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Cognitive Inhibition in Trauma Recovery Among Asylum Seekers: Test in a Randomized Trial of Mindfulness-Based Trauma Recovery for Refugees

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Abstract
Emerging evidence suggests that mindfulness-based interventions (MBIs) may be one promising intervention approach within the global mental-health crisis of forced displacement. Little is known about the mechanisms of action of MBIs for trauma recovery or among diverse forcibly displaced people (FDP). Within a single-site randomized waitlist-control trial among 143 traumatized East African asylum seekers living in a high-risk urban postdisplacement setting, cognitive inhibition (CI) of trauma- and threat-related information was measured (modified Sternberg task) before and after Mindfulness-Based Trauma Recovery for Refugees (MBTR-R) or a parallel waitlist-control period. At preintervention, a deficit in the CI of trauma- and threat-related but not positively valenced emotionally evocative information was associated with posttraumatic stress disorder (PTSD) severity. Although MBTR-R led to improved CI of trauma- and threat-related information, this change process did not mediate the therapeutic effect of MBTR-R on PTSD. Findings inform theory implicating CI in PTSD, MBI mechanisms of action, and FDP mental health.

Keywords
asylum seekers, cognitive inhibition, executive control, mindfulness, PTSD, refugees, working memory

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A global human-rights and mental-health crisis has emerged as a result of the forced displacement of more than 100 million people (United Nations High Commissioner for Refugees [UNHCR], 2022b), including more than 13 million Ukrainians who have been forcibly displaced in recent months (UNHCR, 2022a). Forced displacement has more than doubled in the last decade alone and, in turn, the urgency and scale of the crisis (UNHCR, 2022b). This has led to global calls for the development and study of novel mental-health interventions that are effective and safe yet also brief, cost-effective, and scalable (Collins et al., 2011; Silove et al., 2017; World Health Organization, 2013).

One promising therapeutic approach has applied mindfulness training to promote trauma recovery and buffer the stress of forced displacement (Aizik-Reebs et al., 2021; Shaw et al., 2019; Tol et al., 2020; Van der Gucht et al., 2019). Aizik-Reebs et al. (2021) recently reported randomized waitlist-control trial evidence for the feasibility, safety, and therapeutic efficacy of Mindfulness-Based Trauma Recovery for Refugees (MBTR-R) among traumatized African asylum seekers in a high-risk urban postdisplacement setting (Aizik-Reebs et al., 2021, 2022). There are also promising initial findings, among diverse refugee and asylum-seeker samples, for the feasibility, safety, and therapeutic efficacy of interventions that incorporate elements of mindfulness practices (e.g., Self-Help Plus, culturally adapted cognitive behavior therapy; Shaw et al., 2019; Tol et al., 2018, 2020). There are also promising initial randomized trial findings for the feasibility, safety, and efficacy of trauma-sensitive adaptations of mindfulness-based interventions (MBIs) among traumatized Western, educated, industrialized, rich, and democratic (WEIRD) population

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samples and contexts (Hopwood & Schutte, 2017; Wielgosz et al., 2019). Despite these encouraging findings, there is very limited empirical study of targeted malleable risk processes and mechanisms of action of these mindfulness interventions among forcibly displaced people (FDP; Aizik-Reebs et al., 2022; Baer, 2007; Coffey et al., 2010; Yuval et al., 2020). In fact, there is limited mechanistic study of mental-health interventions among FDP (DiClemente-Bosco et al., 2022; Kangaslampi et al., 2015; Siehl et al., 2021; Uphoff et al., 2020) or of trauma-sensitive MBIs for trauma recovery more broadly (Wielgosz et al., 2019).

Accordingly, we focus here on one promising malleable risk process for posttraumatic stress disorder (PTSD) development and candidate mechanism of action of MBIs for trauma recovery broadly and among FDP more specifically (Aupperle et al., 2012; DeGutis et al., 2015; Sahdra et al., 2011). *Cognitive inhibition* (CI) is the capacity to override reflexive thoughts and memories by deactivating underlying representations or processes (Anderson & Hulbert, 2021). This capacity helps to maintain complex goal-directed behavior by regulating impulses, maladaptive habits of thought and action, and mental and environmental distractors (Diamond, 2013). Accordingly, CI is conceptualized as one of three cores of executive functions along with working memory (WM) and shifting (Diamond, 2013; Miyake et al., 2000).

The rationale for our focus on CI is three-fold. First, deficits in core executive functions including CI, WM, and shifting have been implicated in the development and maintenance of posttraumatic stress symptoms in multiple populations (Aupperle et al., 2012; DeGutis et al., 2015). In particular, a deficit in CI specifically has been theorized to function as a key cognitive process underlying intrusive thoughts and memories (Amir & Bernstein, 2021; Engen & Anderson, 2018; Joormann, 2010; Koster et al., 2011)—hallmark symptoms of posttraumatic stress (Catarino et al., 2015; Moulds et al., 2020). Indeed, CI is closely related to selective attention and resistance to retro- and proactive memory interference (Diamond, 2013) and accordingly functions, in part, to regulate and "shield" the contents of WM (Miyake et al., 2000). CI thereby regulates spontaneous and goal-directed thinking (Christoff et al., 2016) through the removal of, or attentional disengagement from, unselected thoughts and memories (Joormann, 2010; Koster et al., 2011). Accordingly, the emotional- and autobiographical- relevance (e.g., negative, aversive, trauma-related) of attended information is theorized to affect CI processes (e.g., efficiency of CI) and modulate the capacity to inhibit intrusive and perseverative cognitions in PTSD and related conditions (Amir & Bernstein, 2021; Catarino et al., 2015; Joormann, 2010; Zetsche et al., 2018).

Second, CI is a promising intervention target among FDP (Hinton et al., 2016). FDP suffer at high rates from PTSD (Steel et al., 2009; Yuval et al., 2020), with prevalent symptoms that reflect deficits in control over mental content such as intrusive thoughts and memories and perseverative cognitions (Moulds et al., 2020). Indeed, perseverative cognition (or "thinking a lot"; Backe et al., 2021) has been proposed as a key maladaptive, causal, and transcultural process in refugee trauma-related suffering and recovery (Hinton et al., 2016; Ventevogel et al., 2013). Hinton et al. (2016) observed that approximately 80% of Cambodian refugees reported excessive worry about their current status (i.e., present stressors such as finances) as well as ruminated on past (e.g., separation from loved ones)—and traumatic—experiences. Interestingly, when asked, respondents described "thinking a lot" in relation to the loss of control over the foci of attention and inability to stop (inhibit) negative thoughts (i.e., in terms closely related to the processes attributed to executive functions and CI specifically; Diamond, 2013). Likewise, a systematic review of the idiom "thinking too much" found that it was typically used across different cultures to reference ruminative, intrusive, and anxious thoughts (Kaiser et al., 2015). As such, CI may be a key transcultural intervention target relevant to diverse trauma-affected FDP populations (Amir & Bernstein, 2021; Backe et al., 2021; Hinton et al., 2016; Koch et al., 2020; Waldhauser et al., 2018). Indeed, preliminary experimental evidence among a sample of traumatized refugees indicated that frequency of self-reported intrusive memories are associated with degree of deficits in the capacity to inhibit (suppress) long-term and emotionally neutral associative memories (Waldhauser et al., 2018).

Third, CI is theorized to function as a therapeutic target and mechanism of action in MBIs broadly (Jha et al., 2019; Lutz et al., 2008; Sahdra et al., 2011) and in MBIs for trauma recovery more specifically (Wielgosz et al., 2019). MBIs are theorized to train, and thereby enhance, executive control and functions (Jha et al., 2019; Yakobi et al., 2021), and specifically, inhibitory processes (Cásedas et al., 2020; Wielgosz et al., 2019; Yakobi et al., 2021). For example, in mindfulness meditation practices central to MBIs, such as MBTR-R, participants learn to maintain focused attention on an object of experience (e.g., one's breath) for sustained periods of time; to monitor their thoughts, feelings, and sensations nonjudgmentally or nonpreferentially; and to inhibit cognitive elaboration or secondary thoughts by redirecting attention to the target object. Accordingly, in mindfulness meditation practices participants learn to repeatedly detect, and disengage attention from, mind wandering and then redirect attention back

to their present-moment experience (Bishop et al., 2004; Yakobi et al., 2021). Thus, monitoring one's moment-to-moment contents of awareness (i.e., contents of WM; Posner, 1994), while concurrently also intentionally inhibiting spontaneous task-unrelated thoughts and shifting attention back to a target object (e.g., one's breath), is a central inhibitory cognitive capacity trained during mindfulness meditation (Bishop et al., 2004; Gallant, 2016; Jha et al., 2019; Tang et al., 2015; Yakobi et al., 2021). Meta-analyses have documented that, whereas MBIs consistently impact CI (Cásedas et al., 2020; Yakobi et al., 2021), their impact on other executive functions, including WM and shifting, are inconsistent across studies (Gallant, 2016; Wielgosz et al., 2019). Initial evidence has documented that improved cognitive inhibitory processes developed through mindfulness training may contribute to salutary effects of mindfulness training (Sahdra et al., 2011).

Together, theory and research implicate CI deficits in PTSD and trauma recovery (Aupperle et al., 2012; Catarino et al., 2015; DeGutis et al., 2015; Moulds et al., 2020) and implicate CI as a promising intervention target among FDP (Hinton et al., 2016). Likewise, theory and research indicate that CI of trauma-related thoughts and memories may be a central mechanism by which MBIs contribute to more adaptive functioning and trauma recovery (Cásedas et al., 2020; Gallant, 2016; Sahdra et al., 2011; Yakobi et al., 2021). However, study of the association between CI deficits and PTSD symptom severity among FDP is very limited (Waldhauser et al., 2018). Likewise, we do not yet know whether putative CI deficits in PTSD among FDP are specific to emotionally evocative and autobiographical and chronically relevant information, such as trauma- and threat-related information, or perhaps more generally observed with respect to emotionally evocative information that is not necessarily negatively valenced and linked to trauma and threat, such as positively valenced stimuli (Joormann, 2010; Pessoa, 2009; Waldhauser et al., 2018). Finally, we do not yet know whether, as theorized, mindfulness training among FDP therapeutically impacts CI or whether such effects on CI may help to, in part, account for therapeutic effects of MBTR-R on trauma recovery outcomes among FDP.

Current study and aims

In this secondary analysis of a randomized waitlist-control trial among 129 traumatized and chronically stressed East African asylum seekers (46% female), we examined whether CI of trauma- and threat-related information, relative to positively valenced information, is associated with PTSD symptom severity (Aim 1). We also examined whether expected pre- to postintervention changes in CI (Aim 2) mediate the therapeutic effects of MBTR-R, relative to waitlist control, on PTSD symptom severity outcomes (Aim 3). CI of trauma- and threat-related information, before and after MBTR-R, was measured using a modified Sternberg task measuring the inhibition of previously but no longer relevant information from WM (Gustavson & Miyake, 2016; Joormann & Gotlib, 2008; Yoon et al., 2014).

Transparency and Openness

We report how we determined our sample size, all data exclusions and manipulations (see Aizik-Reebs et al., 2021), and all measures in this study because this is a secondary analysis of a randomized waitlist-control trial. The study was registered on ClinicalTrials.gov (NCT04380259). More details on the study materials can be found in the main outcome study (Aizik-Reebs et al., 2021). Analysis code and behavioral data for this study are available on OSF (https://osf.io/skmwj/?view_only=e696843a51a7434bb3733335b28d9f7a). Additionally, only de-identified questionnaire data relevant to reported analyses (i.e., the Harvard Trauma Questionnaire, or HTQ, scales aggregate scores) are available. To protect participant identities, no other questionnaire data are available. The study received human subjects' research ethics approval by a University of Haifa Institutional Review Board committee.

Method

Study overview

This study was part of a larger single-site randomized registered (ClinicalTrials.gov NCT04380259) waitlist-control trial of MBTR-R among a community sample of Eritrean (East African) asylum seekers residing in an urban unstable postdisplacement setting in the Middle East (Israel). For details of the parent study see Aizik-Reebs et al. (2021). At preintervention, and then again at postintervention or the identical waitlist-control period, participants completed self-report assessments of mental health, including PTSD, as well as a modified Sternberg task designed to measure CI of trauma- or threat-related information, or emotionally positive valenced information (Joormann & Gotlib, 2008; Oberauer, 2005).

Participants

Participants were sampled via public flyers, community recruitment, and local NGOs and municipal organizations working with refugees. The selected population of Eritrean asylum seekers residing in Israel are representative of a large proportion of FDP (UNHCR, 2020)

because members of this community (a) have been exposed to severely traumatizing events, (b) face an unpredictable and uncertain future as a result of having no formal residential status, and (c) struggle with chronic and often severe postmigratory life stressors critical to the maintenance of stress-related mental-health problems that interfere with trauma recovery (Aizik-Reebs et al., 2021). Exclusion criteria were (a) active suicidality, (b) current psychotic symptoms, and (c) current mental-health treatment (psychiatrist, psychotherapy, psychosocial support group; Aizik-Reebs et al., 2021).

Of the 158 asylum seekers initially randomized to intervention conditions (for previously reported trial details, see Aizik-Reebs et al., 2021), 129 completed the Modified Sternberg Task measuring CI (45.4% Females, Age: Mean = 31.8; *SD* = 5.2; range = 20–48). In addition, 106 of these participants (53 intervention, 53 waitlist control) were previously classified as intervention completers by Aizik-Reebs et al. Aim 1 was thus tested among 129 participants at baseline preintervention, and Aims 2 and 3 intervention effects on CI were tested among 106 intervention completers. For additional sample information and behavioral task-response validity data, see the Supplemental Materials available online.

Randomized control trial conditions

Intervention condition. MBTR-R is a mindfulness- and compassion-based intervention that is trauma-sensitive and socioculturally adapted for diverse FDP. MBTR-R is delivered in groups (10–20 participants) over the course of nine 2.5-hr weekly sessions and home practice between the sessions. The MBTR-R format and structure parallel common MBIs (mindfulness-based stress reduction, mindfulness-based cognitive therapy; Crane et al., 2017; Santorelli et al., 2017; Segal et al., 2002). First, MBTR-R provides systematic training in mindfulness through formal meditation and informal practice, in which attention regulation, interoceptive awareness, acceptance, and curiosity are taught as skills to facilitate coping with trauma-related mental-health problems (e.g., hyperarousal, avoidance) and daily post-migration stressors. CI is trained in mindfulness practice by directing attention to a neutral or positive salient present-moment experience instead of trauma- or threat-related information when feeling overwhelmed or dissociated and by focusing on somatic sensations in the present moment and thereby disengaging from cognitive elaboration related to such information. Second, loving-kindness and self-compassion practices (Germer & Neff, 2015) are taught as ways of coping with chronic stress and posttraumatic symptoms and in particular to negative self-referential thoughts and emotions such as fear and shame. CI is trained in these practices by engaging in self-compassionate inner speech or mental imagery and thereby disengaging from negative self-referential cognition triggered by trauma- or threat-related information. Third, psychoeducation about posttraumatic stress, stress reactivity, and depression is used to normalize and destigmatize stress- and trauma-related mental-health problems and to facilitate more adaptive responses to these problems (e.g., skillful action; Dutton et al., 2013; Kelly & Garland, 2016; Segal et al., 2002). Finally, trauma-sensitive adaptations are included to improve the salutary benefits of, and to reduce the risk of adverse responding to, mindfulness meditation practices (Treleaven, 2018). MBTR-R also includes multiple sociocultural adaptations in its delivery to facilitate its acceptability and promote participant engagement (for details, see Aizik-Reebs et al., 2021).

Waitlist-control condition. The waitlist-control period ended immediately after the 9-week intervention. After a 1-week postintervention assessment, participants in this group were offered an equivalent group intervention (for details, see Aizik-Reebs et al., 2021). This intervention was offered because of ethical considerations. First, we wanted to ensure that all participants would be able to receive mental-health care. Second, because this was the first study of MBTR-R, we did not yet have evidence for the safety or efficacy outcomes of MBTR-R and were committed to provide this marginalized sample of participants in the waitlist-control group mental-health care that would not involve exposing them to any unnecessary risk (Gold et al., 2017).

Measures

Translation and back-translation. All measures were translated and back-translated and psychometrically evaluated (Sartorius & Kuyken, 1994) and validated for this study or in earlier research (Aizik-Reebs et al., 2021; Tanay & Bernstein, 2013; Yuval et al., 2016). All translated measures were pilot tested and revised in an iterative process, which included cognitive interviewing with translators and Eritrean asylum seekers to ensure linguistic as well as sociocultural meaning by our or other research groups (Badri et al., 2012; Reebs et al., 2017; Yuval et al., 2020).

Modified Sternberg task. CI was measured using the modified Sternberg task adapted from (Joormann & Gotlib, 2008). See Figure 1 for a visual illustration. Each trial consisted of three stages. First, in the learning stage, two lists of two words each were presented simultaneously on the top and bottom of the monitor. Word lists also differed in color (red/blue) and valence (positive/

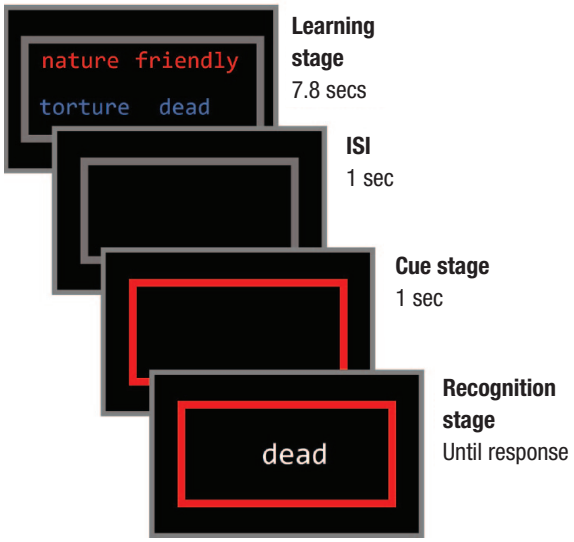

Fig. 1. Modified Sternberg task. Participants respond whether the target word (center of the final slide) came from the relevant list or not. The color of the frame cues participants to the relevant list. This figure illustrates an example of an intrusion trial wherein the target word comes from the irrelevant (uncued) list.

negative). After 7,800 ms the words were removed. Then, in the cue stage, following a 1-s interstimulus-interval, a gray frame changed color to either red or blue. The colored frame was presented for 1,000 ms and cued participants which of the two previous lists was relevant for the subsequent recognition task. Finally, in the recognition stage, a single target word was presented until a response. Participants were instructed to respond whether the target word appeared in the relevant list (yes/no on a response box) as quickly and accurately as possible. Accordingly, performance on this task is reflected in accuracy between trial conditions (see below).

The task consisted of two blocks of 32 trials each. The trial condition was determined by three within-subject factors: the *valence* (positive/trauma- and threat-related) of the relevant list; the *target type*, that is, whether the target word came from the relevant list (*relevant* condition) or irrelevant list (*intrusion* condition) or the target was a new word (i.e., did not appear in either lists; *new* condition); and the *target (word) valence* (which for new words only is conditionally independent of the target type). Thus, each block consisted of eight different trial conditions with each condition randomly occurring four times (trials). Crucially, the *intrusion* condition requires inhibition of information that is no longer relevant (i.e., the irrelevant list) and accordingly serves as the task's critical condition to which other conditions are compared. Finally, there was an additional ninth condition wherein lists were of mixed positive and negative stimuli. Analogous to a catch trial condition, it is designed to ensure that participants base their responding on list—and target word—content rather than a decision heuristic based only on valence (Yoon et al., 2014).

Task stimuli were drawn from a word bank of 130 words, 65 of which were trauma- or threat-related (e.g., brutal, torture, dead) and 65 of which were positively valenced (e.g., friendly, liberty, nature). First, the 110 most positively rated words and 110 most negatively rated and also trauma- and threat-related words were selected from the Affective Norms for English Words (Bradley & Lang, 1999). Second, an additional 15 trauma- or threat-related and positively valenced words, specific to the experiences of Eritrean asylum seekers (e.g., Sinai, Saharonim, coffee),[1] were also included (Yuval & Bernstein, 2017). As part of a community-participatory research model, these stimuli were identified through cognitive interviews with members of the asylum-seeker community (Aizik-Reebs et al., 2021). Finally, six Eritrean asylum seekers from this community rated the candidate list of words according to a 7-point Likert scale (1 = *very unpleasant* to 7 = *very pleasant*), and the 65 most pleasantly rated and the 65 most unpleasantly rated words were selected as task stimuli.

The HTQ (Mollica et al., 1992) was used to measure traumatic stress exposure as well as PTSD symptom severity. The HTQ was developed to be used and adapted across sociocultural groups and languages and thus is a well-established instrument to measure traumatic stress and PTSD symptoms in diverse FDP, including East African populations specifically (Darzi, 2017; Hollifield et al., 2002; Yuval & Bernstein, 2017; Yuval et al., 2020).

Data processing and analysis

Overall accuracy. Baseline mean accuracy rates were .757 (*SD* = .099, range = .550 to .963), and postintervention mean accuracy rates were .777 (*SD* = .102, range = .550 to .963). To ensure valid task data, exclusion criteria were (a) overall accuracy (i.e., across the task conditions) below .55 and/or (b) 0% accuracy (no correct responses) in the intrusion condition—in which the target stimulus is from the irrelevant list. These criteria are used to ensure that participants understand task instructions across conditions, and specifically, the critical (intrusion) condition (for further details, see the Supplemental Material; Oberauer, 2005).

Data-analytic approach

Aim 1. Association between CI and trauma-symptom severity. To test Aim 1, we applied a logistic mixed-model analysis using the lme4 package (Bates et al., 2015) in R (Version 4.2.1; R Core Team, 2013) to preintervention baseline data. The outcome variable was modified

Sternberg trial-level task accuracy. Predictors were centered mean HTQ scores (PTSD symptom severity), target-word valence (positive, trauma threat), and target type (relevant list, irrelevant list/intrusion, new word). The intercept for each participant was modeled as a random effect. *P* values were calculated using the R lmerTest package (Kuznetsova et al., 2017). Finally, we used the emmeans package (Russell, 2019) to test hypotheses regarding interaction effects by contrasting model coefficients. Multiple contrasts' *p* values were corrected using the Benjamini-Hochberg procedure.

This mixed-models approach is particularly well suited for modeling data collected in this design (Singmann & Kellen, 2019). First, the repeated-measurement task design (i.e., multiple trials within each condition and within each participant) violates the underlying assumption of independence of observations of standard analysis-of-variance (ANOVA) models. Second, task-accuracy data follow a binomial rather than the normal distribution assumed by standard ANOVA models.

Aim 2. Effect of MBTR-R on CI. To test Aim 2 and the effect of intervention group (MBTR-R vs. waitlist) on CI, and specifically intrusion conditions in the modified Sternberg task, we applied a logistic mixed model using the Analysis of Factorial Experiments (afex) package in R (Singmann et al., 2020) to pre- and postintervention data. The outcome variable was trial-level accuracy (correct/incorrect response). The four factorial (categorical) predictors were intervention group (MBTR-R, waitlist), session (pre- and postintervention) target-word valence (positive, trauma threat) and target type (relevant list, irrelevant list/intrusion, new word). Intercepts by session for each participant were modeled as random effects.

Aim 3. Mediating effects of CI for the effect of MBTR-R on PTSD outcome. To test Aim 3, whether individual changes (pre- to postintervention) in CI mediated the effects of MBTR-R intervention group on PTSD symptom severity, we applied an accelerated, bootstrapped, cross-product test of mediation using the "mediation" package in R (Tingley et al., 2014) to pre- and postintervention data. The outcome variable was PTSD symptom severity (HTQ total score) at postintervention. The predictor was intervention group (MBTR-R vs. waitlist), and the mediator was postintervention CI of trauma- or threat-related information, or mean accuracy score on the critical (trauma threat) intrusion condition. PTSD symptom severity and trauma-threat intrusion condition mean accuracy scores at preintervention were entered as covariates (Hayes, 2013). For summary tables of regression models, see Table 3 in the Supplemental Material.

Results

Aim 1. Association between cognitive inhibition and trauma-symptom severity in asylum seekers

As predicted, significant effects were observed for the HTQ score, $\beta = -.333$, $SE = .096$, 95% confidence interval (95% CI) = [−.590, −.077], $p = .011$, and intrusion (i.e., relative to model reference relevant) trial type, $\beta = -.615$, $SE = .107$, 95% CI = [−.825, −.405], $p < .001$, on accuracy. These effects were qualified by a three-way significant interaction of HTQ score, intrusion trial type, and trauma-threat condition, $\beta = -.495$, $SE = .206$, 95% CI = [−.899, .092, $p = .016$ (see Fig. 2). As illustrated in Figure 2, the negative association between HTQ score and accuracy likelihood was most pronounced on intrusion trials wherein CI is required and particularly pronounced for CI on trials with trauma-threat target words relative to trials with positively valenced target words.

Accordingly, we ran follow-up contrasts within the trauma-threat condition and found significant differences in coefficients between the intrusion condition and other conditions that do not require CI: intrusion versus new—estimate = −.319, $SE = .119$, 95% CI = [−.033, −.605], $p = .015$; and intrusion versus relevant—estimate = −.034, $SE = .146$, 95% CI = [−.180, −.876], $p < .001$. Contrasts within the positively valenced condition showed no significant differences: intrusion versus new—estimate = −.159, $SE = .117$, 95% CI = [−.122, .439], $p = .529$; and intrusion versus relevant—estimate = −.034, $SE = .146$, 95% CI = [−.312, .383], $p = .816$.

In summary, first, as expected, there was an effect of reduced accuracy probability in trials requiring CI (i.e., intrusion condition). Second, there was also a between-subjects effect of accuracy reduction as a function of elevated PTSD symptom severity. Finally, these within- and between-subject effects interacted. Participants who reported greater PTSD symptom severity demonstrated poorer performance in trials requiring CI, specifically CI of trauma- and threat-related information, but not for positively valenced information. For a summary of the logistic mixed-model analysis, see Table 2 in the Supplemental Materials.

Aim 2. Effect of MBTR-R on CI

For an ANOVA summary table of the mixed model (Singmann et al., 2020), see Table 1. As predicted, we found a significant interaction between group, session, trial type, and target-word valence, $X^2_{(2)} = 11.178$, $p = .004$. To unpack this interaction, for each group separately, we ran contrasts between sessions by trial type and target-word valence combination (see Table 2; Russell,

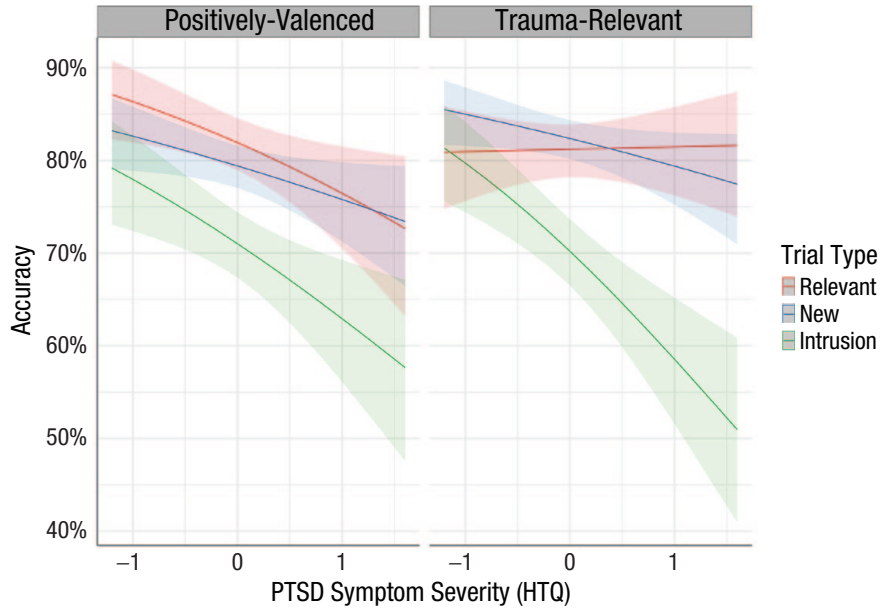

Fig. 2. Predicted probabilities of accurate response by Harvard Trauma Questionnaire (HTQ) score (centered) by target valence by target type. The figure shows the three-way interaction wherein negative effects of greater HTQ score on accuracy are strongest on intrusion trials and particularly pronounced on trials with trauma- or threat-related target words (relative to trials with positively valenced target words).

2019). As predicted, we found a significant elevation in accuracy among the MBTR-R group from pre- to postintervention in the intrusion and trauma-threat condition: Session 1—M = .665, SE = .032, 95% CI = [.600, .724]; and Session 2—M = .799, SE = .028, 95% CI = [.739, .848] (OR = .499, SE = .093, p = .002) and not in the relevant or new-word conditions. However, we also observed a nonsignificant trend in the same condition among the waitlist-control group: Session 1—M = .672, SE = .32, 95% CI = [.607, .731]; and Session 2—M = .764, SE = .032, 95% CI = [.695, .821] (OR = .633, SE = .123, p = .055). For visual comparisons of the critical trauma-threat intrusion condition between intervention groups and sessions, see Figure 3.

We also observed an unexpected reduction in accuracy from baseline to postintervention in the control group in the new and positively valenced condition—Session 1: M = .795, SE = .020, 95% CI = [.754, .831]; and

Table 1. Mixed-Model ANOVA Summary

	X^2	df	p
Group	1.362	26	.243
Session	2.160	26	.142
Trial type	100.423	25	< .001
Valence	2.320	26	.128
Group : session	1.400	26	.237
Group : trial type	1.400	25	.500
Session : trial type	41.080	25	< .001
Group : valence	0.110	26	.740
Session : valence	3.294	26	.070
Trial type : valence	2.332	25	.312
Group : session : trial type	1.032	25	.600
Group : session : valence	1.238	26	.266
Group : trial type : valence	1.132	25	.568
Session : trial type : valence	2.834	25	.304
Group : session : trial type : valence	11.178	25	.004

Note: Full-model df = 27. ANOVA = analysis of variance.

Table 2. Pre- to Postintervention Contrasts

Trial type	Probe valence	Group	*OR*	*SE*	*z* Ratio	*p*
Relevant	Positive	Controls	0.793	0.170	−1.082	.372
New	Positive	Controls	1.678	0.242	3.588	.002
Intrusion	Positive	Controls	0.773	0.148	−1.343	.307
Relevant	Negative	Controls	1.070	0.225	0.321	.830
New	Negative	Controls	1.247	0.184	1.498	.307
Intrusion	Negative	Controls	0.633	0.123	−2.361	.055
Relevant	Positive	MBT-R	1.046	0.221	0.212	.832
New	Positive	MBT-R	0.958	0.134	−0.304	.830
Intrusion	Positive	MBT-R	0.811	0.149	−1.140	.372
Relevant	Negative	MBT-R	0.587	0.126	−2.479	.053
New	Negative	MBT-R	1.217	0.174	1.378	.307
Intrusion	Negative	MBT-R	0.499	0.093	−3.727	.002

Note: *P*-value adjustment: Benjamini-Hochberg method for 12 tests. Tests were performed on the log odds ratio scale. MBT-R = Mindfulness-Based Trauma Recovery for Refugees.

Session 2—M = .698, SE = .031, 95% CI = [.634, .755] (OR = 1.678, SE = .242, p = .002), with no similar change in the MBTR-R group: Session 1—M = .787, SE = .020, 95% CI = [.745, .824]; and Session 2—M = .794, SE = .024, 95% CI = [.744, .837] (OR = .959, SE = .134 p = .831). All other contrasts were nonsignificant (see Table 2). In summary, we found that only the MBTR-R group demonstrated a specific, and statistically significant, improvement in the CI of trauma- and threat-related words.

Aim 3. Mediating effects of CI for the effect of MBTR-R on PTSD outcome

As previously reported (Aizik-Reebs et al., 2021), we found significant total and direct effects of the intervention on PTSD (see Table 3), such that MBTR-R was associated with a significant reduction in PTSD symptom severity relative to the waitlist control. Contrary to what had been predicted, the effect of MBTR on the change in the CI of trauma- and threat-related information did not mediate the observed effect of MBTR-R on trauma recovery. This suggests that, although MBTR-R seems to have affected the CI of trauma- and threat-related information (see Aim 2 findings), these changes did not account for the salutary effects of MBTR-R on PTSD symptom severity. For details of regression models comprising the mediation model, see Table 3 in the Supplemental Material. To test the robustness of this null mediation effect, we tested and found the same pattern of results in (a) an

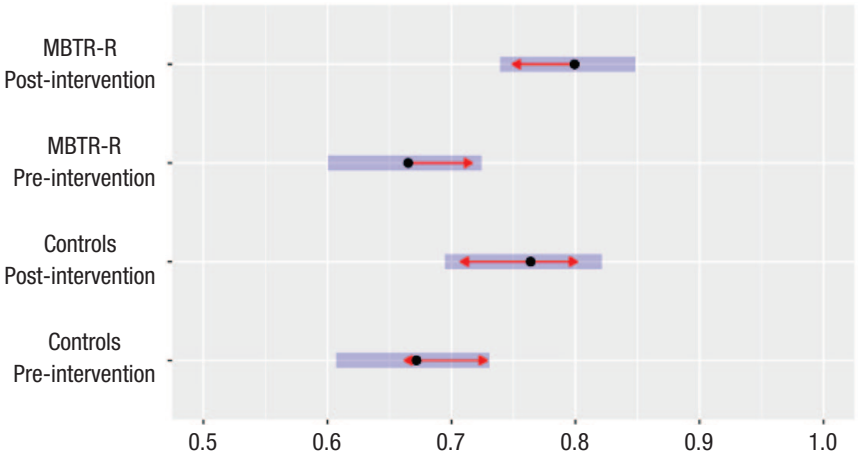

Fig. 3. Estimated marginal mean of accuracy in the trauma-threat and intrusion condition by group and session. The blue bars represent the confidence intervals, and arrows represent the numeric range used for statistical comparison. If arrows between conditions overlap the difference is not statistically significant (for details, see Russell, 2019). Accordingly, in terms of pre- and postcomparisons, only the differences within the MBTR-R group are statistically significant. Controls = waitlist controls.

Table 3. Mediation Analysis Summary

	Estimate	95% CI (lower)	95% CI (upper)	*p*
Mediation effect	0.002	−0.041	0.020	.967
Direct effect	−0.210	−0.402	−0.030	.024*
Total effect	−0.208	−0.404	−0.030	.026*

*$p < .05$.

additional post hoc model in which the outcome and mediator were pre- to postintervention change scores and (b) three additional post hoc models in which outcomes were PTSD arousal, avoidance, and reexperiencing HTQ subscale scores).

Discussion

We studied the role of CI in PTSD and trauma recovery in a single-site randomized waitlist-control trial of a trauma-sensitive mindfulness- and compassion-based intervention (MBTR-R; Aizik-Reebs et al., 2021) among traumatized African asylum seekers in an unstable urban postdisplacement setting in the Middle East. First, as theorized, we found that greater impairment in CI of trauma- and threat-related information co-occurred with greater the PTSD symptom severity, and inversely, the greater the capacity for this form of CI, the lower the severity of PTSD symptoms. This effect was specific to trauma- and threat-related information, such that a similar effect was not observed for CI for emotionally evocative positively valenced information. Second, as theorized, relative to waitlist controls, MBTR-R led to a significant improvement in the CI of trauma- and threat-related information. After mindfulness-based training, asylum seekers were better able to inhibit trauma- and threat-related information when it was no longer relevant and interfered with task performance. Third, inconsistent with prediction, the observed effect of MBTR-R on improved CI of trauma- and threat-related information did not mediate the observed therapeutic effect of the intervention on PTSD symptom severity outcomes postintervention. To the best of our knowledge, despite extensive theory, this is the first test of change in CI as a mediator of the salutary effect of a MBI on PTSD (Cásedas et al., 2020; Sahdra et al., 2011; Tang et al., 2015; Wielgosz et al., 2019; Yakobi et al., 2021). Mediation effects remained null when testing these effects with respect to specific facets of PTSD symptoms (e.g., arousal, intrusion). Thus, the null mediation effect was observed despite the observed significant effect of MBTR-R on improved CI of trauma- and threat-related information (Aim 2), the strong association between CI and PTSD (Aim 1), and the therapeutic effect of MBTR-R on improved PTSD postintervention in these data (Aizik-Reebs et al., 2021).

The current findings support extant theory and findings implicating executive dysfunctions, and specifically deficits in CI (DeGutis et al., 2015; van der Bij et al., 2020), in posttraumatic stress (Aupperle et al., 2012) and extend these findings to trauma-affected FDP. Furthermore, current findings are consistent with previous reports implicating memory control deficits in PTSD among FDP (Waldhauser et al., 2018). Crucially, the current findings also document that CI deficits may be specific to the inhibition of trauma- and threat-related information and not emotionally evocative information more broadly that is not necessarily negatively valenced and linked to trauma and threat, such as positively valenced information. Furthermore, similar trauma- and threat-specific inhibitory deficits have also been previously observed in long-term memory control functions in traumatized WEIRD samples (Catarino et al., 2015). In addition, these findings indicate that the risk for PTSD associated with CI observed in WEIRD samples may also generalize to diverse populations such as this sample of East African refugees and asylum seekers (Henrich et al., 2010; Reebs et al., 2017; Yuval et al., 2020). Similar sociocultural universality has been observed with respect to other related risk factors such as avoidance, behavioral reactivity, cognitive appraisal, self-referentiality (in the form of self-criticism and low self-compassion), negative emotions such as shame, and dysregulation of attention to trauma- and threat-related cues and memories (Aizik-Reebs et al., 2022; Nickerson et al., 2017; Oren-Schwartz et al., 2022; Reebs et al., 2017; Yuval & Bernstein, 2017; Yuval et al., 2016).

The observed effect of mindfulness- and compassion-based training tailored to FDP (MBTR-R) on CI for trauma- and threat-related information was consistent with recent meta-analytic findings (Cásedas et al., 2020; Yakobi et al., 2021). In primarily WEIRD populations, meta-analyses have documented that mindfulness training impacts executive functions broadly and, most consistently, CI specifically (Cásedas et al., 2020; Millett et al., 2021; Yakobi et al., 2021). Current findings are noteworthy in that they indicate that cognitive capacities impacted by mindfulness training, such as CI, may also generalize to diverse populations such as this sample of East African refugees and asylum seekers (Henrich et al., 2010; Reebs et al., 2017; Yuval et al., 2020). These finding may speak to the transcultural generalizability of this MBI approach by targeting processes that may, at least in part, transcend sociocultural differences (Aizik-Reebs et al., 2021; Kabat-Zinn, 2019).

Furthermore, as theorized, the observed effect of MBTR-R on CI was specific to improved inhibition of threat- and trauma-related information. We hypothesize that this reflects some combination of the specific form of executive functions and the CI most impaired in PTSD among FDP on the one hand along with the

central inhibitory functions trained in mindfulness meditation practices on the other. First, FDP with PTSD experience elevated levels of intrusive thoughts and memories (Hinton et al., 2016; Yuval et al., 2020) that theory and our findings link to deficits in the CI of trauma- and threat-related information (Aupperle et al., 2012; Engen & Anderson, 2018). Moreover, frequent intrusive thoughts/memories during mindfulness meditation practice not only pose a challenge to the mediation practice(s), and a participant's capacity to benefit from the practice(s), but paradoxically also the repeated opportunity to learn to detect and implement the mindfulness skills in response to these experiences requiring selective CI (Treleaven, 2018; Wielgosz et al., 2019). Second, in these WM task data among traumatized FDP, performance was most impaired on intrusion trials entailing trauma- and threat-related trials. Consequently, and as argued by Yakobi et al. (2021), the observed effects of mindfulness training on CI in the current study were most likely observed in task performance characterized by the greatest degree of impairment preintervention (i.e., both intrusion and trauma-threat condition; see also Diamond, 2013). Finally, it is important to note that we also observed a nonsignificant trend of improved CI of trauma- and threat-related information among the waitlist-control group, although this change was nonspecific among controls. Indeed, unlike for the MBTR-R condition, among waitlist controls we also observed worsening of CI of new and positive information. Definitive conclusions about the effects of MBTR-R on CI, and trauma-sensitive mindfulness-based interventions on CI more broadly (Wielgosz et al., 2019), await replication and future study.

Finally, we speculate regarding three post hoc hypotheses that may help account for the observed null mediation effects and may merit further study. First, it may be that mindfulness-training effects on trauma recovery are mediated by improved CI of trauma- and threat-related information but that such effects may more likely be observed for more specific and proximal outcomes that are functionally related to CI, such as frequency of intrusive thoughts (Streb et al., 2016; Waldhauser et al., 2018). A similar direct effect was observed for difficulty disengaging internal attention from (simulated) negative thoughts in cognitive vulnerability, but not for more distal mental-health symptom outcomes that were nevertheless associated with the cognitive vulnerability subserved by internal attentional dyscontrol (Amir et al., 2021). Second, strengthening CI may indeed contribute to trauma recovery, but such effects may depend on more complex interactions with other cognitive and affective processes, such as WM and selective attention and emotion regulation (Joormann, 2010). Such effects may not be detected by our measurement and thereby mediation model that examined CI as a sole mediator (Hayes, 2013). Finally, deficits in CI may be a risk *marker* for PTSD but not a malleable causal risk factor in its etiology or maintenance (Kraemer et al., 1997; Zvolensky et al., 2006). This could be because CI deficits are symptomatic of PTSD or because CI deficits may contribute to maladaptive trauma processing that may contribute to PTSD risk but may not be functionally causally linked to PTSD maintenance or remission following its onset (Holmes & Bourne, 2008).

The current study has a number of limitations that may be addressed in future research. First, findings may be limited to a sample of East African asylum seekers who have sought sanctuary in an unstable urban setting in the Middle East and may not generalize to other FDP or contexts (but see Hinton et al., 2016). Although the displacement experience and sociocultural background of this sample closely mirror those of a large proportion of asylum seekers worldwide (Silove et al., 2017; UNHCR, 2022b), and unstable urban postdisplacement settings are increasingly common (Guterres & Spiegel, 2012), future studies should nevertheless examine the generalizability of the current findings to other FDP and contexts. Second, because of ethical and methodological constraints (Aizik-Reebs et al., 2021), findings are based on comparisons to a waitlist condition. It is important that future studies compare the effect of MBTR-R on CI relative to an active control condition, particularly an intervention that does not explicitly target executive functions (Davidson & Kaszniak, 2015). Third, we did not include measures of broader executive functions. Thus, although findings suggest that CI of trauma- and threat-related information is associated with posttraumatic stress, we cannot rule out that that other executive functions (shifting, WM capacity, sustained attention) may also be related to PTSD among FDP (DeGutis et al., 2015; Esterman et al., 2019) or impacted by mindfulness-based training (Esterman et al., 2019; Jha et al., 2019). Fourth, because of methodological constraints in this type of complex postdisplacement setting, we measured CI once preintervention and once postintervention. Future studies could test whether, or to what degree, gains in CI after MBTR-R or related intervention are prospectively stable postintervention, as well as test the extent to which they depend on continued practice of mindfulness and compassion after the intervention. Finally, these and related findings should be evaluated in light of the capacity of cognitive-experimental tasks (e.g., modified Sternberg task) to measure changes in individual differences in a cognitive function such as CI (Hedge et al., 2018). Although we observed moderate test–retest reliability (see details in the Supplemental Material), limited reliability

may be compounded when measuring individual differences at two time points and individual differences in changes across time points. Such compounding effects may drastically increase the noise-to-signal ratio and limit the sensitivity of mediation models (Gonzalez & MacKinnon, 2021). This is a limitation, albeit the best we have currently, of the field's reliance on such behavioral and cognitive-experimental tasks to make inferences about complex cognitive processes such as CI (Hedge et al., 2018).

In summary, we found that CI for trauma- and threat-related information was implicated in the risk for PTSD symptom severity among traumatized asylum seekers. Likewise, we found that although a trauma-sensitive and socioculturally adapted mindfulness- and compassion-based intervention program for FDP therapeutically impacted CI, this effect did not mediate or statistically account for the therapeutic effect of the intervention on trauma recovery. We hope findings advance understanding of risk processes and intervention science for FDP mental health.

Transparency

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Author Contributions

Amir contributed to the conceptualization, analysis and writing of the manuscript. A. Aizik-Reebs and K. Yuval contributed to the conceptualization, data collection and writing of the manuscript. Y. Hadash contributed to the conceptualization and writing of the manuscript. A. Bernstein contributed to the conceptualization, analysis, writing and funding acquisition of this research project. All of the authors approved the final manuscript for submission.

Declaration of Conflicting Interests

The author(s) declared that there were no conflicts of interest with respect to the authorship or the publication of this article.

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Supplemental Material

Additional supporting information can be found at http://journals.sagepub.com/doi/suppl/10.1177/21677026231164958

Note

1. Sinai refers to the desert peninsula through which this population of asylum seekers migrated on their way to Israel and in which they frequently experience traumatic events such as trafficking, imprisonment, and torture. Saharonim is a detention facility where the majority of asylum seekers from this population were detailed after their arrival following their forced migration through the Sinai peninsula. Likewise, serving coffee to guests is a common ceremony and social activity in Eritrean and more broadly East African culture.

References

Aizik-Reebs, A., Amir, I., Yuval, K., Hadash, Y., & Bernstein, A. (2022). Candidate mechanisms of action of mindfulness-based trauma recovery for refugees (MBTR-R): Self-compassion and self-criticism. *Journal of Consulting and Clinical Psychology*, *90*(2), 107–122. https://doi.org/10.1037/ccp0000716

Aizik-Reebs, A., Yuval, K., Hadash, Y., Gebreyohans Gebremariam, S., & Bernstein, A. (2021). Mindfulness-Based Trauma Recovery for Refugees (MBTR-R): Randomized waitlist-control evidence of efficacy and safety. *Clinical Psychological Science*, *9*(6), 1164–1184. https://doi.org/10.1177/2167702621998641

Amir, I., & Bernstein, A. (2022). Dynamics of internal attention and internally-directed cognition: The attention-to-thoughts (A2T) model. *Psychological Inquiry*, *33*(4), 239–260, https://doi.org/10.1080/1047840X.2022.2141000

Amir, I., Ruimi, L., & Bernstein, A. (2021). Simulating thoughts to measure and study internal attention in mental health. *Scientific Reports*, *11*(1), Article 2251. https://doi.org/10.1038/s41598-021-81756-w

Anderson, M. C., & Hulbert, J. C. (2021). Active forgetting: Adaptation of memory by prefrontal control. *Annual Review of Psychology*, *72*(1), 1–36. https://doi.org/10.1146/annurev-psych-072720-094140

Aupperle, R. L., Melrose, A. J., & Paulus, M. P. (2012). Executive function and PTSD: Disengaging from trauma.

Neuropharmacology, *62*(2), 686–694. https://doi.org/10.1016/J.NEUROPHARM.2011.02.008

Backe, E. L., Bosire, E. N., Kim, A. W., & Mendenhall, E. (2021). "Thinking too much": A systematic review of the idiom of distress in Sub-Saharan Africa. *Culture, Medicine, and Psychiatry*, *45*, 655–682. https://doi.org/10.1007/s11013-020-09697-z

Badri, A., Crutzen, R., & Van den Borne, H. W. (2012). Exposures to war-related traumatic events and post-traumatic stress disorder symptoms among displaced Darfuri female university students: An exploratory study. *BMC Public Health*, *12*(1), Article 603. https://doi.org/10.1186/1471-2458-12-603

Baer, R. (2007). Mindfulness, assessment, and transdiagnostic processes. *Psychological Inquiry*, *18*(4), 238–242. https://doi.org/10.1080/10478400701598306

Bates, D., Mächler, M., Bolker, B., & Walker, S. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software*, *1*(1), 1–48. https://www.jstatsoft.org/v067/i01

Bishop, S. R., Lau, M., Shapiro, S., Carlson, L., Anderson, N. D., Carmody, J., Segal, Z. V., Abbey, S., Speca, M., Velting, D., & Devins, G. (2004). Mindfulness: A proposed operational definition. *Clinical Psychology: Science and Practice*, *11*(3), 230–241. https://doi.org/10.1093/clipsy.bph077

Bradley, M. M., & Lang, P. J. (1999). *Affective Norms for English Words (ANEW): Instruction manual and affective ratings*. Center for Research in Psychophysiology, University of Florida.

Cásedas, L., Pirruccio, V., Vadillo, M. A., & Lupiáñez, J. (2020). Does mindfulness meditation training enhance executive control? A systematic review and meta-analysis of randomized controlled trials in adults. *Mindfulness*, *11*(2), 411–424. https://doi.org/10.1007/s12671-019-01279-4

Catarino, A., Küpper, C. S., Werner-Seidler, A., Dalgleish, T., & Anderson, M. C. (2015). Failing to forget: Inhibitory-control deficits compromise memory suppression in post-traumatic stress disorder. *Psychological Science*, *26*(5), 604–616. https://doi.org/10.1177/0956797615569889

Christoff, K., Irving, Z. C., Fox, K. C. R. R., Spreng, R. N., & Andrews-Hanna, J. R. (2016). Mind-wandering as spontaneous thought: A dynamic framework. *Nature Reviews Neuroscience*, *17*(11), Article 718. https://doi.org/10.1038/nrn.2016.113

Coffey, K. A., Hartman, M., & Fredrickson, B. L. (2010). Deconstructing mindfulness and constructing mental health: Understanding mindfulness and its mechanisms of action. *Mindfulness*, *1*(4), 235–253. https://doi.org/10.1007/s12671-010-0033-2

Collins, P. Y., Patel, V., Joestl, S. S., March, D., Insel, T. R., Daar, A. S., Bordin, I. A., Costello, E. J., Durkin, M., Fairburn, C., Glass, R. I., Hall, W., Huang, Y., Hyman, S. E., Jamison, K., Kaaya, S., Kapur, S., Kleinman, A., Ogunniyi, A., . . . Walport, M. (2011). Grand challenges in global mental health. *Nature*, *475*(7354), 27–30. https://doi.org/10.1038/475027a

Crane, R. S., Brewer, J., Feldman, C., Kabat-Zinn, J., Santorelli, S., Williams, J. M. G., & Kuyken, W. (2017). What defines mindfulness-based programs? The warp and the weft. *Psychological Medicine*, *47*(6), 990–999. https://doi.org/10.1017/S0033291716003317

Darzi, C. (2017). *The Harvard Trauma Questionnaire: Reliability and validity generalization studies of the symptom scale* [Doctoral thesis, University of Ottawa].

Davidson, R. J., & Kaszniak, A. W. (2015). Conceptual and methodological issues in research on mindfulness and meditation. *American Psychologist*, *70*(7), 581–592. https://doi.org/10.1037/a0039512

DeGutis, J., Esterman, M., McCulloch, B., Rosenblatt, A., Milberg, W., & McGlinchey, R. (2015). Posttraumatic psychological symptoms are associated with reduced inhibitory control, not general executive dysfunction. *Journal of the International Neuropsychological Society*, *21*(5), 342–352. https://doi.org/10.1017/S1355617715000235

Diamond, A. (2013). Executive functions. *Annual Review of Psychology*, *64*(1), 135–168. https://doi.org/10.1146/annurev-psych-113011-143750

DiClemente-Bosco, K., Elizabeth Neville, S., Berent, J. M., Farrar, J., Mishra, T., Abdi, A., Beardslee, W. R., Creswell, J. W., & Betancourt, T. S. (2022). Understanding mechanisms of change in a family-based preventive mental health intervention for refugees by refugees in New England. *Transcultural Psychiatry*. Advance online publication. https://doi.org/10.1177/13634615221111627

Dutton, M. A., Bermudez, D., Matás, A., Majid, H., & Myers, N. L. (2013). Mindfulness-based stress reduction for low-income, predominantly African American women with PTSD and a history of intimate partner violence. *Cognitive and Behavioral Practice*, *20*(1), 23–32. https://doi.org/10.1016/j.cbpra.2011.08.003

Engen, H. G., & Anderson, M. C. (2018). Memory control: A fundamental mechanism of emotion regulation. *Trends in Cognitive Sciences*, *22*(11), 982–995. https://doi.org/10.1016/j.tics.2018.07.015

Esterman, M., Fortenbaugh, F. C., Pierce, M. E., Fonda, J. R., DeGutis, J., Milberg, W., & McGlinchey, R. (2019). Trauma-related psychiatric and behavioral conditions are uniquely associated with sustained attention dysfunction. *Neuropsychology*, *33*(5), 711–724. https://doi.org/10.1037/neu0000525

Gallant, S. N. (2016). Mindfulness meditation practice and executive functioning: Breaking down the benefit. *Consciousness and Cognition*, *40*, 116–130. https://doi.org/10.1016/j.concog.2016.01.005

Germer, C. K., & Neff, K. D. (2015). Cultivating self-compassion in trauma survivors. In V. M. Follette, J. Briere, D. Rozelle, J. W. Hopper, & D. I. Rome (Eds.), *Mindfulness-oriented interventions for trauma: Integrating contemplative practices* (pp. 43–58). Guilford Press.

Gold, S. M., Enck, P., Hasselmann, H., Friede, T., Hegerl, U., Mohr, D. C., & Otte, C. (2017). Control conditions for randomised trials of behavioural interventions in psychiatry: A decision framework. *The Lancet Psychiatry*, *4*(9), 725–732. https://doi.org/10.1016/S2215-0366(17)30153-0

Gonzalez, O., & MacKinnon, D. P. (2021). The measurement of the mediator and its influence on statistical mediation

conclusions. *Psychological Methods*, *26*(1), 1–17. https://doi.org/10.1037/met0000263

Gustavson, D. E., & Miyake, A. (2016). Trait worry is associated with difficulties in working memory updating. *Cognition and Emotion*, *30*(7), 1289–1303. https://doi.org/10.1080/02699931.2015.1060194

Guterres, A., & Spiegel, P. (2012). The state of the world's refugees: Adapting health responses to urban environments. *JAMA*, *308*(7), 673–674. https://doi.org/10.1001/2012.jama.10161

Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. Guilford Press.

Hedge, C., Powell, G., & Sumner, P. (2018). The reliability paradox: Why robust cognitive tasks do not produce reliable individual differences. *Behavior Research Methods*, *50*(3), 1166–1186. https://doi.org/10.3758/s13428-017-0935-1

Henrich, J., Heine, S. J., & Norenzayan, A. (2010). The weirdest people in the world? *Behavioral and Brain Sciences*, *33*(2–3), 61–83. https://doi.org/10.1017/S0140525X0999152X

Hinton, D. E., Barlow, D. H., Reis, R., & de Jong, J. (2016). A transcultural model of the centrality of "thinking a lot" in psychopathologies across the globe and the process of localization: A Cambodian refugee example. *Culture, Medicine, and Psychiatry*, *40*(4), 570–619. https://doi.org/10.1007/s11013-016-9489-4

Hollifield, M., Warner, T. D., Lian, N., Krakow, B., Jenkins, J. H., Kesler, J., Stevenson, J., & Westermeyer, J. (2002). Measuring trauma and health status in refugees: A critical review. *JAMA*, *288*(5), 611–621. https://doi.org/10.1001/jama.288.5.611

Holmes, E. A., & Bourne, C. (2008). Inducing and modulating intrusive emotional memories: A review of the trauma film paradigm. *Acta Psychologica*, *127*(3), 553–566. https://doi.org/10.1016/j.actpsy.2007.11.002

Hopwood, T. L., & Schutte, N. S. (2017). A meta-analytic investigation of the impact of mindfulness-based interventions on post traumatic stress. *Clinical Psychology Review*, *57*, 12–20. https://doi.org/10.1016/j.cpr.2017.08.002

Jha, A. P., Denkova, E., Zanesco, A. P., Witkin, J. E., Rooks, J., & Rogers, S. L. (2019). Does mindfulness training help working memory 'work' better? *Current Opinion in Psychology*, *28*, 273–278. https://doi.org/10.1016/j.copsyc.2019.02.012

Joormann, J. (2010). Cognitive inhibition and emotion regulation in depression. *Current Directions in Psychological Science*, *19*(3), 161–166. https://doi.org/10.1177/0963721410370293

Joormann, J., & Gotlib, I. H. (2008). Updating the contents of working memory in depression: Interference from irrelevant negative material. *Journal of Abnormal Psychology*, *117*(1), 182–192. https://doi.org/10.1037/0021-843X.117.1.182

Kabat-Zinn, J. (2019). Foreword: Seeds of a necessary global renaissance in the making: The refining of psychology's understanding of the nature of mind, self, and embodiment through the lens of mindfulness and its origins at a key inflection point for the species. *Current Opinion in Psychology*, *28*, xi–xvii. https://doi.org/10.1016/j.copsyc.2019.02.005

Kaiser, B. N., Haroz, E. E., Kohrt, B. A., Bolton, P. A., Bass, J. K., & Hinton, D. E. (2015). "Thinking too much": A systematic review of a common idiom of distress. *Social Science & Medicine*, *147*, 170–183. https://doi.org/10.1016/j.socscimed.2015.10.044

Kangaslampi, S., Garoff, F., & Peltonen, K. (2015). Narrative exposure therapy for immigrant children traumatized by war: Study protocol for a randomized controlled trial of effectiveness and mechanisms of change. *BMC Psychiatry*, *15*(1), Article 127. https://doi.org/10.1186/s12888-015-0520-z

Kelly, A., & Garland, E. L. (2016). Trauma-informed mindfulness-based stress reduction for female survivors of interpersonal violence: Results from a Stage I RCT. *Journal of Clinical Psychology*, *72*(4), 311–328. https://doi.org/10.1002/jclp.22273

Koch, T., Liedl, A., Takano, K., & Ehring, T. (2020). Daily worry in trauma-exposed Afghan refugees: Relationship with affect and sleep in a study using ecological momentary assessment. *Cognitive Therapy and Research*, *44*(3), 645–658. https://doi.org/10.1007/s10608-020-10091-7

Koster, E. H. W., De Lissnyder, E., Derakshan, N., & De Raedt, R. (2011). Understanding depressive rumination from a cognitive science perspective: The impaired disengagement hypothesis. *Clinical Psychology Review*, *31*(1), 138–145. https://doi.org/10.1016/j.cpr.2010.08.005

Kraemer, H. C., Kazdin, A. E., Offord, D. R., Kessler, R. C., Jensen, P. S., & Kupfer, D. J. (1997). Coming to terms with the terms of risk. *Archives of General Psychiatry*, *54*(4), 337–343. https://doi.org/10.1001/archpsyc.1997.01830160065009

Kuznetsova, A., Brockhoff, P. B., & Christensen, R. H. B. (2017). lmerTest package: Tests in linear mixed effects models. *Journal of Statistical Software*, *82*(13), 1–26.

Lutz, A., Slagter, H. A., Dunne, J. D., & Davidson, R. J. (2008). Attention regulation and monitoring in meditation. *Trends in Cognitive Sciences*, *12*(4), 163–169. https://doi.org/10.1016/j.tics.2008.01.005

Millett, G., D'Amico, D., Amestoy, M. E., Gryspeerdt, C., & Fiocco, A. J. (2021). Do group-based mindfulness meditation programs enhance executive functioning? A systematic review and meta-analysis of the evidence. *Consciousness and Cognition*, *95*, Article 103195. https://doi.org/10.1016/j.concog.2021.103195

Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A., & Wager, T. D. (2000). The unity and diversity of executive functions and their contributions to complex "frontal lobe" tasks: A latent variable analysis. *Cognitive Psychology*, *41*(1), 49–100. https://doi.org/10.1006/cogp.1999.0734

Mollica, R. F., Caspi-Yavin, Y., Bollini, P., Truong, T., Tor, S., & Lavelle, J. (1992). The Harvard Trauma Questionnaire: Validating a cross-cultural instrument for measuring torture, trauma, and posttraumatic stress disorder in Indochinese refugees. *Journal of Nervous and Mental Disease*, *180*(2), 111–116.

Moulds, M. L., Bisby, M. A., Wild, J., & Bryant, R. A. (2020). Rumination in posttraumatic stress disorder: A systematic review. *Clinical Psychology Review*, *82*, Article 101910. https://doi.org/10.1016/j.cpr.2020.101910

Nickerson, A., Garber, B., Liddell, B. J., Litz, B. T., Hofmann, S. G., Asnaani, A., Ahmed, O., Cheung, J., Huynh, L., Pajak, R., & Bryant, R. A. (2017). Impact of cognitive reappraisal on negative affect, heart rate, and intrusive memories in traumatized refugees. *Clinical Psychological Science*, *5*(3), 497–512. https://doi.org/10.1177/2167702617690857

Oberauer, K. (2005). Binding and inhibition in working memory: Individual and age differences in short-term recognition. *Journal of Experimental Psychology: General*, *134*(3), 368–387. https://doi.org/10.1037/0096-3445.134.3.368

Oren-Schwartz, R., Aizik-Reebs, A., Yuval, K., Hadash, Y., & Bernstein, A. (2022). Effect of mindfulness-based trauma recovery for refugees on shame and guilt in trauma recovery among African asylum-seekers. *Emotion*. Advance online publication. https://doi.org/10.1037/emo0001126

Pessoa, L. (2009). How do emotion and motivation direct executive control? *Trends in Cognitive Sciences*, *13*(4), 160–166. https://doi.org/10.1016/j.tics.2009.01.006

Posner, M. I. (1994). Attention: The mechanisms of consciousness. *Proceedings of the National Academy of Sciences, USA*, *91*(16), 7398–7403. https://doi.org/10.1073/pnas.91.16.7398

R Core Team. (2013). *R: A language and environment for statistical computing* [Computer software, Version 4.2.1]. R Foundation for Statistical Computing. http://www.R-project.org

Reebs, A., Yuval, K., & Bernstein, A. (2017). Remembering and responding to distressing autobiographical memories: Exploring risk and intervention targets for posttraumatic stress in traumatized refugees. *Clinical Psychological Science*, *5*(5), 789–797. https://doi.org/10.1177/2167702617713786

Russell, L. (2019). *emmeans: Estimated marginal means, aka least-squares means* (R package version 1.4. 3.01). https://cran.r-project.org/web/packages/emmeans/index.html

Sahdra, B. K., MacLean, K. A., Ferrer, E., Shaver, P. R., Rosenberg, E. L., Jacobs, T. L., Zanesco, A. P., King, B. G., Aichele, S. R., Bridwell, D. A., Mangun, G. R., Lavy, S., Wallace, B. A., & Saron, C. D. (2011). Enhanced response inhibition during intensive meditation training predicts improvements in self-reported adaptive socioemotional functioning. *Emotion*, *11*(2), 299–312. https://doi.org/10.1037/a0022764

Santorelli, S. F., Kabat-Zinn, J., Blacker, M., Meleo-Meyer, F., & Koerbel, L. (2017). *Mindfulness-based stress reduction (MBSR) authorized curriculum guide*. Center for Mindfulness in Medicine, Health Care, and Society (CFM), University of Massachusetts Medical School.

Sartorius, N., & Kuyken, W. (1994). Translation of health status instruments. In J. Orley & W. Kuyken (Eds.), *Quality of life assessment: International perspectives* (pp. 3–18). Springer.

Segal, Z. V., Williams, J. M. G., & Teasdale, J. D. (2002). *Mindfulness-based cognitive therapy for depression: A new approach to preventing relapse*. Guilford Press.

Shaw, S. A., Ward, K. P., Pillai, V., & Hinton, D. E. (2019). A group mental health randomized controlled trial for female refugees in Malaysia. *American Journal of Orthopsychiatry*, *89*(6), 665–674. https://doi.org/10.1037/ort0000346

Siehl, S., Robjant, K., & Crombach, A. (2021). Systematic review and meta-analyses of the long-term efficacy of narrative exposure therapy for adults, children and perpetrators. *Psychotherapy Research*, *31*(6), 695–710. https://doi.org/10.1080/10503307.2020.1847345

Silove, D., Ventevogel, P., & Rees, S. (2017). The contemporary refugee crisis: An overview of mental health challenges. *World Psychiatry*, *16*(2), 130–139. https://doi.org/10.1002/wps.20438

Singmann, H., Bolker, B., Westfall, J., Aust, F., & Ben-Shachar, M. S. (2020). *afex: Analysis of factorial experiments* (R package version 0.27-2). https://cran.r-project.org/package=afex

Singmann, H., & Kellen, D. (2019). An introduction to mixed models for experimental psychology. *New Methods in Cognitive Psychology*, *28*, 4–31.

Steel, Z., Chey, T., Silove, D., Marnane, C., Bryant, R. A., & van Ommeren, M. (2009). Association of torture and other potentially traumatic events with mental health outcomes among populations exposed to mass conflict and displacement: A systematic review and meta-analysis. *JAMA*, *302*(5), 537–549. https://doi.org/10.1001/jama.2009.1132

Streb, M., Mecklinger, A., Anderson, M. C., Lass-Hennemann, J., & Michael, T. (2016). Memory control ability modulates intrusive memories after analogue trauma. *Journal of Affective Disorders*, *192*, 134–142. https://doi.org/10.1016/j.jad.2015.12.032

Tanay, G., & Bernstein, A. (2013). State Mindfulness Scale (SMS): Development and initial validation. *Psychological Assessment*, *25*(4), 1286–1299. https://doi.org/10.1037/a0034044

Tang, Y. Y., Hölzel, B. K., & Posner, M. I. (2015). The neuroscience of mindfulness meditation. *Nature Reviews Neuroscience*, *16*(4), 213–225. https://doi.org/10.1038/nrn3916

Tingley, D., Yamamoto, T., Hirose, K., Keele, L., & Imai, K. (2014). *Mediation: R package for causal mediation analysis*. *Journal of Statistical Software*, *59*(5), 1–38. https://doi.org/10.18637/jss.v059.i05

Tol, W. A., Augustinavicius, J., Carswell, K., Brown, F. L., Adaku, A., Leku, M. R., García-Moreno, C., Ventevogel, P., White, R. G., & van Ommeren, M. (2018). Translation, adaptation, and pilot of a guided self-help intervention to reduce psychological distress in South Sudanese refugees in Uganda. *Global Mental Health*, *5*, Article e25. https://doi.org/10.1017/gmh.2018.14

Tol, W. A., Leku, M. R., Lakin, D. P., Carswell, K., Augustinavicius, J., Adaku, A., Au, T. M., Brown, F. L., Bryant, R. A., Garcia-Moreno, C., Musci, R. J., Ventevogel, P., White, R. G., & van Ommeren, M. (2020). Guided self-help to reduce psychological distress in South Sudanese female refugees in Uganda: A cluster randomised trial. *The Lancet Global Health*, *8*(2), e254–e263. https://doi.org/10.1016/S2214-109X(19)30504-2

Treleaven, D. A. (2018). *Trauma-sensitive mindfulness: Practices for safe and transformative healing*. W. W. Norton & Company.

UNHCR. (2020). *Global trends: Forced displacement in 2020*. https://www.unhcr.org/60b638e37/unhcr-global-trends-2020

UNHCR. (2022a). *Ukraine emergency*. https://www.unrefugees.org/emergencies/ukraine/#:~:text=About the Crisis in Ukraine&text=The crisis has displaced over,%2C Hungary%2C Moldova and others

UNHCR. (2022b). *UNHCR: Global displacement hits another record, capping decade-long rising trend*. https://www.unhcr.org/news/press/2022/6/62a9d2b04/unhcr-global-displacement-hits-record-capping-decade-long-rising-trend.html

Uphoff, E., Robertson, L., Cabieses, B., Villalón, F. J., Purgato, M., Churchill, R., & Barbui, C. (2020). An overview of systematic reviews on mental health promotion, prevention, and treatment of common mental disorders for refugees, asylum seekers, and internally displaced persons. *Cochrane Database of Systematic Reviews*, *9*. https://doi.org/10.1002/14651858.CD013458.pub2

van der Bij, J., Op den Kelder, R., Montagne, B., & Hagenaars, M. A. (2020). Inhibitory control in trauma-exposed youth: A systematic review. *Neuroscience and Biobehavioral Reviews*, *118*, 451–462. https://doi.org/10.1016/j.neubiorev.2020.06.001

Van der Gucht, K., Glas, J., De Haene, L., Kuppens, P., & Raes, F. (2019). A mindfulness-based intervention for unaccompanied refugee minors: A pilot study with mixed methods evaluation. *Journal of Child and Family Studies*, *28*(4), 1084–1093. https://doi.org/10.1007/s10826-019-01336-5

Ventevogel, P., Jordans, M., Reis, R., & de Jong, J. (2013). Madness or sadness? Local concepts of mental illness in four conflict-affected African communities. *Conflict and Health*, *7*(1), Article 3. https://doi.org/10.1186/1752-1505-7-3

Waldhauser, G. T., Dahl, M. J., Ruf-Leuschner, M., Müller-Bamouh, V., Schauer, M., Axmacher, N., Elbert, T., & Hanslmayr, S. (2018). The neural dynamics of deficient memory control in heavily traumatized refugees. *Scientific Reports*, *8*(1), Article 13132. https://doi.org/10.1038/s41598-018-31400-x

Wielgosz, J., Goldberg, S. B., Kral, T. R. A., Dunne, J. D., & Davidson, R. J. (2019). Mindfulness meditation and psychopathology. *Annual Review of Clinical Psychology*, *15*(1), 285–316. https://doi.org/10.1146/annurev-clinpsy-021815-093423

World Health Organization. (2013). *Mental health action plan 2013-2020*.

Yakobi, O., Smilek, D., & Danckert, J. (2021). The effects of mindfulness meditation on attention, executive control and working memory in healthy adults: A meta-analysis of randomized controlled trials. *Cognitive Therapy and Research*, *45*, 543–560. https://doi.org/10.1007/s10608-020-10177-2

Yoon, K. L., LeMoult, J., & Joormann, J. (2014). Updating emotional content in working memory: A depression-specific deficit? *Journal of Behavior Therapy and Experimental Psychiatry*, *45*(3), 368–374. https://doi.org/10.1016/j.jbtep.2014.03.004

Yuval, K., Aizik-Reebs, A., Lurie, I., Demoz, D., & Bernstein, A. (2020). A functional network perspective on posttraumatic stress in refugees: Implications for theory, classification, assessment, and intervention. *Transcultural Psychiatry*, *58*(2), 268–282. https://doi.org/10.1177/1363461520965436

Yuval, K., & Bernstein, A. (2017). Avoidance in posttraumatic stress among refugee survivors of violent conflict and atrocities: Testing trans-cultural risk processes and candidate intervention targets. *Behaviour Research and Therapy*, *99*, 157–163. https://doi.org/10.1016/j.brat.2017.10.008

Yuval, K., Zvielli, A., & Bernstein, A. (2016). Attentional bias dynamics and posttraumatic stress in survivors of violent conflict and atrocities: New directions in clinical psychological science of refugee mental health. *Clinical Psychological Science*, *5*(1), 64–73. https://doi.org/10.1177/2167702616649349

Zetsche, U., Bürkner, P. C., & Schulze, L. (2018). Shedding light on the association between repetitive negative thinking and deficits in cognitive control – A meta-analysis. *Clinical Psychology Review*, *63*, 56–65. https://doi.org/10.1016/j.cpr.2018.06.001

Zvolensky, M. J., Schmidt, N. B., Bernstein, A., & Keough, M. E. (2006). Risk-factor research and prevention programs for anxiety disorders: A translational research framework. *Behaviour Research and Therapy*, *44*(9), 1219–1239. https://doi.org/10.1016/j.brat.2006.06.001