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Psychiatry Research

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Changes in facets of mindfulness and posttraumatic stress disorder treatment outcome

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ARTICLE INFO

Article history:

Received 19 August 2011

Received in revised form

29 June 2012

Accepted 15 July 2012

Keywords:

Mindfulness

Posttraumatic Stress Disorder

PTSD

Acceptance

Awareness

Treatment outcome

ABSTRACT

Though there has been a recent surge of interest in the relations between facets of mindfulness and Posttraumatic Stress Disorder (PTSD), there has been a dearth of empirical studies investigating the impact of changes in facets of mindfulness on PTSD treatment outcomes. The present study tested the prospective associations between pre- to post-treatment changes in facets of mindfulness and PTSD and depression severity at treatment discharge, among 48 military Veterans in residential PTSD treatment adhering to a cognitive-behavioral framework. Together, changes in facets of mindfulness significantly explained post-treatment PTSD and depression severity (19–24% of variance). Changes in acting with awareness explained unique variance in post-treatment PTSD severity and changes in nonjudgmental acceptance explained unique variance in post-treatment depression severity. These results remained significant after adjusting for shared variance with length of treatment stay.

Published by Elsevier Ireland Ltd.

1. Introduction

There has been a recent surge of interest in the relation between facets of mindfulness and Posttraumatic Stress Disorder (PTSD) outcomes (Vujanovic et al., 2011). This interest is in part driven by the fact that mindfulness-based interventions are effective in treating a wide range of psychological disorders (Hofmann et al., 2010) and may offer a promising adjunct to evidence-based psychosocial treatments for PTSD (e.g., cognitive processing therapy, prolonged exposure) that are associated with high rates of dropout and non-response (e.g., Resick et al., 2002). However, a dearth of empirical research has examined whether changes in self-reported in facets of mindfulness are associated with improved PTSD outcomes prospectively over the course of an established evidence-based psychosocial treatment for PTSD.

Although the conceptual and operational definition(s) of mindfulness is a topic contemporary debate and study, one central conceptual model includes attention to and awareness of the present moment, and nonjudgmental acceptance of thoughts,

sensations, and/or emotional states (Baer et al., 2006; Bishop et al., 2004). Moreover, facets of mindfulness are likely functionally related (Tanay et al., in press). For example, awareness of one's experience in the present moment may be necessary for the development of the ability to accept those thoughts, emotions and physical sensations without judgment (Kumar et al., 2008; Mitmansgruber et al., 2009).

Mindfulness has been theoretically linked to reductions in PTSD symptoms (Vujanovic et al., 2011). However, few studies have tested their relations, most of which have been cross-sectional and among non-clinical samples (Bernstein et al., 2011; Thompson and Waltz, 2010; Vujanovic et al., 2009). Among a sample composed of trauma-exposed adults, Vujanovic et al. (2009) found that severity of total posttraumatic stress symptoms, and PTSD Re-experiencing, Avoidance/Numbing and Hyperarousal symptom clusters, were inversely associated with nonjudgmental acceptance; PTSD Re-experiencing symptoms were also inversely associated with acting with awareness. Among a college student sample, Thompson and Waltz (2010) found an inverse association between nonjudgmental acceptance and posttraumatic stress avoidance symptoms, above and beyond measures of experiential avoidance (i.e., the general tendency to be unwilling to experience unwanted private events coupled with actions taken to avoid them; Thompson and Waltz, 2010). Among

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a sample of trauma-exposed adults, Bernstein et al. (2011) found levels of acting with awareness to be associated with total posttraumatic stress symptom severity and anhedonic depression, above and beyond lifetime trauma exposure severity.

Two studies have examined mindfulness among individuals receiving treatment for PTSD (Kimbrough et al., 2010; Owens et al., 2012). In a study among survivors of childhood sexual abuse it was found that PTSD and depressive symptoms were reduced during an 8-week course of mindfulness meditation-based stress reduction with daily practice of mindfulness skills (Kimbrough et al., 2010). In the only study to examine mindfulness and psychopathology in a sample receiving an empirically supported residential treatment for PTSD, Owens et al. (2012) found that: (a) facets of mindfulness increased, albeit to a non-significant degree, over the course of treatment that included Cognitive Processing Therapy (Resick et al., 2007) and specific groups devoted to mindfulness training; and (b) changes in facets of mindfulness, and especially, acting with awareness, were negatively associated with clinician-rated measures of PTSD and depression. Together these studies provide evidence for an inverse relation between mindfulness (particularly acting with awareness and nonjudgmental acceptance) and severity of post-traumatic stress and related (depression) symptoms.

The goal of the present investigation was to extend the results of Owens et al. (2012) by prospectively investigating the associations between changes in self-reported facets of mindfulness and PTSD and depression severity, in a Veterans Affairs (VA) PTSD residential rehabilitation program that did not specifically target mindfulness. The primary treatment modality was cognitive-behavioral group therapy, and included group Cognitive Processing Therapy (Resick et al., 2007). Although not designed to target mindfulness per se, cognitive behavioral therapies for PTSD require active effort to purposely direct one's attention to memories and cognition and to tolerate associated unpleasant emotions and physical sensations as one develops new, more adaptive cognitive appraisals (Zayfert and Becker, 2008). Thus, it is hypothesized that cognitive-behavior therapy for PTSD indirectly targets facets of mindfulness, such as acting with awareness and nonjudgmental acceptance, and through this, in-part achieves its therapeutic effect. Following, this study had the potential to extend the results of Owens et al. (2012) to a standard VA PTSD residential rehabilitation program that does not specifically target mindfulness, and thus investigate the robustness of related findings. In addition to PTSD severity, as a test of specificity, we included depression severity as an outcome based on theory and research demonstrating that depressive symptoms are common associated features of PTSD (Elhai et al., 2011) which may potentially be reduced through PTSD treatment (e.g., Bryant et al., 1998) and the use of mindfulness (Bernstein et al., 2011). We hypothesized that: (1) facets of mindfulness would increase to a small but measurable extent from pre- to post-treatment; (2) increases in facets of mindfulness would together predict lower overall PTSD and depression severity at treatment discharge, after controlling for PTSD and depression symptom severity, respectively, at treatment intake; and (3) these results (hypothesis 2) would remain significant after accounting for shared variance with length of treatment stay.

2. Method

2.1. Participants

A total of 48 military Veterans with a primary diagnosis of PTSD (98% male; $M_{age}=46.0$ years, $S.D.=14.9$), admitted to a VA residential rehabilitation program for PTSD between 2008 and 2010, participated in this study. PTSD diagnosis was determined through chart review and/or clinical interview conducted by VA staff. The majority of the sample identified as Caucasian (55.3%), followed by Hispanic/

Latino/a (21.3%), African American (12.8%), Pacific Islander (4.3%), Native American/Alaskan Native (4.3%), and "Other" (3.4%). Almost all participants (90.5%) were exposed to some form of combat, with the remaining reporting the experience of non-combat related traumatic events. The majority of participants reported combat experiences in Vietnam (41.7%), followed by Iraq/Afghanistan (39.6%) and the Persian Gulf (10.4%). Participants were included in this study if they completed measures of mindfulness and PTSD and depression symptom severity at both treatment intake and discharge. Participants who were included in this study did not differ from non-participating patients ($N=62$) who completed the residential program in terms of age ($t(104)=-0.5$, $p=0.63$), length of stay ($t(101)=-0.0$, $p=0.99$), baseline PTSD symptom severity ($t(102)=1.0$, $p=0.32$), or depressive symptoms ($t(93)=1.6$, $p=0.12$).

2.2. Measures

2.2.1. Facets of mindfulness

Facets of mindfulness were measured using the Kentucky Inventory of Mindfulness Skills (KIMS; Baer et al., 2004). The KIMS is a 39-item questionnaire on which respondents indicate, using a 5-point scale (1=Never or very rarely true to 5=Very often or always true), the general tendency to be mindful in daily life (Baer et al., 2004). Item content for the KIMS was initially guided by theory and based on facets of mindfulness identified by Dialectical Behavior Therapy (Dimidjian and Linehan, 2003) in particular. Items were evaluated through exploratory and confirmatory factor analysis, which revealed that the measure has four factors: Observing (i.e., observing a variety of internal and external stimuli, including bodily sensations, cognitions, emotions, signs, and sounds), Describing (i.e., describing observed phenomena by covertly applying labels), Awareness (i.e., engaging in activity with undivided attention), and Acceptance (i.e., allowing or being nonjudgmental or nonevaluative about present-moment experience). Subscale means were used in our analyses. The KIMS has excellent psychometric properties (Baer et al., 2004) and demonstrated good internal consistency at treatment intake and discharge (see Table 1).

2.2.2. PTSD severity

PTSD severity was measured using the PTSD Checklist—Military Version (PCL-M; Weathers et al., 1993). The PCL-M is a 17-item measure used to assess the severity of PTSD symptoms in total, and the severity of the three symptom clusters corresponding to the DSM-IV diagnostic criteria for PTSD (Re-experiencing, Avoidance/Numbing, and Hyperarousal; American Psychiatric Association, 2000). Participants indicate the severity of individual symptoms using a 5-point scale (1=Not at all bothered to 5=Extremely bothered). We used the sum of items in our analyses. The PCL-M has excellent psychometric properties (Weathers et al., 1993) and demonstrated good internal consistency at treatment intake and discharge (see Table 1).

2.2.3. Depression severity

Depression severity was measured using the 21-item Beck Depression Inventory (BDI; see Beck et al., 1988). Respondents were asked to indicate the degree to which they experienced various depressive symptoms (e.g., feeling sad, sleep problems) during the previous week using a 4-point scale (0=I do not feel sad; 3=I am so sad or unhappy that I can't stand it). We used the sum of items in our analyses. Higher scores represented higher levels of psychological distress. The BDI has excellent psychometric properties (Beck et al., 1988) and demonstrated good internal consistency at treatment intake and discharge (see Table 1).

Table 1

Descriptive statistics and internal reliabilities (Cronbach's α) for all scales.

	Mean (S.D.)	Range	Cronbach's α
<i>Intake</i>			
1. Observing	3.1 (0.7)	1.5–4.8	0.87
2. Describing	2.7 (0.7)	1.1–4.8	0.84
3. Awareness	2.7 (0.7)	1.0–4.2	0.87
4. Acceptance	2.6 (0.8)	1.2–4.9	0.88
5. PTSD Severity	62.0 (13.1)	37.0–85.0	0.94
6. Depression Severity	29.1 (11.1)	5.0–56.0	0.92
<i>Discharge</i>			
7. Observing	3.1 (0.6)	2.0–4.5	0.82
8. Describing	2.9* (0.8)	1.4–5.0	0.91
9. Awareness	2.8 (0.7)	1.3–4.0	0.84
10. Acceptance	2.8* (0.7)	1.4–4.8	0.86
11. PTSD Severity	47.4* (17.2)	17.0–84.0	0.96
12. Depression Severity	18.2 (10.9)	0.0–48.0	0.92

* Discharge and Intake values of scale significantly differ (all p 's < 0.05)

Table 2
Zero-order correlations among all scales.

	1	2	3	4	5	6	7	8	9	10	11
<i>Intake</i>											
1. Observing											
2. Describing	0.34*										
3. Awareness	0.21	0.36*									
4. Acceptance	-0.04	0.29*	0.36*								
5. PTSD Severity	-0.01	-0.14	-0.18	-0.50**							
6. Depression Severity	-0.14	-0.38**	-0.51**	-0.72**	0.51**						
<i>Discharge</i>											
7. Observing	0.65**	0.44**	0.23	-0.13	0.11	-0.08					
8. Describing	0.29*	0.77**	0.21	0.16	-0.20	-0.32*	0.47**				
9. Awareness	0.34*	0.39**	0.79**	0.29*	-0.09	-0.48**	0.27	0.36*			
10. Acceptance	0.33*	0.48**	0.34*	0.67**	-0.44**	-0.71**	0.10	0.43**	0.49**		
11. PTSD Severity	-0.21	-0.17	-0.01	-0.27	0.51**	0.38**	-0.02	-0.33*	-0.24	-0.53**	
12. Depression Severity	-0.21	-0.28	-0.14	-0.22	0.30*	0.48**	-0.08	-0.37*	-0.34*	-0.54**	0.58**

^: Discharge and Intake values of scale significantly differ (all p 's < 0.05).

* $p < 0.05$.

** $p < 0.01$.

2.3. Procedure

Participants were admitted for PTSD treatment at the residential rehabilitation programs of the VA Palo Alto Health Care System for a mean length of stay of 83.8 days ($S.D.=29.2$). This program admits Veterans and active-duty military personnel with military-related PTSD and related problems. The program receives referrals from VA hospitals/clinics, Vet Centers, and private practitioners around the country. Veterans are referred to the residential program when a more intensive, residential treatment environment is indicated. Exclusion criteria for enrollment in the program included: (a) imminent risk of harm to self or others, (b) active withdrawal or inability to remain alcohol and illegal substance-free during treatment, (c) medical (e.g., active cancer) or mental conditions (e.g., presence of a psychotic disorder) rendering the individual unsuitable for residential level of care or unable to actively participate in treatment, and (d) legal issues requiring absence from treatment or court-ordered specifically to the program.

The primary treatment modality is cognitive behavioral group therapy delivered by an interdisciplinary team within the context of a therapeutic community/milieu. Group Cognitive Processing Therapy (CPT), a 14-session, manualized, trauma-focused form of cognitive behavioral therapy for PTSD that is based on cognitive theory of PTSD (Resick and Schnicke, 1992) is the primary form of trauma-focused treatment that patients receive (see Alvarez et al., 2011). Two of the 14-sessions are devoted to gaining information about veterans' pre-military autobiography, and the remaining 12 sessions are the standard CPT protocol. Additional treatment groups include cognitive therapy (which does not focus on trauma), communication skills, psychoeducation, process groups, parenting skills, and recreation therapy. Additionally, individuals who report substance use problems prior to intake engage in regular mutual self-help groups (e.g. Alcoholics Anonymous). As part of normal clinical practice, intake measures were collected during the week following treatment intake and discharge measures during the week prior to treatment discharge.

3. Results

As shown in Table 2, preliminary zero-order correlation analyses revealed significant inverse associations at treatment intake between (a) PTSD severity and nonjudgmental acceptance and (b) depression severity and describing, acting with awareness, and nonjudgmental acceptance. At treatment discharge: (a) PTSD severity was significantly inversely associated with describing and nonjudgmental acceptance, and (b) depression severity was significantly inversely associated with describing, acting with awareness, and acceptance.

To test our first, primary hypothesis we evaluated whether PTSD and depression severity and facets of mindfulness significantly changed from pre- to post-treatment using repeated measures ANOVAs and the Reliable Change Index (RCI; Jacobson et al., 1999; Jacobson and Traux, 1991). PTSD severity ($F(1,47)=42.9$, $p < 0.01$, $\eta_p^2=0.48$) and depression severity ($F(1,47)=44.8$, $p < 0.01$, $\eta_p^2=0.49$) significantly decreased during treatment. Calculation of the RCI demonstrated that from pre- to post-treatment

54.2% of participants experienced changes in PTSD or depression severity at rates greater than could be attributable to measurement error alone ($RCI > 1.96$). In terms of facets of mindfulness, describing ($F(1,47)=7.9$, $p < 0.01$; $\eta_p^2=0.14$) and nonjudgmental acceptance ($F(1,47)=4.4$, $p < 0.05$; $\eta_p^2=0.09$) were found to significantly change (increase) during treatment, and acting with awareness changed (increased) at the level of a trend ($F(1,47)=3.0$, $p < 0.10$; $\eta_p^2=0.06$). Observation did not statistically change ($F(1,47)=0.0$, $p=0.87$; $\eta_p^2=0.00$). Calculation of the RCI demonstrated that from pre- to post-treatment, 14.6% reliably increased ($RCI > 1.96$) and 31.3% of participants reliably decreased ($RCI < -1.96$) in observation, describing, acting with awareness, and nonjudgmental acceptance. An additional 14.6% substantially, although not reliably increased ($1.96 > RCI > 1$) and 29.2% of participants substantially decreased ($-1.96 > RCI > -1$) in these facets. Although no significant mean level treatment change was observed for acting with awareness or observing facets, we proceeded with planned analyses between change in mindfulness and PTSD treatment outcomes due to the observed directional variation in change in facets of mindfulness. Indeed, RCI data illustrated a reduction for some and elevation for others in these facets of mindfulness, thereby explaining the null pre-to-post ANOVA effects.

Two hierarchical multiple regression analyses (HMR) were conducted to test our primary hypothesis—that changes in facets of mindfulness would predict PTSD and depression severity at discharge. Calculation of the variance inflation factor (VIF), tolerance (reciprocal of the VIF) and Cook's D and leverage values when conducting the HMRs, as well as skew and kurtosis of predictor and dependent variables, revealed that assumptions were met regarding lack of multicollinearity and extreme outliers, and of normal distributions of variables. In Step 1, pre-treatment PTSD or depression severity and length of treatment stay were entered as covariates. In Step 2, changes in facets of mindfulness were simultaneously entered. As shown in Table 3, in the first HMR, intake values of PTSD severity but not length of treatment stay significantly predicted discharge values of PTSD severity ($F(2, 46)=7.1$, $p < 0.01$). The inclusion of facets of mindfulness at Step 2 significantly accounted for additional variance in the prediction of PTSD severity ($\Delta R^2=0.19$, $p < 0.05$; $F(6, 46)=5.1$, $p < 0.01$).¹

¹ Upon examination of individual PTSD symptom clusters as outcomes, HMR results revealed that facets of mindfulness together predicted Re-experiencing ($\Delta R^2=0.15$, $p < 0.05$), Avoidance/Numbing ($\Delta R^2=0.20$, $p < 0.05$), but not Hyperarousal symptoms ($\Delta R^2=0.15$, $p=0.07$), after statistically accounting for

Table 3
Hierarchical multiple regression analyses predicting PTSD (column A) and depression (column B) severity at discharge.

Predictor	A				B			
	Predicting PTSD severity at discharge				Predicting depression severity at discharge			
	R^2	ΔR^2	β	SR^2	R^2	ΔR^2	β	SR^2
Step 1	0.21**	0.24**			0.17**	0.21**		
PTSD/Depression severity at Intake			0.49**	0.24			0.45**	0.20
Length of treatment stay			−0.16	0.03			0.02	0.00
Step 2	0.35**	0.19*			0.36**	0.24**		
Observing Δ			0.10	0.01			0.07	0.00
Describing Δ			−0.11	0.01			−0.11	0.01
Awareness Δ			−0.32*	0.07			−0.13	0.01
Acceptance Δ			−0.12	0.01			−0.41**	0.11

Note: R^2 =Adjusted multiple R^2 .

* $p < 0.05$.

** $p < 0.01$.

Furthermore, increases in acting with awareness ($\beta = -0.32$, $p < 0.05$), but no other facet of mindfulness significantly predicted PTSD severity at Step 2. Similarly, in the second HMR, intake values of depression severity but not length of treatment stay significantly predicted discharge values of depression severity ($F(2, 46) = 5.7$, $p < 0.01$). The inclusion of facets of mindfulness at Step 2 significantly accounted for additional variance in the prediction of depression severity ($\Delta R^2 = 0.24$, $p < 0.01$; $F(6, 46) = 5.3$, $p < 0.01$). Furthermore, increases in nonjudgmental acceptance ($\beta = -0.41$, $p < 0.01$), but no other facet of mindfulness significantly predicted depression severity at Step 2.

4. Discussion

The present investigation is among the first to investigate the prospective association between changes in facets of mindfulness and PTSD and depression severity over the course of an empirically supported PTSD treatment. Consistent with previous research (Owens et al., 2012), we found that facets of mindfulness generally increased during the course of treatment. However, there was substantial variability within the sample, and reliable increase or decrease in facets of mindfulness occurred in a limited proportion of the sample. The substantial variability in mindfulness change is likely the result of the fact that mindfulness was not directly targeted for change in the treatment offered. However, a meaningful test of the association between prospective change in mindfulness and PTSD treatment outcome was permitted because of the variability in change in facets of mindfulness. Consistent with hypotheses and prior work (e.g., Bernstein et al., 2011; Owens et al., 2012; Vujanovic et al., 2011), changes in facets of mindfulness were associated with reductions in post-treatment PTSD and depression severity, even after accounting for the large and significant variance explained by pre-treatment PTSD and depression severity, respectively, and length of treatment stay. Although Owens et al. (2012) found similar results, the current results are clinically and theoretically novel and significant in that a cognitive-behavioral-based treatment not designed to directly target mindfulness per se, nevertheless may have lead to changes in these facets which were related to PTSD treatment outcome.

Unique from variance explained by other facets of mindfulness, changes in acting with awareness accounted for significant

variance in PTSD symptom severity at discharge, whereas changes in nonjudgmental acceptance accounted for significant variance in depression symptom severity at discharge. These findings are consistent with Owens et al.'s (2012) finding that change in acting with awareness was associated with PTSD severity (obtained via self-report and clinician administered measures) at discharge, but inconsistent with the findings that changes in: (1) nonjudgmental acceptance significantly predicted PTSD severity, albeit obtained via a clinician-administered measure, at discharge; (2) describing significantly predicted self-reported depressive symptoms at discharge; and (3) acting with awareness significantly predicted point prevalence of major depressive disorder at discharge. We hypothesize that inconsistencies between our results and those of Owens et al. (2012) are due to the primary difference between studies, namely, that participants in our study did not receive specific training in mindfulness skills like participants in Owens et al.'s (2012) study. We hypothesize that treatment-related training in the use of specific mindfulness skills may change the functional relation between mindfulness skills and treatment outcomes. Perhaps the relative strength of these relations varies depending upon how facets of mindfulness are emphasized as skills to be used to manage symptoms associated with PTSD. Yet, the results of both of these studies together suggest that the two commonly recognized core components of mindfulness (Baer et al., 2006; Bishop et al., 2004), acting with awareness and nonjudgmental acceptance, are consistent and strong predictors of PTSD treatment outcome. Future research will benefit from testing these hypotheses that directly measure the learning and use of facets of mindfulness in treatment-related studies. Higher-resolution behavioral analytic measurement methodology, such as ecological momentary analysis over the course of a mindfulness-based intervention, may be useful in this regard.

As theorized (e.g., Brown and Ryan, 2003; Vujanovic et al., 2011), increases in mindfulness may have assisted patients in actively and adaptively approaching, rather than habitually but maladaptively avoiding, trauma-relevant stimuli. By definition, cognitive-behavioral therapy for PTSD requires active effort to purposely direct one's attention to memories and cognition and to tolerate associated unpleasant emotions and physical sensations as one develops new, more adaptive cognitive appraisals. Thus, a number of therapeutic activities beyond traditional mindfulness meditation training and practice, such as cognitive-behavioral therapy for PTSD, may facilitate the development of acting with awareness and nonjudgmental acceptance. Of course, without a control group, we cannot be certain that one or more unmeasured variables contributed to changes in mindfulness instead of or in

(footnote continued)

intake values of the corresponding PTSD symptom cluster and length of treatment stay.

addition to the treatment. Future research is needed to evaluate the broader implication of these findings, including directly testing the potential mediating role of change in mindfulness for treatment outcome.

The present study is limited in a number of respects. First, we cannot be certain that changes in mindfulness or PTSD and depression severity were directly attributable to the treatment or to an unmeasured variable. Second, the sample was small in size and limited to military veterans. Third, the intervention involved a residential rehabilitation and treatment program for PTSD and related disorders, but was not a mindfulness-based intervention specifically. Though as noted above, this aspect of the therapeutic context provided a novel and interesting perspective on change in mindfulness, and its therapeutic implications, in the context of non-mindfulness based interventions. Fourth, prospective changes in mindfulness and PTSD and depression symptoms were measured at the same pre- and post-intervention time-points, limiting inference regarding the directionality underlying the observed relations. Fifth, structured diagnostic interviews were not used to measure change in PTSD or depression, nor were multiple measures used to measure mindfulness. In regard to the latter, we cannot be certain that changes in self-reported mindfulness represent actual or perceived change. To address these limitations, future research may involve evaluation of a mindfulness-based intervention or PTSD treatment augmented by mindfulness-based training conducted among a large diverse sample. Additionally, a real-time assessment of mindfulness, in which participants use mindfulness skills in response to trauma-related stimuli, could be used to assess efficacy/ability to use mindfulness skills. Such study could be particularly useful if change in mindfulness were evaluated as a mediating mechanism(s), and the temporal order of mindfulness development and PTSD symptom reduction were tested.

Acknowledgments

Dr. Bernstein recognizes the funding support from the Israeli Council for Higher Education Yigal Alon Fellowship, the European Union FP-7 Marie Curie Fellowship International Reintegration Grant, Psychology Beyond Borders Mission Award, the Rothschild-Caesarea Foundation's Returning Scientists Project at the University of Haifa, and a NIH Clinical LRP. This work was also supported by a Veterans Affairs Clinical Science Research and Development (CSR&D) Career Development Award-2, and California HIV/AIDS Research Program IDEA Award (163836), Granted to Dr. Bonn-Miller. The expressed views do not necessarily represent those of the Department of Veterans Affairs.

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