift in discussion topics toward issues predominant among adolescents and adolescents with psychiatric disorders more specifically, including self-image, life transitions, self-harming behaviors, and difficulties related to communication and interpersonal relationships. TAU involved individual and/or group psychotherapy and/or psychotropic medication management at the study site. In accord with usual clinical care at the site, there was considerable variance in TAU received. However, there were no significant differences between the MBSR + TAU and TAU conditions on any form of TAU received at each of the three assessment points ($ps > .10$).

Study measures. A number of measures were obtained at pretest, posttest, and 3-month follow-up. The following self-report measures were of interest to this research.

Mindfulness. The MAAS–A (described in Study 1) was administered. The internal consistency (Cronbach's alpha) in this sample was .86.

Mental health. In an attempt to broadly assess psychological stress, distress, and well-being, we used well-validated scales tapping several cognitive and affective dimensions of experience. The 10-item *Rosenberg Self-Esteem Scale* (Rosenberg, 1989) was rated on a 4-point Likert scale (*strongly agree* to *strongly disagree*). Higher scores reflected lower self-esteem (sample α = .92). The 10-item version of the *Perceived Stress Scale* (PSS-10; Cohen & Williamson, 1988) was used to measure the degree to which situations in a participant's life during the previous month were appraised as stressful on a 5-point scale (*never* to *very often*). The internal consistency of the scale (Cronbach's alpha) in the present sample was .74.

Anxiety was measured at both state ("past week") and trait ("past month") levels with the *State–Trait Anxiety Inventory* (STAI; Spielberger, 1983). The state STAI (sample α = .92) and the trait STAI (sample α = .94) each contained 20 self-descriptive statements rated on a 4-point scale (*not at all* to *very much so*). Finally, the *Hopkins Symptom Checklist 90 (Revised*) nonpatient adolescent measure (SCL-90–R; Derogatis, 1977) assessed psychological symptom patterns on a 5-point scale of distress (*not at all* to *extremely*). Six of the nine symptom subscales were deemed most appropriate for the population of adolescents under study: Depression, Anxiety, Obsession-Compulsion, Somatization, Interpersonal Sensitivity, and Hostility (sample alpha range = .85–.90). These subscale scores were combined into a global symptom index. Finally, sleep quality change was assessed with a single item: "Using the 1 to 7 scale below, please indicate whether there have been any changes in the quality of your sleep since you started the course" (ranging from *got much worse* to *got much better*) both at posttest and at follow-up.

Statistical analyses. To assess changes in MAAS–A scores and the relation of MAAS–A scores to mental health variables over time in the MBSR + TAU versus TAU only conditions, we used a restricted maximum likelihood (REML) mixed modeling approach (e.g., Bryk & Raudenbush, 1992; Kreft & deLeeuw, 1998). Among other advantages, this approach permitted analysis of the full ITT sample (i.e., using all available data from all randomized participants as allocated, N = 102). The MIXED procedure in SAS was used to estimate all REML mixed models (Littell, 2006). The predictor variables were pretreated (Bryk & Raudenbush, 1992; Schwartz & Stone, 1998) to enhance interpretability of the mixed-model intercept parameters. Level 2 continuous variables measured at study outset, including age and number of prestudy therapy sessions, were centered around zero, and Level 2 categorical variables that did not include a meaningful zero value in the original scaling (gender, group, time) were rescaled to include zero. Level 2 variables were treated as fixed effects and the Level 1 time variable was treated as random, as were the intercept

and slope for each participant. The "between/within" method for computing denominator degrees of freedom was used in all models. Choice of most appropriate within-person error covariance structure (unstructured, compound symmetry, or first-order autoregressive) was determined through chi-square tests comparing the −2 restricted log likelihood model fit indices for each outcome (as well as significance of autoregression). The unstructured or compound symmetry covariance structures were used in all models. Before beginning analyses, all continuous variables were checked for skewness and kurtosis and converted to categorical scores where necessary.

Results and Discussion

Preliminary analyses. As reported by Biegel et al. (2009), the MBSR and TAU groups did not significantly differ on baseline demographic, diagnostic, or therapeutic characteristics except that MBSR participants were slightly older and had a higher incidence of Axis I diagnoses besides mood and anxiety disorders. In preliminary analyses these variables did not predict any of the outcomes, so they were not further considered.

Treatment effects on MAAS–A Mindfulness. MAAS–A scores at baseline did not differ by gender, age, or race/ethnicity, diagnosis at baseline, TAU treatment, or medication use characteristics, with one exception: Participants with Axis I mood disorder had lower baseline MAAS–A scores ($p < .05$). However, mood disorder did not predict MAAS–A change in preliminary analyses, so it was not further considered for this analysis. Preliminary analyses revealed that MBSR participants had lower MAAS–A scores than did TAU controls at baseline ($p < .01$). Thus, within-group REML analyses were conducted on this outcome.

MBSR participants showed strongly significant improvements from pretest to follow-up in MAAS–A score ($p < .001$; $M_{\text{pre-test}} = 3.31$, $SD = 0.78$; $M_{\text{follow-up}} = 3.76$, $SD = 0.70$); this change in scores was a medium-size effect ($d = 0.61$; Cohen, 1988). No changes over this time period in MAAS–A scores were found in the TAU condition ($p > .46$; $M_{\text{pre-test}} = 3.80$, $SD = 1.00$; $M_{\text{follow-up}} = 3.79$, $SD = 1.16$; $d = 0.01$). Post hoc tests showed that significant improvements in MAAS–A score in MBSR participants occurred between pre- and posttest time points ($p < .01$) and between pretest and follow-up points ($p < .01$). No differences in MAAS–A scores between MBSR and TAU conditions were found at posttest or at follow-up ($ps > .39$), but this may have been due to the higher MAAS–A score among TAU participants at pretest noted above. In general, these results indicate that MAAS–A scores improved significantly over time among adolescents randomized to mindfulness training. No significant changes over time in MAAS–A scores were found among participants randomized to TAU, suggesting that MAAS–A scores were sensitive to the effects of mindfulness training.[2]

It is possible that the significant increase in MAAS scores among the former group represents a regression artifact (regression to the mean), as the MBSR participants' MAAS scores at baseline were significantly lower than TAU participants' scores. Weighed against this possibility is the fact that there is no reason to expect a regression to the mean effect to be limited to one group in a randomized trial. More likely is that the lower baseline scores in the MBSR group were a chance occurrence.

Relations of MAAS–A Mindfulness to mental health outcomes. Table 3 shows the zero-order correlations between MAAS–A and the mental health variables at pretest. MAAS–A scores were moderately correlated with all mental health variables in the expected directions. We next tested whether the changes in MAAS–A scores from pretest to follow-up found in the MBSR condition would be related to the improvements in mental health in this sample reported by Biegel et al. (2009); they showed that these MBSR participants showed significant improvements in Rosenberg self-esteem, PSS perceived stress, STAI present and past-month anxiety, and SCL-90–R psychological symptoms.

Preliminary analyses were conducted to determine whether demographic, diagnostic, and other baseline participant characteristics should be controlled in the primary analyses. Preliminary analyses showed that gender and the presence of Axis I mood disorder at baseline were significantly related to several mental health outcomes ($ps < .05$). Age, number of prestudy hospitalizations, and presence of a V-code diagnosis were also related to several of these outcomes ($ps < .05$). These variables were included as predictors in preliminary REML analyses of the relations between the MAAS–A and mental health indicators where relevant. If significant, either as main effects or in interaction with time, the variables were retained for the reported analyses. Given the number of tests conducted, we corrected the alpha level to .01.

The REML analyses showed that across time, higher MAAS–A scores were related to higher Rosenberg self-esteem ($p < .0001$), lower PSS perceived stress ($p < .0002$), STAI past anxiety ($p < .007$), and SCL-90–R psychological symptoms ($p < .0001$). In the model predicting STAI present anxiety, there was an interaction between MAAS–A and time, indicating that the relation of MAAS–A to present anxiety increased over time in the MBSR group ($p < .01$; see also Table 3). There were no other significant MAAS–A × Time interactions in the prediction of the mental health outcomes. Regarding the covariates, the presence of V-code diagnoses at baseline predicted higher past-month anxiety over time ($p < .01$), and baseline mood disorder predicted higher SCL-90–R psychological symptoms across time ($p < .003$). No other covariates were significant predictors in these models.

When taken in the context of significant MAAS–A increases over time, described previously, and the significant positive changes in mental health outcomes among MBSR participants reported by Biegel et al. (2009), the present findings indicate that increases in MAAS–A scores among the adolescent outpatient MBSR participants were related to beneficial changes in mental health over the baseline-to-follow-up study period.

[2] To further test whether MAAS–A change was limited to the MBSR group, we conducted a multiple-least-squares regression analysis that included study-completing participants from both groups ($N = 74$) and that controlled for the group difference in Time 1 MAAS–A scores. This analysis showed a significant MAAS–A × Group interaction effect ($p < .05$); change in MAAS–A scores from Time 1 to Times 2 and 3 occurred in the MBSR group only.

Table 3
Correlations of Scores on the MAAS–A With Concurrent Mental Health Variables at MBSR Pretreatment, Posttreatment, and Follow-Up (Study 2)

Scale	Pretreatment	Posttreatment	Follow-up
Rosenberg self-esteem	−.22	−.39**	−.59***
PSS perceived stress	−.38**	−.41**	−.69****
STAI anxiety, present	−.05	−.40**	−.67****
STAI anxiety, past	−.22	−.47**	−.63****
SCL-90–R psychological symptoms	−.45***	−.51***	−.70****
Sleep quality change		.17	.19

Note. $N = 50$, 39, and 34 at pretreatment, posttreatment, and follow-up, respectively. Sleep quality change at posttreatment is in reference to pretreatment and at follow-up is in reference to posttreatment. MAAS–A = Mindful Attention Awareness Scale—Adolescent; MBSR = Mindfulness-Based Stress Reduction; PSS = Perceived Stress Scale; STAI anxiety, present = State–Trait Anxiety Inventory, state; STAI anxiety, past = State–Trait Anxiety Inventory, trait; SCL-90–R = Symptom Checklist-90–R.
** $p < .01$. *** $p < .001$. **** $p < .0001$.

General Discussion

With a growing research and clinical interest in mindfulness training for adolescents (see reviews by Black, Milam, & Sussman, 2009; Burke, 2010), there is a need for validated mindfulness measures that are suitable for use in normative and clinical adolescent populations. In the present studies, we adapted the well-validated Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003) for use in both adolescent populations age 14–18 years. Although this adaptation was minor (removal of one item), the studies provided necessary evidence for the reliability and validity of the adapted scale for use in these populations of increasing interest to mindfulness researchers and clinicians.

In large samples of normative adolescents age 14–18 years, Study 1 found that the 14-item Mindful Attention Awareness Scale—Adolescent (MAAS–A) showed strong evidence for a single-factor structure in both exploratory and confirmatory factor analyses. These results parallel those found in adult normative samples (e.g., Brown & Ryan, 2003; Carlson & Brown, 2005; Jermann et al., 2009; MacKillop & Anderson, 2007). Study 1 found that the internal consistency of the scale was high, as were test–retest reliability and agreement. MAAS–A scores did not differ by age or race (Caucasians vs. others), but there was evidence that male adolescents produced slightly higher scale scores than did female adolescents. Consistent with criterion validity evidence on the MAAS (e.g., Brown & Ryan, 2003), MAAS–A scores were significantly correlated with a number of indicators of psychological well-being and adaptive functioning in the normative sample, even after controlling for relevant demographic characteristics.

Results from Study 2 supported the reliability and validity of the MAAS–A in a mixed psychiatric adolescent sample. We found that the MAAS–A showed high internal consistency in a sample of primarily anxiety- and mood-disordered adolescents age 14–18 years. Scores on the scale increased significantly among those randomized to receive an 8-week MBSR intervention but not among those assigned to TAU. The significant increases in MAAS scores in this group are consistent with other MBSR trial research with adults (e.g., Cohen-Katz et al., 2005; Shapiro et al., 2007).

Further, the MAAS–A score increases among MBSR recipients were significantly related to positive changes in mental health and well-being over the preintervention to 3-month follow-up period. In particular, increases in MAAS–A Mindfulness were significantly related to increases in self-esteem and declines in perceived stress, past and present anxiety, and general psychological symptoms. These findings suggest that the MAAS–A is sensitive to change among mixed outpatient adolescents receiving mindfulness training and that such change is related to positive mental health changes. The findings of the two studies suggest that the MAAS–A has utility in normative and in psychiatric adolescent populations.

Limitations and Future Research

The present studies were conducted with comparatively large normative samples with good gender and age representation, but more research is needed to test the semantic equivalence, reliability, and validity of the MAAS–A with a broader diversity of ethnicities. Also, the psychiatric sample was heterogeneous, with a variety of diagnoses represented, although most participants had mood and anxiety disorders. Although comorbidity is common in adolescent psychiatric populations (Kessler et al., 2009), research is needed to validate the MAAS–A in specific diagnostic groups before it can be strongly recommended for use with specific groups.

The present research was designed to provide foundational evidence for a valid and reliable measure of mindfulness among adolescents. Study 2 found that the MAAS–A was apparently sensitive to mindfulness-treatment-related change, as shown by significant scale score increases, but further substantiation of the validity of the scale will require research that uses active control groups, to control for endorsement of scale items that may be attributable to instructor attention and other nonspecific treatment factors. Also, much research remains to be conducted to establish the utility of the MAAS–A in predicting subjective and objective mental health and other outcomes. As noted, the adult version of the scale has begun to demonstrate utility in predicting theoretically consistent neural (Creswell et al., 2007; Way et al., 2010) and behavioral responses (e.g., Lakey et al., 2007; Michalak et al., 2008). The psychometric evidence relevant to the MAAS–A presented in these two studies offers a basis to proceed with such investigations with adolescent groups. The growing field of research on mindfulness among adolescents may also benefit from

efforts to validate other measures of mindfulness for this age group, both original measures and those, like the MAAS, developed for use among adults (e.g., Baer et al., 2006; Feldman, Hayes, Kumar, Greeson, & Laurenceau, 2007; Walach et al., 2006). Future research on the measurement of mindfulness will also benefit from efforts to disclose external criteria or referents for mindfulness, such as demonstrations of sustained or flexible use of attention in laboratory tasks or daily-life contexts.

Finally, it is important to note that the current validation of the MAAS–A is limited to normative and psychiatric populations without extensive training in mindfulness (e.g., over hundreds or thousands of hours). Indeed, this is true for most extant self-report measures of mindfulness. This limitation is important, because the conception and operationalization of this construct may differ in identifiable ways when applied to highly trained populations of adolescents or adults (Grossman, 2008). Like that of other psychological phenomena subject to training-related change (e.g., cognitive skills), the nature of mindfulness may change in ways significant enough to require different measurement approaches that are sensitive to more sophisticated subjective and behavioral expressions of the phenomenon.

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Received October 16, 2009
Revision received July 12, 2010
Accepted July 16, 2010 ■