

# Main and Interactive Effects of Mental Contamination and Tolerance of Negative Emotions in Relation to Posttraumatic Stress Symptoms Following Sexual Trauma

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**Abstract** Mental contamination, an internal sense of dirtiness that originates in the absence of physical contact with a stimulus, has been implicated in the exacerbation of posttraumatic stress (PTS) symptoms following sexual trauma. In addition, evidence suggests that associations between PTS-related risk factors and PTS symptoms may depend on the degree to which one can tolerate experiencing negative emotions. To better understand the association between mental contamination and PTS symptoms, we examined main and interactive effects of mental contamination and tolerance of negative emotions in relation to PTS symptoms, including specific symptom clusters, in a community sample of women who experienced sexual trauma ( $N=101$ ). Tolerance of negative emotions moderated the association between mental contamination and PTS symptoms (total symptom severity, intrusion cluster, and cognitive/mood alterations cluster). These results indicate that difficulties tolerating negative emotions may be a necessary condition for mental contamination to relate to PTS symptoms following sexual trauma.

**Keywords** Mental contamination · Posttraumatic stress · Posttraumatic stress disorder (PTSD) · Sexual trauma

Whereas it is not uncommon to experience a traumatic event, a relatively small number of trauma-exposed individuals develop posttraumatic stress disorder (PTSD). The lifetime prevalence of PTSD in the United States is 6.8 % (Kessler et al.

2005), with women almost twice as likely as men to meet criteria for PTSD (Tolin and Foa 2006). In a representative sample of women in the United States, Resnick et al. (1993) found a lifetime prevalence of PTSD of approximately 12.3 %. Resnick et al. found that specific categories of trauma are related to higher rates of PTSD, with approximately 32.0 % of women who were victims of rape and 30.8 % of women who were victims of sexual assault other than rape developing PTSD during their lifetime. Such findings underscore the importance of identifying risk factors for sexual trauma-related distress among women.

## Mental Contamination and PTS Symptoms Among Female Sexual Assault Survivors

Among a number of risk factors for PTSD, research suggests that mental contamination may play a role in the development and maintenance of posttraumatic stress (PTS) symptoms among women following sexual trauma. Mental contamination refers to an internal sense of dirtiness that originates in the absence of physical contact with a contaminant (Rachman 2004). Mental contamination (a) can be evoked by memories, thoughts, or images, (b) is not attenuated by cleansing behavior or other forms of avoidance, (c) is associated with a broad array of negative emotional states, and (d) is typically not alleviated by standard exposure therapy techniques (Fairbrother et al. 2005). Highlighting the potential relevance of mental contamination to sexual trauma, Rachman stated that “the victims of an assault, humiliation, accusation, may believe that they are permanently damaged/polluted by the event and that their future life is blighted” (p. 1250). In fact, the association between mental contamination and PTS symptoms may be specific to sexual trauma. Badour et al. (2013a) examined mental contamination and PTS symptoms

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among women with a history of sexual trauma ( $N=22$ ) or non-sexual trauma ( $N=19$ ). These researchers found that PTS symptoms predicted greater mental contamination following the presentation of an audio taped first-person account of participants' index traumatic event, but only among women with a history of sexual assault.

Additional studies among women with a history of sexual trauma support mental contamination as a relatively prevalent phenomenon that shares a robust association with PTS symptoms. For example, Fairbrother and Rachman (2004) found that approximately 60 % of women ( $N=50$ ) who reported experiencing an unwanted sexual experience experienced at least one of the six mental contamination criteria identified by these researchers. Fairbrother and Rachman's six criteria for mental contamination criteria indicate that feelings of dirtiness are (a) internally experienced, (b) emotional, (c) morally relevant, (d) persist even without contact with a contaminant, (e) not fully removed through washing, and (f) evoked by means other than contact with a contaminant (e.g., memories, external information, images).

Fairbrother and Rachman (2004) found that mental contamination shared a strong association with a clinician administered measure and self-report measure of PTS symptoms ( $r$ s of 0.53 and 0.59, respectively). Subsequent studies have found that the association between mental contamination and PTS symptoms among women following sexual trauma is not attributable to relevant covariates. For example, Olatunji et al. (2008) found the association between mental contamination and PTS symptoms remained significant after statistically controlling for depression among a sample of female sexual assault survivors ( $N=48$ ). Further, Badour et al. (2013b) found the association between mental contamination and PTS symptoms remained significant after statistically controlling sexual assault-related disgust among a sample ( $N=35$ ) of female sexual assault survivors.

### Measurement Considerations in Assessing Mental Contamination

Whereas the above reviewed studies assessed mental contamination using a trauma-specific measure of mental contamination in the aftermath of a traumatic event, Badour et al. (2014) hypothesized that a domain-general assessment of mental contamination (using the Vancouver Obsessional Compulsive Inventory-Mental Contamination Scale [VOCI-MC]; Radomsky et al. 2014) may increase the generality of study findings. For example, use of the VOCI-MC allows for an examination as to whether a general propensity toward mental contamination contributes to PTS symptoms following trauma exposure. Badour et al. found a strong association between the VOCI-MC and PTS symptoms ( $r=0.62$ ) among a sample

of female sexual assault survivors ( $N=72$ ). This association was unaccounted for by obsessive-compulsive symptoms, depression, contamination sensitivity, peritraumatic fear, posttraumatic cognitions, and disgust.

### Mental Contamination and PTS Symptom Clusters

The above reviewed studies suggest that mental contamination shares a robust association with PTS symptoms following sexual trauma. What remains less clear from the extant literature is whether mental contamination is particularly relevant to certain PTS symptoms. For example, Fairbrother and Rachman (2004) speculated that mental contamination may be particularly relevant to the intrusion symptoms of sexual assault-related PTS. This speculation was informed by reactions following a task in which 43 women recalled a sexual trauma memory. Fairbrother and Rachman found a significant increase in feelings of dirtiness after the recollection of a sexual trauma memory, relative to a pleasant memory, and that mental contamination correlated with feelings of dirtiness after recalling the trauma memory ( $r=0.45$ ).

Other researchers suggest that mental contamination may contribute to avoidance symptoms. For example, Badour et al. (2013b) speculated that mental contamination following sexual trauma may maintain PTS symptoms by increasing negative emotions and leading to maladaptive coping (e.g., avoidance of trauma cues). In a slightly different conceptualization, Olatunji et al. (2008) speculated that mental contamination developing in the acute aftermath of a sexual trauma may decrease the likelihood that victims can maintain positive views of the world and of their own self-worth, thus resulting in higher levels of PTS-related cognitions (i.e., negative cognitions about the self, the world, and relatively higher levels of self-blame). These cognitions may lead to avoidance of trauma-related cues, which, in turn, maintains PTS symptoms. Despite such speculations, to our knowledge, no known published study has yet examined how mental contamination relates to the four PTS symptom clusters (i.e., intrusion, negative alterations in cognitions and mood, avoidance, and hyperarousal) defined in the most recent edition of the Diagnostic and Statistical Manual of Mental Disorders (5th ed., DSM-5; American Psychiatric Association 2013).

### Moderating Impact of Tolerance of Negative Emotions

Another gap in the literature pertains to whether the impact of mental contamination on PTS symptoms following sexual trauma is affected by tolerance of negative emotions, a variable that has been found to correlate (negatively) with PTS

symptoms across a number of published studies (Fetzner et al. 2014; Marshall-Berenz et al. 2011; Vujanovic et al. 2011; 2013). Such an examination may be especially important because evidence suggests that associations between PTS-related risk factors and PTS symptoms may depend on the degree to which one can tolerate experiencing negative emotions (e.g., Marshall-Berenz et al. 2011; Vujanovic et al. 2013). Marshall-Berenz et al. (2011) speculated that a propensity for experiencing negative emotional states, in combination with the expectancy such states cannot be tolerated, may lead one to believe that their emotional distress is relatively more severe. As a result, such individuals may evidence a hypersensitivity to distress and have an increased likelihood of experiencing PTS symptoms. Although the association between mental contamination and tolerance of negative emotions has yet to be examined in the extant literature, it is possible that individuals who report relatively greater mental contamination *and* difficulties tolerating negative emotions may be especially likely to experience PTS symptoms.

Such a possibility is informed by existing conceptual models of PTSD, such as Ehlers and Clark's (2000) cognitive model. Central to Ehlers and Clark's model is the role of negative appraisals in the development and maintenance of PTSD. According to Ehlers and Clark, negative appraisals about the traumatic event and its consequences create a sense of current threat that, in turn, leads to maladaptive coping. Mental contamination is relatively common following sexual trauma (Fairbrother and Rachman 2004) and is frequently accompanied by negative emotions, such as disgust, shame, guilt, and anxiety (Fairbrother et al. 2005). Individuals who have a propensity to experience mental contamination *and* who perceive themselves as having greater difficulties tolerating negative emotions may, thus, be especially likely to experience a sense of current threat, which results in maladaptive coping in an attempt to alleviate said distress (e.g., avoidance behaviors). As a result, such individuals may be more likely to experience prolonged negative affective states and PTS symptoms because extinction of the fear response associated with traumatic memories and emotions is inhibited due to heightened perceived threat and subsequent maladaptive coping (Ehlers and Clark 2000).

## Present Study

In the present study, we sought to extend prior research in which the relation between mental contamination and PTS was examined among women following sexual trauma by providing the first known examination of associations among mental contamination, tolerance of negative emotions, and DSM-5 PTS symptom clusters. This type of examination may be important because of speculation that mental contamination is especially relevant to intrusion (Fairbrother and

Rachman 2004) and/or avoidance (Badour et al. 2013b; Olatunji et al. 2008) following sexual trauma. Following from those speculations, we predicted that mental contamination would share unique associations with re-experiencing and avoidance PTS symptoms. We statistically controlled for tolerance of negative emotions and, to be consistent with the extant literature and to provide a more stringent test of the targeted associations, we also statistically controlled for negative affect (e.g., Badour et al. 2014), years since trauma exposure, and the number of experienced traumas (e.g., Fetzner et al. 2014). Consistent with Badour et al. (2014), we assessed mental contamination using the VOCI-MC.

Whereas the above predictions focus on the main effects of mental contamination, we further predicted that the relation between mental contamination and total PTS symptoms would be strongest when there were concurrent difficulties tolerating negative emotions. Because a consistent pattern of findings pertaining to the moderating effect of tolerance of negative emotions in relation to specific PTS symptoms has not emerged across prior studies (e.g., Marshall-Berenz et al. 2011; Vujanovic et al. 2013), no a-priori predictions were made regarding the interaction between mental contamination and tolerance of negative emotions in relation to specific PTS symptom clusters.

## Method

### Participants

A total of 706 women, recruited from across the United States through an online crowdsourcing website, completed study measures. To be included in the present study women had to report that they were a victim of sexual trauma and that a sexual trauma currently bothered them the most on a self-report measure of trauma exposure (i.e., Life Events Checklist for DSM-5; Weathers et al. 2013a). As noted by Fairbrother and Rachman (2004), the operational definition of sexual trauma often differs across studies. Research suggests that the endorsement of sexual trauma is reduced when questions that contain stigmatized terminology, such as "rape," are used (e.g., Resnick et al. 1993). Following Fairbrother and Rachman, we operationalized sexual trauma broadly, including reported sexual assault (rape, attempted rape, made to perform any type of sexual act through force or threat of harm), as well as other unwanted sexual experiences. A total of 101 women met the inclusion criteria. The average age was 32.5 years ( $SD=9.4$ , range 19-65). The sample was primarily White (87.1 %) and not Hispanic or Latino (94.1 %). Approximately 6.9 % of the sample self-identified as African American, 3.0 % as Asian, and 3.0 % as "other."

## Measures

**Life Events Checklist for DSM-5 (LEC-5)** The LEC-5 (Weathers et al. 2013a) is an updated version of the original LEC, a psychometrically-sound self-report measure that assesses trauma exposure (Gray et al. 2004). Participants are provided with a list of 17 potentially traumatic events (e.g., sexual assault, motor vehicle accident, combat). For each event, respondents indicate whether the event directly happened to them, they witnessed it, they learned about it, it was part of their job, they are unsure, or the event did not apply to them. From the events reported, participants are asked to identify the one event that currently bothers them the most and reference this event when completing the follow-up measure of PTS symptoms. As noted, participants who identified a sexual trauma as the event that currently bothered them the most on the LEC-5 were included in the present study. Years since the sexual trauma was assessed using the LEC-5, as was the number (#) of experienced traumas (calculated by summing the LEC-5 events in which participants reported that the event directly happened to them, they witnessed it, they learned about it, or it was part of their job).

**PTSD Checklist-5-Civilian Version (PCL-5)** The PCL-5 (Weathers et al. 2013b) is an updated version of the PCL (Weathers et al. 1991), a psychometrically-sound self-report measure of PTS symptoms (e.g., Ruggiero et al. 2003; Weathers et al. 2001). The PCL-5 is a 20-item measure designed to assess DSM-5 PTSD Criteria B, C, D, and E. PCL-5 scores include a total score, as well as intrusion, avoidance, cognition, and arousal symptom scores. The civilian version of the PCL-5 was used in the present study. Participants were instructed to indicate the extent to which they experienced each symptom in the past month in relation to the sexual trauma identified on the LEC-5. PCL-5 responses are rated using a 5-point scale (0 to 4). Higher scores indicate greater PTS symptoms. Consistent with evidence suggesting that PTSD is not a discrete clinical syndrome, but rather a dimensional construct (e.g., Broman-Fulks et al. 2006; Forbes et al. 2005; Ruscio et al. 2002), PCL-5 items were summed to create an overall total score and symptom scores for use as continuous variables. The PCL-5 scales (total: Cronbach's  $\alpha=0.96$ , intrusion:  $\alpha=0.93$ , avoidance:  $\alpha=0.88$ , cognition:  $\alpha=0.89$ , and arousal:  $\alpha=0.86$ ) demonstrated good internal consistency in the present study.

**Vancouver Obsessional Compulsive Inventory-Mental Contamination Scale (VOCI-MC)** As discussed, the VOCI-MC (Radosky et al. 2014) provides a domain-general assessment of mental contamination (e.g., *I often feel dirty or contaminated even though I haven't touched anything dirty*). Responses are made using a 5-point scale (ranging

from 0 to 4). Higher scores indicate greater mental contamination. As described, prior research has found a strong correlation ( $r=0.62$ ) between the VOCI-MC and PTS symptoms (Badour et al. 2014). The VOCI-MC ( $\alpha=0.97$ ) demonstrated good internal consistency in the present study.

**Distress Tolerance Scale (DTS)** The DTS (Simons and Gaher 2005) is a 15-item measure that assesses one's ability to withstand distress associated with negative emotional states. Specifically, it assesses tolerance (e.g., *Feeling distressed or upset is unbearable to me*), appraisal (e.g., *I am ashamed of myself when I feel distressed or upset*), absorption (*My feelings of distress are so intense that they completely take over*), and regulation (e.g., *I'll do anything to stop feeling distressed or upset*) of negative emotions. Response options are made using a 5-point scale (ranging from 1 to 5). Higher scores on the DTS indicate greater tolerance of negative emotions. A total scale score was used in the present study because the four scales of the DTS load on a higher-order factor (Simons and Gaher 2005) and prior studies examining the DTS in relation to PTS symptoms have used a total scale score (Fetzner et al. 2014; Marshall-Berenz et al. 2011; Vujanovic et al. 2011, 2013). These prior studies have found moderate correlations ( $r$ s ranging from  $-0.28$  to  $-0.46$ ) between the DTS and PTS symptoms. The DTS ( $\alpha=0.94$ ) demonstrated good internal consistency in the present study.

**Positive and Negative Affect Schedule (PANAS)** The PANAS (Watson et al. 1988) asks respondents to indicate to what extent single-word descriptors (e.g., distressed, scared) capture how they have felt over previous 7 day period by rating each item on a 5-point scale (1 to 5). The negative affect scale of the PANAS – the PANAS scale of interest in the present study – consists of 10 items. PANAS-Negative Affect (NA) has shown strong ( $r$ s ranging from 0.51 to 0.74) correlations with other measures of negative affect (Watson et al. 1988). Higher scores indicate greater negative affect. PANAS-NA ( $\alpha=0.93$ ) demonstrated good internal consistency in the present study.

## Procedure

Participant recruitment took place using Amazon Mechanical Turk (MTurk), an online crowd sourcing website where researchers can recruit general population adults to complete questionnaires in exchange for payment. Research supports the quality of data collected via MTurk (Buhrmester et al. 2011; Paolacci and Chandler 2014; Shapiro et al. 2013) and MTurk samples tend to be more demographically diverse than American undergraduate samples (Buhrmester et al. 2011). Participation was restricted to MTurk workers with approval ratings above 95 %, a method shown to increase the likelihood that MTurk data are of high quality (Peer et al. 2014).

Participants were paid \$1.5 (USD) in exchange for their participation, an amount consistent with precedence for MTurk participant payment (Buhrmester et al. 2011).

### Data Analytic Strategy

Zero-order correlations were initially used to examine interrelations among the study variables. Next, a series of hierarchical multiple linear regressions were used to examine the main and interactive effects of mental contamination and tolerance of negative emotions in relation to PTS symptoms. The covariates (negative affect, years since trauma, # of traumas endorsed), mental contamination, and tolerance of negative emotions were simultaneously entered into Step 1 of the regression models. An interaction term was computed between scores on the VOICI-MC and DTS-Total (calculated as the product of the centered predictors, following Aiken and West 1991) and entered into Step 2 of the regression models to examine the moderating effect of tolerance of negative emotions in the association between mental contamination and PTS symptoms. Graphs and simple regression equations (simple effects) were used next to further investigate significant interaction terms (again following Aiken and West 1991). Two simple regression equations were constructed (using  $\pm 1$  SD from the mean score on the DTS-Total) for each significant interactive effect. To plot these equations, two values of the VOICI-MC ( $\pm 1$  SD from the mean) were substituted into the regression equations. Significance of the simple slopes of these regression equations were tested at both low ( $-1$  SD) and high ( $+1$  SD) DTS-Total values (again following Aiken and West 1991). The regression models only differed in terms of the respective PCL-5 scale that was the criterion variable.

## Results

### Descriptive Statistics and Zero-Order Correlations

Descriptive statistics and zero-order correlations are presented in Table 1. There are few established standards for interpreting skew and kurtosis statistics (Kline 2011), with some standards recommending that these values generally range from  $-1$  to  $1$  (Morgan et al. 2001). Skew and kurtosis statistics for VOICI-MC scores fell outside of this recommended range (*Skew*=1.9, *Kurtosis*=3.5). Significant results obtained using the non-transformed VOICI-MC scores were unchanged when using a square root transformation of VOICI-MC scores. For ease of interpretation, only the results using non-transformed scores are presented. Consistent with prior studies, the VOICI-MC shared a strong correlation with the PCL-5-Total. Among the PCL-5 subscales, the VOICI-MC clustered more strongly with the intrusion, cognition, and arousal scales relative to the

avoidance scale. The VOICI-MC and the DTS shared a moderate intercorrelation.

### Main and Interactive Effects

Results from the hierarchical multiple linear regressions are presented in Table 2. The maximum variance inflation factor (VIF) among the predictors was 1.98, well below conventional guidelines ( $> 10$ ; Cohen et al. 2003) for indicating problems with multicollinearity. VOICI-MC scores were associated with the PCL-Total score and, as predicted, the PCL-5-Intrusion score after controlling for the covariates. VOICI-MC scores were also associated with the PCL-5-Arousal score in the regression analyses. Of note, DTS-Total scores were only associated with the PCL-5-Cognition scores after controlling for the other modeled statistical predictors. In contrast to one of our hypotheses, VOICI-MC scores were not associated with the PCL-5-Avoidance scores after controlling for the covariates.

As shown in Table 2, DTS-Total scores moderated the association between scores on the VOICI-MC and the PCL-Total, as well as two PCL-5 subscales (Intrusion and Cognition). The effect sizes of the interactions were small in magnitude (Cohen's  $f^2$  ranged from 0.06 to 0.07). Simple effects are depicted in Fig. 1. Simple effects indicated that VOICI-MC scores shared an association with scores on the PCL-5 Total and two PCL-5 subscales at low (Total:  $\beta=0.62$ , Intrusion:  $\beta=0.54$ , and Cognition:  $\beta=0.58$ ; all  $\beta$ s  $p<.01$ ), but not high (Total:  $\beta=-0.01$ , Intrusion:  $\beta=-0.01$ , and Cognition:  $\beta=-0.06$ ; all  $\beta$ s *ns*), DTS-Total values.

## Discussion

As predicted, mental contamination shared a unique association with intrusion symptoms after controlling for tolerance of negative emotions, negative affect, years since trauma, and the number of traumas endorsed. Mental contamination also was found to share a unique association with arousal symptoms. As predicted, tolerance of negative emotions moderated the association between mental contamination and PTS symptoms. Exploratory analyses examining the moderating effect across PTS symptoms indicated that tolerance of negative emotions is particularly relevant for understanding the impact of mental contamination on intrusion and cognitive symptoms following sexual trauma. Contrary to predictions, mental contamination did not seem particularly relevant to avoidance.

The observed interactive effect between mental contamination and tolerance of negative emotions on PTS symptoms was expected, in part, based upon Ehlers and Clark's (2000) cognitive model of PTSD. As discussed, negative appraisals about the traumatic event and its consequences create a sense of current threat that, in turn, leads to maladaptive coping

**Table 1** Descriptive statistics and zero-order correlations

Variable	Mean	SD	1	2	3	4	5	6	7	8
1. VOICI-MC	14.64	16.81	–							
2. DTS-total	2.96	1.00	<b>–0.38</b>	–						
3. PCL-5-total	25.06	19.78	<b>0.58</b>	<b>–0.42</b>	–					
4. PCL-5-intrusion	5.54	5.29	<b>0.47</b>	<b>–0.26</b>	<b>0.88</b>	–				
5. PCL-5-avoidance	3.51	2.66	<b>0.29</b>	<b>–0.21</b>	<b>0.75</b>	<b>0.63</b>	–			
6. PCL-5-cognition	9.15	8.15	<b>0.56</b>	<b>–0.46</b>	<b>0.94</b>	<b>0.75</b>	<b>0.64</b>	–		
7. PCL-5-arousal	6.86	6.14	<b>0.60</b>	<b>–0.41</b>	<b>0.90</b>	<b>0.71</b>	<b>0.57</b>	<b>0.77</b>	–	
8. PANAS-NA	20.09	8.72	<b>0.73</b>	<b>–0.46</b>	<b>0.58</b>	<b>0.35</b>	<b>0.31</b>	<b>0.62</b>	<b>0.62</b>	–
9. Years since trauma	13.90	10.88	–0.08	–0.05	–0.05	–0.11	–0.16	0.01	0.01	0.01
10. # of traumas endorsed	9.32	3.89	–0.01	0.05	–0.01	–0.05	0.04	–0.02	0.02	–0.02

N=101. Bolded *rs* significant at  $p < .01$  (two-tailed). Cronbach’s alpha values listed on in parentheses along the diagonal

VOICI-MC Vancouver Obsessional Compulsive Inventory-Mental Contamination Scale, DTS Distress Tolerance Scale, PCL-5 PTSD Checklist-5 (Civilian Version), PANAS-NA Positive and Negative Affect Schedule-Negative Affect

within this model. According to Ehlers and Clark, negative appraisals that lead to a sense of current threat include appraisals related to the consequences of the traumatic event. For example, an individual who experiences sexual trauma may negatively appraise possible physical consequences of the traumatic event (e.g., *My body is ruined*) or cues of potential rejection from others following the traumatic event (Ehlers and Clark 2000). Such negative appraisals share consistency with the experience of mental contamination as described by Fairbrother and Rachman (2004). Specifically, washing behavior may be repeatedly used by a sexual assault survivor who experiences internal feelings of dirtiness following the traumatic event in attempt to alleviate the mental contamination and related distress. However, washing is likely to exacerbate mental contamination and related distress rather than alleviate it (Fairbrother et al. 2005). Additionally, an

individual experiencing mental contamination following sexual trauma may be more likely to believe that others can also perceive the internal sense of dirtiness, even after prolonged bathing (Fairbrother et al. 2005). Individuals who concurrently experience difficulties tolerating negative emotions may be more likely to use maladaptive coping strategies in an attempt to alleviate distress, thus inhibiting extinction of the fear response related to trauma-related reminders (e.g., external cues, memories, physical sensations).

The present results support Fairbrother and Rachman’s (2004) speculation that mental contamination is particularly relevant to intrusion symptoms following sexual trauma. Importantly, the pattern of associations from moderation analyses suggests that difficulties tolerating negative emotions are a necessary condition by which mental contamination relates to intrusion symptoms. Fetzner et al. (2014) speculated that a

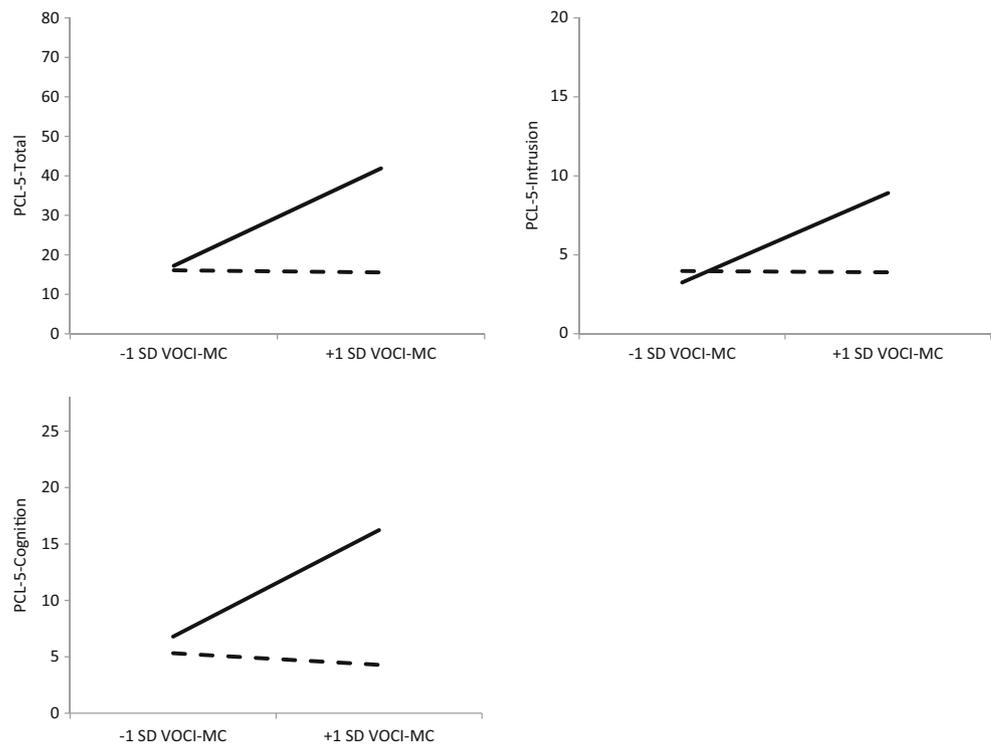
**Table 2** Regression results examining targeted main and interactive effects

	PCL-5									
	Total		Intrusion		Avoidance		Cognition		Arousal	
	$\Delta R^2$	$\beta$								
Main Effects (Step 1)	0.42**		0.23**		0.14*		0.44**		0.45**	
PANAS-NA		0.27*		–0.02		0.19		0.36**		0.33**
Years since Trauma		–0.03		–0.07		–0.16		0.01		0.03
# of Traumas Endorsed		0.01		–0.04		0.05		0.01		0.03
DTS-Total		–0.17		–0.11		–0.09		–0.21*		–0.14
VOICI-MC		0.32**		0.44**		0.10		0.22		0.31**
Interactive Effect (Step 2)	0.04*		0.04*		0.02		0.03*		0.02	
VOICI-MCxDTS-Total		–0.26*		–0.26*		–0.21		–0.24*		–0.19

N=101. \* $p < .05$ ; \*\* $p < .01$  (two-tailed)

PCL-5 PTSD Checklist-5 (Civilian Version), PANAS-NA Positive and Negative Affect Schedule-Negative Affect, DTS Distress Tolerance Scale, VOICI-MC Vancouver Obsessional Compulsive Inventory-Mental Contamination Scale

**Fig. 1** Moderating effect of tolerance of negative emotions ( $-1$  SD DTS-Total (*solid line*);  $+1$  SD DTS-Total (*dashed line*)) on the association between mental contamination (VOCI-MC) and posttraumatic stress symptoms (PCL-5)



reduced ability to tolerate negative emotions may attenuate an individual's ability to cope with intrusive imagery and memories following trauma exposure. Moreover, Fairbrother and Rachman found that mental contamination correlated with feelings of dirtiness after recalling a sexual trauma memory.

Mental contamination can be revived by memories (Fairbrother et al. 2005) and, thus, re-experiencing the traumatic event may prompt further feelings of mental contamination. However, Ehlers and Clark (2000) described a phenomenon known as “affect without recollection,” in which individuals experience emotions associated with the traumatic event without a recollection of the event. Although speculative, it is possible that mental contamination could be evoked without re-experiencing the traumatic event per se. Of note, results from the present study suggest that mental contamination may only be a risk factor for intrusion symptoms following sexual trauma for women who also have a reduced tolerance of negative emotions. Thus, greater tolerance of negative emotions may buffer women with higher levels of mental contamination from experiencing memories of the sexual trauma in a way that produces impairment or considerable distress.

Our finding that mental contamination was not uniquely associated with avoidance symptoms stands in contrast to prior speculations that mental contamination contributes to PTS-related avoidance behaviors following sexual trauma (Badour et al. 2013b; Olatunji et al. 2008). It is important to note that the magnitude of the interaction effect (i.e.,  $\Delta R^2$ ) between mental contamination and tolerance of negative emotions in

predicting PCL-Avoidance was similar in size to the three significant interaction effects. Our sample size was consistent with those used in prior studies examining the moderating effect of tolerance of negative emotions in relation to PTS symptoms (Marshall-Berenz et al. 2011; Vujanovic et al. 2013). A post-hoc power analysis (Faul et al. 2009) identified that our sample of 101 participants was sufficient to achieve statistical power of 0.80 when attempting to determine the significance (two-tailed) of an interactive effect that was small in size (Cohen's  $f^2=0.08$ ). However, the effect sizes for the significant interaction effects fell slightly below the effect size associated with statistical power of 0.80 in the power analysis. Thus, failure of the interaction term to reach statistical significance in predicting PCL-Avoidance ( $p=.10$ , in the present study) may have been the result of reduced statistical power. It will be important to replicate results from the present study in a larger sample of women with a history of sexual trauma in future research.

In the present study, tolerance of negative emotions was only uniquely associated with negative alterations in cognitions and mood symptoms. Although this finding stands in contrast to prior findings that tolerance of negative emotions uniquely relates to other PTS symptom clusters (Fetzner et al. 2014; Marshall-Berenz et al. 2011; Vujanovic et al. 2011, 2013), at least two caveats regarding this pattern of associations are notable. First, the present study is the first known published study to report associations between tolerance of negative emotions and PTS symptoms using the DSM-5 conceptualization of PTS symptoms and specifically among

individuals who experienced sexual trauma. The negative alterations in cognitions and mood symptoms cluster is newly defined in the DSM-5 (American Psychiatric Association 2013). New criteria in this symptom cluster include holding negative beliefs about the self, others, or the world, experiencing self-blame for the stressful event, and experiencing strong negative emotions (e.g., shame). Prior research has found associations among PTS-related cognitions, negative emotional states, and mental contamination following sexual trauma (e.g., Badour et al. 2013b, 2014; Olatunji et al. 2008). Importantly, the present pattern of results suggests that the impact of mental contamination on such experiences may be contingent upon an individual's ability to tolerate negative emotional states. As reviewed, Olatunji et al. (2008) suggested that mental contamination developing in the acute aftermath of a sexual trauma may decrease the likelihood that victims can maintain positive views of the world and of their own self-worth, thus resulting in higher levels of PTS-related cognitions. A tolerance of negative emotions may allow one to behave in ways that combat (e.g., approach) rather than maintain (e.g., avoidance) these negative views, thus reducing one's sense of current threat through fear extinction and reducing one's likelihood of developing PTSD.

Interestingly, the relationship between mental contamination and arousal symptoms was not significantly impacted by tolerance of negative emotions. Pursuant to these unexpected findings, mental contamination following sexual trauma purportedly remains even in the absence of continued contact with the perpetrator (Badour et al. 2013a; Fairbrother and Rachman 2004). Although speculative, the inability to remove the internal feelings of dirtiness following sexual trauma may lead individuals with a propensity to experience mental contamination to also experience symptoms consistent with the arousal symptom cluster following sexual trauma, particularly hypervigilance. Such a possibility is consistent with Rachman's (2004) conceptualization of contamination fears. Rachman proposed that once contamination fears are established, an individual becomes hypervigilant for possible threats of further contamination because of concerns of the anticipated effects of such contamination (e.g., experiencing even greater distress). As noted by Rachman, the hypervigilance of contamination threat includes internal cues of contamination (e.g., *Does my body feel absolutely clean?*).

The present findings support assertions that improving tolerance of negative emotions may be an important adjunct to exposure therapy for PTSD (Fetzner et al. 2014; Vujanovic et al. 2013), especially for women who have experienced sexual trauma. As reviewed, mental contamination is not typically reduced by standard exposure therapy techniques (Fairbrother et al. 2005). Additionally, the present findings suggest that difficulties tolerating negative emotions may be a necessary condition by which mental contamination relates to certain PTS symptoms following sexual trauma. The

augmentation of exposure therapy with interventions designed to improve tolerance of negative emotions may be important in the treatment of PTSD following sexual trauma, especially when individuals have a heightened propensity to experience mental contamination. By increasing tolerance of negative emotions, it is possible that individuals with a propensity to experience mental contamination can better cope with internal feelings of dirtiness following sexual trauma and thereby regulate trauma-related distress more effectively.

Study limitations must be acknowledged. Although research supports conceptualizing PTS symptoms dimensionally (e.g., Broman-Fulks et al. 2006; Forbes et al. 2005; Ruscio et al. 2002), thus supporting the use of a sample not selected based on the severity of PTS symptoms, replication of the present results among respondents diagnosed with PTSD will be important in ensuring the generalizability of study findings to a clinical population. The generality of the present findings are further limited by the lack of available information on the nature of the sexual trauma and the limited racial/ethnic diversity of the present sample. Pursuant to this limitation, trauma frequency was assessed as the number of traumas endorsed by each participant rather than the number of times each participant experienced a particular traumatic event. As such, the frequency of sexual trauma was not assessed.

Whereas prior studies examining PTS symptoms also have used internet samples (e.g., Fetzner et al. 2014), it is important to acknowledge that the quality of data obtained via remote collection efforts remains an issue to be fully vetted in the psychopathology literature. Known methods shown to increase the quality of remotely collected data were used in the present study (e.g., using only high reputation MTurk workers; Peer et al. 2014) and an accumulating body of research supports MTurk as a viable method for data collection (Buhrmester et al. 2011; Paolacci and Chandler 2014; Shapiro et al. 2013). MTurk samples tend to be more diverse than standard Internet samples or American undergraduate samples, but MTurk samples should not be considered representative of the general population (Buhrmester et al. 2011; Paolacci and Chandler 2014). The generality of these findings would be supported by examining other groups of community respondents.

Our cross-sectional study design precludes causal conclusions among the study variables, although the variables were modeled in a manner consistent with how they have previously been modeled (e.g., Badour et al. 2013a; b; Badour et al. 2014; Fetzner et al. 2014; Marshall-Berenz et al. 2011; Olatunji et al. 2008; Vujanovic et al. 2011; Vujanovic et al. 2013). Longitudinal and experimental studies will be important in teasing apart the temporal relationships among mental contamination, tolerance of negative emotions, and PTS symptoms. Finally, it should be noted that the observed interactive effects accounted for only a small amount of unique variance in PTS symptoms scores. However, the size of the interactive effects were consistent with those found in prior

studies examining the moderating effect of the tolerance of negative emotions in relation to PTS symptoms (e.g., Marshall-Berenz et al. 2011; Vujanovic et al. 2013). Additionally, the association between the PCL-5 total scale score and mental contamination at low levels of tolerance of negative emotions in the simple effects analyses was above the currently suggested cutoff score on the PCL-5 of 38 for indicating clinically severe symptoms (Weathers et al. 2013b). As such, we believe the observed interactive effects are meaningful.

With these study limitations in mind, the present results provide additional evidence for the relevance of mental contamination to PTS symptoms following sexual trauma. Importantly, the association between mental contamination and PTS symptoms following sexual trauma generally seems best understood by concurrently considering tolerance of negative emotions. Increased attention given to interrelations among mental contamination, tolerance of negative emotions, and PTS symptoms has the potential to improve treatment outcomes for victims of sexual trauma.

**Conflicts of Interest** Thomas A. Fergus and Joseph R. Bardeen declare that they have no conflict of interest.

**Experiment Participants** The protocol for this study was approved by the Office of Research Compliance at Auburn University. All participants provided electronic consent as part of their study participation.

## References

- Aiken, L. S., & West, S. G. (1991). *Multiple regression: Testing and interpreting interactions*. Thousand Oaks: Sage.
- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington: American Psychiatric Association.
- Badour, C. L., Feldner, M. T., Babson, K. A., Blumenthal, H., & Dutton, C. E. (2013a). Disgust, mental contamination, and posttraumatic stress: unique relations following sexual versus non-sexual assault. *Journal of Anxiety Disorders, 27*, 155–162.
- Badour, C. L., Feldner, M. T., Blumenthal, H., & Bujarski, S. J. (2013b). Examination of increased mental contamination as a potential mechanism in the association between disgust sensitivity and sexual assault-related posttraumatic stress. *Cognitive Therapy and Research, 37*, 697–703.
- Badour, C. L., Ojserkis, R., McKay, D., & Feldner, M. T. (2014). Disgust as a unique affective predictor of mental contamination following sexual trauma. *Journal of Anxiety Disorders, 28*, 704–711.
- Broman-Fulks, J. J., Ruggiero, K. J., Green, B. A., Kilpatrick, D. G., Danielson, K., Resnick, H. S., & Saunders, B. E. (2006). Taxometric investigation of PTSD: data from two nationally representative samples. *Behavior Therapy, 37*, 364–380.
- Buhrmester, M., Kwang, T., & Gosling, S. D. (2011). Amazon's mechanical Turk: a new source of inexpensive, yet high-quality, data? *Perspectives on Psychological Science, 6*, 3–5.
- Cohen, J., Cohen, P., West, S. G., & Aiken, L. A. (2003). *Applied multiple regression/correlation analysis for the behavioral sciences* (3rd ed.). Hillsdale: Lawrence Erlbaum.
- Ehlers, A., & Clark, D. M. (2000). A cognitive model of posttraumatic stress disorder. *Behaviour Research and Therapy, 38*, 319–345.
- Fairbrother, N., & Rachman, S. (2004). Feelings of mental pollution subsequent to sexual assault. *Behaviour Research and Therapy, 42*, 173–189.
- Fairbrother, N., Newth, S. J., & Rachman, S. (2005). Mental pollution: feelings of dirtiness without physical contact. *Behaviour Research and Therapy, 43*, 121–130.
- Faul, F., Erdfelder, E., Buchner, A., & Lang, A. (2009). Statistical power analyses using G\*Power 3.1: tests for correlation and regression analyses. *Behavior Research Methods, 41*, 1149–1160.
- Fetzner, M. G., Peluso, D. L., & Asmundson, G. J. G. (2014). Tolerating distress after trauma: differential associations between distress tolerance and posttraumatic stress symptoms. *Journal of Psychopathology and Behavioral Assessment, 36*, 475–484.
- Forbes, D., Haslam, N., Williams, B. J., & Creamer, M. (2005). Testing the latent structure of posttraumatic stress disorder: a taxometric study of combat veterans. *Journal of Traumatic Stress, 18*, 647–656.
- Gray, M. J., Litz, B. T., Hsu, J. L., & Lombardo, T. W. (2004). Psychometric properties of the Life Events Checklist. *Assessment, 11*, 330–341.
- Kessler, R. C., Chiu, W. T., Demler, O., & Walters, E. E. (2005). Prevalence, severity, and comorbidity of 12 month DSM-IV disorders in the national comorbidity survey replication. *Archives of General Psychiatry, 62*, 617–627.
- Kline, R. B. (2011). *Principles and practice of structural equation modeling* (3rd ed.). New York: Guilford.
- Marshall-Berenz, E. C., Vujanovic, A. A., & Zvolensky, M. J. (2011). Main and interactive effects of a nonclinical panic attack history and distress tolerance in relation to PTSD symptom severity. *Journal of Anxiety Disorders, 25*, 185–191.
- Morgan, G. A., Griego, O. V., & Gloeckner, G. (2001). *SPSS for Windows: An introduction to use and interpretation in research*. Mahwah: Lawrence Erlbaum.
- Olatunji, B. O., Elwood, L. S., Williams, N. L., & Lohr, J. M. (2008). Mental pollution and PTSD symptoms in victims of sexual assault: a preliminary examination of the mediating role of trauma-related cognitions. *Journal of Cognitive Psychotherapy, 22*, 37–47.
- Paolacci, G., & Chandler, J. (2014). Inside the Turk: understanding mechanical Turk as a participant pool. *Current Directions in Psychological Science, 23*, 184–188.
- Peer, E., Vosgerau, J., & Acquisti, A. (2014). Reputation as a sufficient condition for data quality on Amazon Mechanical Turk. *Behavior Research Methods, 46*, 1023–1031.
- Rachman, S. (2004). Fear of contamination. *Behaviour Research and Therapy, 42*, 1227–1255.
- Radomsky, A. S., Rachman, S., Shafraan, R., Coughtrey, A. E., & Barber, K. C. (2014). The nature and assessment of mental contamination: a psychometric analysis. *Journal of Obsessive-Compulsive and Related Disorders, 3*, 181–187.
- Resnick, H. S., Kilpatrick, D. G., Dansky, B. S., Saunders, B. E., & Best, C. L. (1993). Prevalence of civilian trauma and posttraumatic stress disorder in a representative national sample of women. *Journal of Consulting and Clinical Psychology, 61*, 984–991.
- Ruggiero, K. J., Del Ben, K., Scotti, J. R., & Rabalais, A. E. (2003). Psychometric properties of PTSD Checklist-Civilian Version. *Journal of Traumatic Stress, 16*, 495–502.
- Ruscio, A. M., Ruscio, J., & Keane, T. M. (2002). The latent structure of posttraumatic stress disorder: a taxometric investigation of reactions to extreme stress. *Journal of Abnormal Psychology, 111*, 290–301.
- Shapiro, D. N., Chandler, J., & Mueller, P. A. (2013). Using mechanical Turk to study clinical populations. *Clinical Psychological Science, 1*, 213–220.
- Simons, J. S., & Gaher, R. M. (2005). The distress tolerance scale: development and validation of a self-report measure. *Motivation and Emotion, 29*, 83–102.

- Tolin, F., & Foa, E. B. (2006). Sex differences in trauma and posttraumatic stress disorder: a quantitative review of 25 years of research. *Psychological Bulletin*, *132*, 959–992.
- Vujanovic, A. A., Bonn-Miller, M. O., Potter, C. M., Marshall, E. C., & Zvolensky, M. J. (2011). An evaluation of the relation between distress tolerance and posttraumatic stress within a trauma-exposed sample. *Journal of Psychopathology and Behavioral Assessment*, *33*, 129–135.
- Vujanovic, A. A., Hart, A. S., Potter, C. M., Berenz, E. C., Niles, B., & Bernstein, A. (2013). Main and interactive effects of distress tolerance and negative affect intensity in relation to PTSD symptoms among trauma-exposed adults. *Journal of Psychopathology and Behavioral Assessment*, *35*, 235–243.
- Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of Positive and Negative Affect: the PANAS scales. *Journal of Personality and Social Psychology*, *54*, 1063–1070.
- Weathers, F. W., Huska, J. A., & Keane, T. M. (1991). *PCL-C for DSM-IV*. Boston: National Center for PTSD -Behavioral Science Division.
- Weathers, F. W., Keane, T. M., & Davidson, J. R. T. (2001). Clinician-administered PTSD scale: a review of the first ten years of research. *Depression and Anxiety*, *156*, 132–156.
- Weathers, F. W., Blake, D. D., Schnurr, P. P., Kaloupek, D. G., Marx, B. P., & Keane, T. M. (2013a). *The life events checklist for DSM-5 (LEC-5)*. Instrument available from the National Center for PTSD at [www.ptsd.va.gov](http://www.ptsd.va.gov).
- Weathers, F. W., Litz, B. T., Keane, T. M., Palmieri, P. A., Marx, B. P., & Schnurr, P. P. (2013b). *The PTSD checklist for DSM-5 (LEC-5)*. Instrument available from the National Center for PTSD at [www.ptsd.va.gov](http://www.ptsd.va.gov).