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ORIGINAL ARTICLE

Posttraumatic Mental Contamination and the Interpersonal Psychological Theory of Suicide: Effects via DSM-5 PTSD Symptom Clusters

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Abstract
Research has yet to establish a relationship between posttraumatic mental contamination and suicide risk, despite theoretical overlap. The present study examined relationships between posttraumatic mental contamination and suicide risk via posttraumatic stress symptom clusters and appraisals of perceived burdensomeness and thwarted belongingness. Trauma-exposed participants ($N = 183$) completed measures of posttraumatic mental contamination, posttraumatic stress symptoms, thwarted belongingness, perceived burdensomeness, and suicide risk. Findings revealed significant indirect effects of posttraumatic mental contamination on suicide risk via all posttraumatic stress symptom clusters. Significant serial indirect effects of posttraumatic mental contamination on suicide risk were observed via posttraumatic avoidance and arousal/reactivity and, subsequently, via thwarted belongingness and perceived burdensomeness. Serial models via posttraumatic re-experiencing and negative cognitions/mood symptoms were nonsignificant. Results suggest that posttraumatic mental contamination may increase suicide risk via posttraumatic stress symptom severity, and maladaptive interpersonal appraisals may explain these links through distinct symptom pathways. Implications for posttraumatic suicide risk are discussed.

Keywords Mental contamination · PTSD · Suicide · Perceived burdensomeness · Thwarted belongingness · Appraisals

Background

Mental contamination has been described as an internal and/or diffuse feeling of dirtiness, infection, or impurity occurring in the absence of contact with an external source (Rachman 1994; Rachman et al. 2015). Mental contamination may stem from thoughts or mental images of objects considered to be repugnant or contaminated, as well as recollections of prior violations or moral transgressions involving other people (Rachman et al. 2015; Coughtrey et al. 2012). Posttraumatic mental contamination—mental contamination experienced in the wake of a traumatic event—has recently gained particular attention for its relation to traumatic experiences and symptoms of posttraumatic stress disorder (PTSD; Badour et al. 2013a; Olatunji et al. 2008). Mental contamination has demonstrated positive associations with trauma-related emotions of anxiety, disgust, shame, anger, and sadness (Badour et al. 2014; Coughtrey et al. 2013; Fairbrother et al. 2005; Radomsky and Elliott 2009), as well as event-specific appraisals of personal responsibility, violation, immorality, and perceptions of dirtiness (Elliott and Radomsky 2012, 2013; Rachman et al. 2015). Mental contamination appears to be particularly relevant among individuals experiencing sexual violation (Badour et al. 2013a, b; Fairbrother and Rachman 2004; Ishikawa et al. 2015), moral violation (Elliott and Radomsky 2009; Zhong and Liljenquist 2006), and betrayal (Rachman 2010). Research has also underscored the role of maladaptive posttraumatic cognitions in explaining links between mental contamination and PTSD symptomology (Olatunji et al. 2008). In particular, individuals experiencing mental contamination following a traumatic violation may believe that their thoughts and

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associated feelings of dirtiness are indicative of personal flaws and perceive themselves to be permanently polluted (Rachman et al. 2015; Steil et al. 2011).

In addition to links with posttraumatic cognitions and mood, mental contamination has been highlighted for its tendency to become more severe and less manageable via traditional methods of coping with contamination (e.g., washing/cleaning) over time (Rachman et al. 2015). These management difficulties may result from the spread of mental contamination to new stimuli associated with the original contamination source (e.g., objects that remind an individual of the violator) with little loss of intensity (Coughtrey et al. 2012, 2014). As Rachman et al. (2015) note, individuals with mental contamination "dread the persistence of the unbearable feelings, feel defeated, and resign themselves to uncontrollable pollution and enduring misery" (p. 75). These characteristics are in line with speculations that mental contamination may lead to increased avoidance symptoms, including preemptive avoidance of future contamination triggers (Badour et al. 2013b), avoidance of others due to perceived risk of contamination spread (Coughtrey et al. 2012), and greater avoidant coping via risky behaviors (e.g., substance use, self-harm; Brake et al. 2018). Although current research on the long-term impact and behavioral outcomes of mental contamination is limited, these preliminary findings and supporting theory implicate posttraumatic mental contamination as a potential indicator for increased risk of adverse outcomes due to its decreased manageability and negative impact on individuals' self-appraisals and outlook.

Given these links with negative mood, maladaptive appraisals, long-term deterioration, and avoidance, mental contamination may serve as a key but as-of-yet unexplored factor in posttraumatic suicide risk. Among existing models of suicide risk, the Interpersonal Psychological Theory of Suicide (IPTS; Joiner 2005; Van Orden et al. 2010) is a particularly well-established framework researched across various clinical presentations that has posed distinct pathways by which interpersonal difficulties may lead to increased desire for and actions toward suicide (for reviews, see Chu et al. 2017; Ma et al. 2016). Research on the IPTS has demonstrated that increases in appraisals of *perceived burdensomeness* (PB; comprised of self-hate and the belief that one is a liability to others) and *thwarted belongingness* (TB; comprised of loneliness, disconnection, and lack of reciprocal care in relationships) are associated with increased suicidal desire and ideation, particularly if individuals feel that these interpersonal difficulties are permanent or irreparable. Furthermore, the IPTS posits that suicidal desire escalates into suicidal behavior once individuals possess greater capability for suicide (i.e., reduced fear of death and elevated pain tolerance), hypothesized to emerge from both genetic vulnerabilities and repeated exposure to painful or distressing events (Chu et al. 2017).

Conceptually, posttraumatic mental contamination would appear to have notable overlap with TB and PB appraisals that contribute to suicidal desire. Posttraumatic experiences of undiminished dirtiness, corruption, or immorality may elevate TB appraisals if individuals perceive themselves as incapable or unworthy of establishing meaningful relationships (e.g., "I am unclean/immoral and therefore unlovable"). Additionally, PB appraisals may increase if posttraumatic mental contamination leads individuals to worry about the permanence of their defilement (e.g., Steil et al. 2011), the spread of their contamination to others, and the increased time and effort necessary to neutralize or avoid the spread (Coughtrey et al. 2012). Van Orden et al. (2010) have also noted that factors that may contribute to increased PB include feelings of shame, self-blame, and low self-esteem; all of which have been previously associated with mental contamination (Rachman et al. 2015).

Though not previously examined in concert, posttraumatic mental contamination and interpersonal appraisals of TB and PB may relate through shared associations with PTSD symptomatology. Posttraumatic mental contamination has previously been conceptualized as exacerbating PTSD symptomatology, with research linking it to greater overall PTSD symptom severity (Badour et al. 2013a, b; Fairbrother and Rachman 2004) and individual symptom clusters (Fergus and Bardeen 2016). Furthermore, strong links between PTSD and suicide risk are well-established (Nock et al. 2009; Panagioti et al. 2009), including specific associations with suicidal ideation (Krysinska and Lester 2010) and suicide-linked appraisals (Panagioti et al. 2013). A small number of studies have examined relationships between suicide risk and PTSD at the symptom level, noting strong associations between PTSD symptoms of emotional numbing (particularly detachment/estrangement) with suicidal ideation in nonclinical community and military participants (Davis et al. 2014; Guerra and Calhoun 2011), as well as with both TB and PB in nonclinical military personnel (Pennings et al. 2017). Given the prior evidence linking mental contamination with a host of posttraumatic alterations in mood and appraisals, it is plausible that posttraumatic mental contamination may play an important role in increased risk for suicide via relationships with PTSD severity (particularly negative cognition/mood severity), TB, and PB.

Although posttraumatic mental contamination has been previously linked with factors tied to suicide risk, prior research has yet to directly examine these relationships. The present study thus aimed to test a novel model linking posttraumatic mental contamination to suicide risk via PTSD symptoms and IPTS-model appraisals specifically associated with desire for suicide (i.e., TB, PB) in a community adult sample with prior trauma exposure. Much of the existing research surrounding mental contamination and PTSD has utilized trait-based mental contamination measures (i.e.,

nonspecific to trauma experiences), a subset of items from a larger measure not explicitly designed to assess mental contamination [e.g., within the Sexual Assault and Rape Appraisals (SARA) Inventory; Badour et al. 2013b; Fairbrother and Rachman 2004], or brief trauma-specific measures designed to assess state mental contamination elicited experimentally [e.g., Mental Contamination Report (MCR); Badour et al. 2013a]. As such, the present study also aimed to improve on previous approaches by adapting a widely used and extensively validated trait mental contamination measure to specifically reference posttraumatic mental contamination.

We hypothesized that posttraumatic mental contamination would be positively related to suicide risk, and that simple indirect effects via total PTSD symptoms and separate PTSD symptom clusters would, at least in part, explain this relationship. Furthermore, we hypothesized that TB and PB would explain a significant portion of the simple indirect effects via the PTSD symptom cluster of negative cognitions/mood, such that greater posttraumatic mental contamination would be related to increased suicide risk through increased PTSD negative cognitions/mood symptoms and, serially, through increased TB/PB. We withheld a priori hypotheses on serial indirect effects via other PTSD symptom clusters due to limited extant research informing these relationships. Depression, biological sex, and history of unwanted sexual experience were included as covariates in all analyses given prior evidence linking these constructs to mental contamination (e.g., Badour et al. 2013a; Brake et al. 2018). Additionally, given the strong relationships and overlap between experiences of contact contamination and mental contamination (Elliott and Radomsky 2009), we included contact contamination as an additional covariate to ensure that significant links with primary study variables would be specific to mental contamination experienced in the wake of traumatic events (rather than general contamination sensitivity).

Method

Participants

The present study utilized a sample of 183 community adults over the age of 18 (M_{age} = 40.65; SD = 12.37; 60.4% female) who reported a history of at least one Criterion A trauma event as defined by the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders [DSM-5; American Psychiatric Association (APA) 2013]. The present sample was derived from a larger online survey (n = 359) which included self-selecting community adults living in the United States whose primary language was English. Individuals from the larger sample were excluded from the present study if they (1) did not endorse at least one prior DSM-5-defined Criterion A trauma event (n = 107), (2) completed the survey battery in less than half the mean duration for completion (n = 31), and (3) failed to correctly respond on at least 75% of four validity check items approximately evenly distributed within the survey battery (n = 38). Such procedures are in line with validation recommendations for online data collection (e.g., Oppenheimer et al. 2009). Participant demographics are provided in Table 1.

Participants reported their index trauma [i.e., worst or most distressing (as measured by the Trauma History Questionnaire, see below)] to be: serious illness, injury, or unexpected death of a loved one (40.1%); unwanted sexual experience (11.2%); actual or attempted break-in or robbery (10.1%); natural or man-made disasters (9.6%); personal situations involving serious injury, illness, or fear of death (8.6%); physical assault (5.9%); serious accident (e.g., motor vehicle; 5.3%); seeing or handling dead bodies (3.7%); seeing someone seriously injured or killed (2.1%); military combat (1.1%); and other (2.1%). Approximately one quarter of the sample (n = 44) reported a history of unwanted sexual experiences, regardless of whether the participant indicated this event type as their index trauma.

Measures

Trauma History

Participants' exposure to potentially traumatic events was assessed using a modified version of the Trauma History Questionnaire (THQ; Hooper et al. 2011). The THQ is a 24-item self-report measure that evaluates three categories of potentially traumatic experiences: crime-related events (e.g., robbery, mugging), general disaster and trauma (e.g., injury, natural or man-made disaster), and unwanted physical or sexual experiences. History of non-consensual sexual experiences includes items assessing experiences of forced or threatened vaginal, oral or anal intercourse, fondling of sex organs, and other attempts at unwanted sexual contact. Participants indicated whether they had experienced each of the 24 events listed. If an item was endorsed, participants specified the number of times and the ages at which they experienced the event. Index trauma was then determined by asking participants to identify which of their experienced event(s) they would currently consider to be their worst or most bothersome. To ensure that each participant's index trauma satisfied the definition of PTSD as outlined in Criterion A of the DSM-5 (APA 2013), additional questions were added to the THQ to inquire about how the index traumatic event was encountered. Specifically, respondents reported if they experienced the event directly, witnessed the event, learned about the event happening to a close family member or friend, or if they were repeatedly exposed to details of

Table 1 Demographic information

Category	n (%)	Category	n (%)
Age (M,SD)	40.90 (12.36)		
Biological sex		Education	
Male	71 (38.8%)	Graduated high school (or equivalent)	12 (6.6%)
Female	112 (61.2%)	Some college	44 (24.0%)
Sexual orientation		Graduated 2-year college	28 (15.3%)
Heterosexual	159 (86.9%)	Graduated 4-year college	57 (31.1%)
Homosexual	7 (3.8%)	Some graduate/professional school	14 (7.7%)
Bisexual	16 (8.7%)	Completed graduate/professional school	28 (15.3%)
Other	1 (0.5%)	Employment	
Race		Unemployed/looking for work	11 (6.0%)
Caucasian	153 (83.6%)	Unemployed/retired	9 (4.9%)
African American	13 (7.1%)	Unemployed/disabled	9 (4.9%)
Native Hawaiian/Other Pacific Islander	1 (0.5%)	Employed (part-time)	38 (20.8%)
Asian	9 (4.9%)	Employed (full-time)	113 (61.7%)
American Indian/Alaska Native	2 (1.1%)	Student	3 (1.6%)
Multi-racial	5 (2.7%)	Marital status	
Ethnicity		Married	77 (42.1%)
Hispanic	12 (6.6%)	Separated	4 (2.2%)
Non-Hispanic	171 (93.4%)	Divorced	18 (9.8%)
Income		Widowed	3 (1.6%)
<$20,000	44 (24.0%)	Single	63 (34.4%)
$20,000–<$40,000	50 (27.3%)	Cohabitating	18 (9.8%)
$40,000–<$60,000	38 (20.8%)		
$60,000–<$80,000	25 (13.7%)		
$80,000–<$100,000	13 (7.1%)		
>$100,000	13 (7.1%)		

the event as part of their occupation. Additionally, participants indicated if the event involved life threat, threatened or actual serious injury, or sexual violence. If the event involved the death of a close family member or friend, participants specified if the death was accidental or violent in nature. The THQ demonstrates fair to excellent test–retest reliability over a 2–3-month period, as well as strong construct and cultural validity (Hooper et al. 2011).

PTSD Symptoms

Past-month PTSD symptom severity in response to the index traumatic event identified on the modified THQ was assessed using the PTSD Checklist for DSM-5 (PCL-5; Weathers et al. 2013). Respondents indicated how much they were bothered by 20 symptoms of PTSD on a five-point Likert-type scale (0 = *not at all* to 4 = *extremely*). The PCL-5 includes an overall assessment of PTSD symptom severity (range 0–80), as well as subscales for each symptom cluster specified in the DSM-5 diagnostic criteria for PTSD, including intrusion (five items), avoidance (two items), negative alterations in mood and cognition (seven items), and alterations in arousal and reactivity (six items). The PCL-5 has demonstrated adequate retest reliability over 1 week (Blevins et al. 2015) and displayed strong internal consistency in the current sample ($\alpha = 0.97$ for the total score; $\alpha = 0.88$–0.93 for each symptom cluster). This measure has also evidenced convergent and discriminant validity, as well as optimal sensitivity and specificity for predicting probable PTSD using a cut score of ≥ 37 (Blevins et al. 2015).

Posttraumatic Mental Contamination

The standard 20-item Vancouver Obsessional Compulsive Inventory-Mental Contamination Scale (VOCI-MC; Rachman 2005) was modified for the purposes of this study to develop a new scale for assessing the degree to which participants experience posttraumatic mental contamination—the Posttraumatic Experience of Mental Contamination Scale (PEMC). The PEMC utilized adapted VOCI-MC items to specifically reference mental contamination experiences since the occurrence of the index trauma (e.g., "Since the event, I often feel dirty under my skin"). The PEMC instructed participants to rate the extent to which each item

is true for them on a five-point Likert-type scale (*0 = Not at all* to *4 = Very much*) while keeping their index trauma event in mind; higher scores on the PEMC indicated greater vulnerability to posttraumatic mental contamination. Lastly, the standard version of the VOCI-MC was also administered to examine validity of the PEMC.

We submitted all 20 PEMC items to a principal components analysis (PCA) with oblique rotation (direct oblimin with delta = 0) to examine the factor structure of the PEMC. With an eigenvalue of 14.41, the first component explained 72.03% of variance in the data. Although the second component's eigenvalue was 1.03 and explained an additional 5.15% of variance, inspection of the scree plot clearly suggested a one-component solution. A one-component solution was additionally supported by a Monte Carlo parallel analysis (Watkins 2000) with 500 replications, which generated a random first eigenvalue of 1.64 and a second eigenvalue of 1.51. Moreover, inspection of the component matrix revealed that all 20 PEMC items strongly loaded onto the single factor (range 0.66–0.91). Consistent with findings from the PCA, internal consistency for the PEMC was excellent in the present sample ($\alpha = 0.98$). Lastly, scores on the PEMC and VOCI-MC exhibited a significant positive correlation with one another ($r = .71$, $p < .001$), suggesting strong convergent validity for the PEMC.

Contact Contamination

The 12-item Contamination subscale from the Vancouver Obsessional Compulsive Inventory (VOCI-CTN; Thordarson et al. 2004) was used to assess concern regarding contact with physical contaminants (e.g., "touching the bottom of my shoes makes me very anxious") and with germs or disease (e.g., "I am excessively concerned about germs and disease"). Responses were rated on a five-point Likert-type scale (0 = *Not at all* to 4 = *Very much*) with higher scores representing greater contact contamination-related concern. This subscale evinced excellent internal consistency in the present sample ($\alpha = 0.96$), and previous research has demonstrated adequate test–retest reliability, and convergent and discriminant validity for the VOCI-CTN (Thordarson et al. 2004). Previous mental contamination research has frequently included contact contamination as a covariate due to conceptual overlap between these constructs (e.g., Brake et al. 2018; Elliott and Radomsky 2009).

Perceived Burdensomeness and Thwarted Belongingness

Participants in the present study completed the 15-item Interpersonal Needs Questionnaire (INQ-15; Van Orden et al. 2012), a measure designed for research on the etiology of suicidal desires based on the interpersonal theory of suicide. The measure includes subscales of PB (INQ-PB; e.g., "These days, the people in my life would be better off if I were gone") and TB (INQ-TB; e.g., "These days, I feel disconnected from other people"). Items are rated on a seven-point Likert-type scale (1 = *Not at all true for me* to 7 = *Very true for me*), with higher scores indicating greater PB and TB. Although participants in this study initially completed the INQ-15, recent psychometric evaluation of multiple versions of the INQ showed the 10-item INQ (Bryan et al. 2010) to demonstrate the best combination of consistent model fit and prediction of concurrent suicidal ideation in both student and psychiatric inpatient samples (Hill et al. 2015). Thus, results reported in the present study utilized INQ-PB and INQ-TB subscale derived using this 10-item scoring algorithm. Internal consistency in the current study was excellent for both INQ-PB ($\alpha = 0.97$) and INQ-TB ($\alpha = 0.92$).

Suicide Risk

Suicide risk was measured using the Suicide Behaviors Questionnaire-Revised (SBQ-R; Osman et al. 2001). The SBQ-R assesses lifetime suicidal ideation and attempts, past-year suicidal ideation, threat of suicide attempt, and likelihood of future suicidal behavior. Scores of the SBQ-R range from 3 to 18, with scores of 7 or greater indicating presence of suicide risk in the general adult population (Osman et al. 2001). The SBQ-R has demonstrated excellent sensitivity (0.93) and specificity (0.95) in identifying suicide among an undergraduate sample and has been recommended for its utility in both community and inpatient adult populations (Osman et al. 2001). The SBQ-R demonstrated good internal consistency ($\alpha = 0.84$) in the present study. Analyses in the present study utilized a continuous index of suicide risk via the SBQ-R, in line with previous research examining suicide risk along a continuum (e.g., Bryan et al. 2010; McKinney et al. 2017; Panagioti et al. 2013).

Depressive Symptoms

Past week depressive symptoms were assessed using the 7-item depression subscale from the Depression, Anxiety, and Stress Scale (DASS-21-DEP; Lovibond and Lovibond 1995). Participants responded to each item on a four-point Likert-type scale (0 = *did not apply to me at* all to 3 = *applied to me very much or most of the time*) and answers ranged from 0 to 21 with higher scores reflecting greater depressive symptoms. Results from prior research suggest that the concurrent, convergent, and discriminant validity of the DASS-21 are in the acceptable to excellent ranges (Antony et al. 1998; Henry and Crawford 2005). Internal consistency for the DASS-21-DEP was excellent in the present sample ($\alpha = 0.94$).

Procedure

Participants were recruited through Amazon's Mechanical Turk (MTurk) to complete a battery of self-report questionnaires. MTurk is a crowdsourcing service where requesters recruit individuals through an online system to complete various tasks for financial compensation (Paolacci et al. 2010). Research has demonstrated that MTurk samples are more representative of the U.S. population and produce comparable results to traditional survey collection methods (e.g., university subject pools, social media postings; Casler et al. 2013; Paolacci et al. 2010). Participants took an average of 1.6 h to complete the self-report battery, which included additional measures not pertinent to the present study. Individuals were compensated $2.00 for their participation. All study procedures were approved by the university's Institutional Review Board.

Data Analytic Approach

All participants provided complete responses to study measures, resulting in no missing data within the present sample. Study variables were first examined for evidence of nonnormality. Only scores on PB and posttraumatic mental contamination evidenced substantial positive skewness (1.85 and 2.22, respectively) and kurtosis (2.51 and 4.63, respectively). To correct for nonnormality of these variables, square-root transformations were applied to PB and posttraumatic mental contamination scores prior to further analysis, resulting in acceptable skewness (1.48 and 1.24, respectively) and kurtosis (1.05 and 0.37, respectively). Differences in primary study variables were then examined as a function of biological sex and history of unwanted sexual experiences via independent samples *t* tests. Prior to independent samples *t* tests, normality of dependent variables was again confirmed for primary study variables within both biological sex and history of unwanted sexual experience subgroups. Levene's test was used to evaluate the equality of variances assumption for all *t* tests, and degrees of freedom were adjusted accordingly when necessary. Next, zero-order correlations and partial correlations were evaluated to inform appropriate covariates for inclusion in multivariate analyses.

Finally, process analyses using the PROCESS 2.15 custom dialog (Hayes 2013) in SPSS 23 were utilized to examine our indirect effects models. First, we evaluated the simple indirect effects of posttraumatic mental contamination on suicide risk via total PTSD severity and separate symptom clusters. Second, we examined serial indirect effects of posttraumatic mental contamination on suicide risk via PTSD total symptoms/symptom clusters and TB/PB to determine the relevance of TB and PB in explaining our initial simple indirect effects. Indirect effects models were evaluated for significance using 95% bias-corrected confidence intervals based on 5000 bootstrapped resamples. Indirect effects were considered significant if zero was not included within bias-corrected confidence intervals.

Results

Descriptive Statistics

Participant demographics are reported in Table 1. Of the total sample, 15.3% met criteria for a probable PTSD diagnosis, based on the previously established cut score of ≥ 37 on the PCL-5 (Blevins et al. 2015), while 33.9% met or exceeded the cut score of 7 on the SBQ-R indicating presence of suicide risk (Osman et al. 2001). Compared to participants without any history of unwanted sexual experience ($n = 139$), those endorsing any history of unwanted sexual experience ($n = 44$) reported significantly more TB, $t(181) = 2.31$, $p = .02$, posttraumatic mental contamination, $t(60.76) = 2.46$, $p = .02$, PTSD total symptom severity, $t(57.04) = 2.49$, $p = .02$, PTSD re-experiencing, $t(60.86) = 2.28$, $p = .03$, PTSD avoidance, $t(61.20) = 2.42$, $p = .02$, and PTSD negative cognitions/mood, $t(56.58) = 2.58$, $p = .01$. Primary study variables did not significantly differ by biological sex.

Zero-order correlations and descriptive statistics (i.e., means, standard deviations, ranges) of all primary study variables are reported in Table 2. For ease of interpretation, nontransformed descriptive statistics are presented, though transformed variables were used in all analyses. As seen in Table 2, depression and contact contamination were significantly positively correlated with posttraumatic mental contamination, total PTSD symptom severity, all PTSD symptom clusters, TB, and PB. Depression (but not contact contamination) was additionally significantly positively correlated with suicide risk.

After controlling for covariates of depression, contact contamination, biological sex, and history of unwanted sexual experience, significance of partial correlations among primary study variables remained unchanged, except that the correlation between TB and PTSD re-experiencing symptoms was reduced to nonsignificance, $r = .14$, $p = .06$, and the correlation between posttraumatic mental contamination and suicide risk was rendered nonsignificant, $r = .04$, $p = .62$. All subsequent PROCESS analyses included these same covariates.

Simple Indirect Effects via PTSD Symptoms

Indirect effect results of posttraumatic mental contamination on suicide risk via total PTSD symptoms and separate PTSD symptom clusters—controlling for covariates—are presented in Table 3. Despite positive zero-order relations between

Table 2 Descriptive statistics and zero-order correlations among continuous variables

	1	2	3	4	5	6	7	8	9	10	11
1. Posttraumatic mental contamination	–	0.62***	0.59***	0.46***	0.59***	0.60***	0.36***	0.38***	0.25**	0.42***	0.54***
2. PTSD-total symptoms		–	0.93***	0.84***	0.95***	0.93***	0.54***	0.51***	0.49***	0.60***	0.35***
3. PTSD-Re-experiencing			–	0.83***	0.82***	0.81***	0.42***	0.45***	0.41***	0.51***	0.37***
4. PTSD-avoidance				–	0.74***	0.68***	0.41***	0.41***	0.39***	0.42***	0.29***
5. PTSD-negative cognitions/mood					–	0.84***	0.59***	0.50***	0.50***	0.63***	0.30***
6. PTSD-arousal						–	0.51***	0.50***	0.46***	0.54***	0.32***
7. Thwarted belongingness							–	0.57***	0.52***	0.65***	0.18*
8. Perceived burdensomeness								–	0.61***	0.60***	0.21**
9. Suicide risk									–	0.62***	0.11
10. Depression										–	0.35***
11. Contact contamination											–
Mean	7.38	15.22	3.66	1.87	5.50	4.19	15.57	9.37	5.93	10.57	9.36
SD	13.66	17.83	4.64	2.30	7.07	5.24	8.65	7.40	3.54	11.62	11.31
Range	0–67	0–77	0–20	0–8	0–27	0–24	5–35	5–35	3–18	0–42	0–46

For ease of interpretation, only nontransformed descriptive statistics are reported

*$p < .05$; **$p < .01$; ***$p < .001$

posttraumatic mental contamination and suicide risk, the total effect was no longer significant after accounting for covariates in the model (Table 3 c *path*). Of note, PROCESS results suggested the zero-order significant relationships between posttraumatic mental contamination and suicide risk was largely driven by depression; when dropping only depression as a covariate from the models, the total effect was significant, $B = 0.33$, SE = 0.14, $p = .02$. Posttraumatic mental contamination was positively associated with total PTSD symptoms and all separate PTSD symptom clusters (Table 3 a_0 *paths*). Additionally, total PTSD symptoms and all separate PTSD symptom clusters were significantly positively associated with suicide risk (Table 3 b_0 *paths*), controlling for posttraumatic mental contamination and other covariates. Bootstrapping analyses revealed significant indirect effects of posttraumatic mental contamination on suicide risk via total PTSD symptom severity and all separate PTSD symptom clusters (Table 3 a_0b_0 *paths*). In all simple indirect effect models, direct effects of posttraumatic mental contamination on suicide risk remained nonsignificant after accounting for indirect pathways (Table 3 c_0' *paths*).

Serial Indirect Effects via PTSD Symptoms and Interpersonal Suicide Risk Variables

Results of serial indirect effect analyses of posttraumatic mental contamination on suicide risk via PTSD symptoms and TB/PB—controlling for covariates—are presented in Table 4 and Figs. 1, 2, 3.

Total PTSD symptoms were significantly associated with both TB and PB (Fig. 1, Models 1a, 1b, *d paths*), controlling for posttraumatic mental contamination and other covariates. However, only PB exhibited positive associations with suicide risk after controlling for effects of posttraumatic mental contamination, total PTSD symptoms, and other covariates (Fig. 1, Model 1b b_2 *path*); the effect of TB on suicide risk was nonsignificant (Fig. 1, Model 1a b_2 *path*). Bootstrapping analyses revealed a significant serial indirect effect of posttraumatic mental contamination on suicide risk via both total PTSD symptoms and PB (Fig. 1, Model 1b *serial path* a_1db_2), but not via total PTSD symptoms and TB (Fig. 1, Model 1a *serial path* a_1db_2; see Table 4).

In cluster-specific models including TB, PTSD symptoms of avoidance, negative cognitions/mood, and arousal/reactivity (but not re-experiencing) were positively associated with TB (Fig. 2, Models 2b–2d *d paths*), controlling for posttraumatic mental contamination and other covariates. Controlling for posttraumatic mental contamination, other covariates, and either PTSD re-experiencing (Fig. 2, Model 2a, b_2 *path*) or PTSD avoidance symptoms (Fig. 2, Model 2b, b_2 *path*), TB was significantly associated with suicide risk. However, b_2 pathways for PTSD negative cognitions/mood (Fig. 2, Model 2c) and arousal/reactivity (Fig. 2, Model 2d) models were nonsignificant.

Table 3 Simple indirect effect models via PTSD symptoms

Posttraumatic mental contamination → PTSD symptoms → Suicide risk							
	c	a_0	b_0	c_0'	a_0b_0	BC 95% CI	
						Lower	Upper
Indirect effect model via							
PTSD-total symptoms	0.06 (0.12)	**3.85 (0.53)*****	**0.05 (0.02)****	−0.12 (0.13)	**0.18 (0.09)**	**0.03**	**0.40**
PTSD-re-experiencing	0.06 (0.12)	**0.93 (0.15)*****	**0.12 (0.06)***	−0.05 (0.13)	**0.11 (0.07)**	**0.004**	**0.28**
PTSD-avoidance	0.06 (0.12)	**0.34 (0.08)*****	**0.25 (0.10)***	−0.03 (0.12)	**0.09 (0.05)**	**0.01**	**0.21**
PTSD-negative cognitions/mood	0.06 (0.12)	**1.43 (0.21)*****	**0.10 (0.04)***	−0.08 (0.13)	**0.14 (0.09)**	**0.002**	**0.35**
PTSD-arousal/reactivity	0.06 (0.12)	**1.14 (0.17)*****	**0.14 (0.05)****	−0.10 (0.13)	**0.16 (0.09)**	**0.03**	**0.37**

c, a_0, b_0, and c_0' represent model pathway unstandardized coefficients: c = total effect of posttraumatic mental contamination on suicide risk; a_0 = effect of posttraumatic mental contamination on PTSD symptom variable; b_0 = effect of PTSD symptom variable on suicide risk, controlling for posttraumatic mental contamination; c_0' = direct effect of posttraumatic mental contamination on suicide risk, controlling for PTSD symptom variable; a_0b_0 = indirect effect via PTSD symptom variable. Significant pathways are bolded. Model covariates include biological sex, history of unwanted sexual experience, contact contamination, and depression

*$p < .05$; **$p < .01$; ***$p < .001$

Bootstrapping analyses revealed significant serial indirect effects of posttraumatic mental contamination on suicide risk via positive links with PTSD avoidance and TB (Table 4; Fig. 2, Model 2b *serial path* a_1db_2), as well as via PTSD arousal/reactivity and TB (Table 4; Fig. 2, Model 2d *serial path* a_1db_2). Serial indirect effect pathways in PTSD re-experiencing and negative cognitions/mood models were nonsignificant.

In cluster-specific models including PB, PTSD symptoms of re-experiencing, avoidance, and arousal/reactivity (but not negative cognitions/mood) were positively associated with PB (Fig. 3, Models 3a, 3b, and 3d *d paths*), controlling for posttraumatic mental contamination and other covariates. Controlling for posttraumatic mental contamination, other covariates, and model-specific PTSD symptom clusters, PB was significantly associated with suicide risk in all models (Fig. 3, Models 3a–3d b_2 *path*). Bootstrapping analyses revealed significant serial indirect effects of posttraumatic mental contamination on suicide risk via positive links with PTSD avoidance and PB (Table 4; Fig. 3, Model 3b *serial path* a_1db_2), as well as via PTSD arousal/reactivity and PB (Table 4; Fig. 3, Model 3d *serial path* a_1db_2). Serial indirect effect pathways in PTSD re-experiencing and negative cognitions/mood models were nonsignificant.

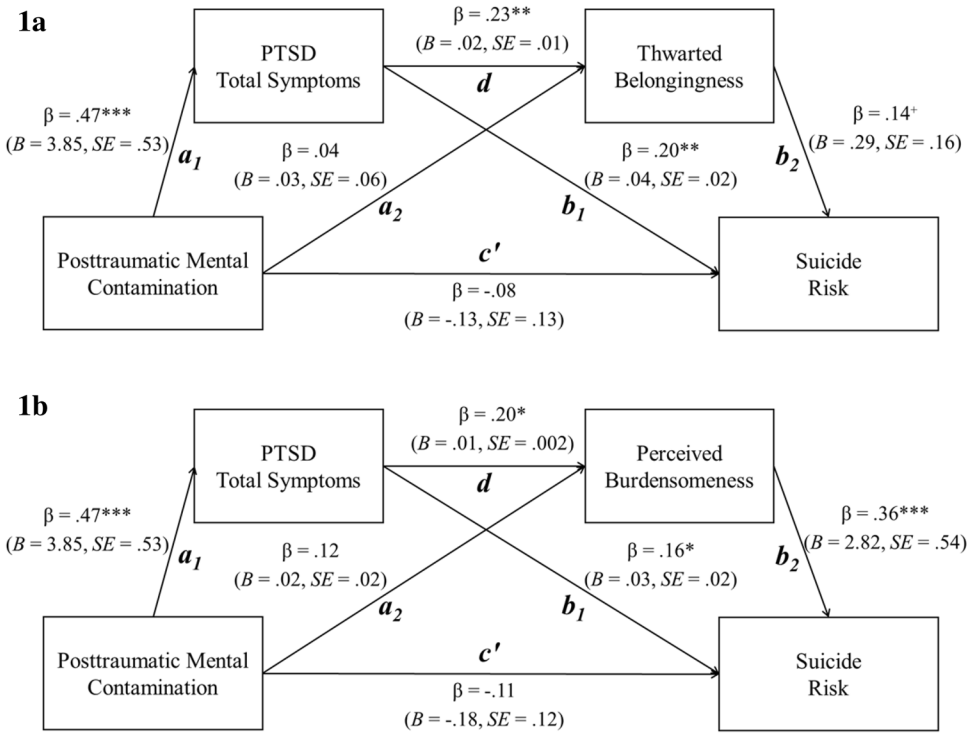
Discussion

The present study is the first to establish a significant association between posttraumatic mental contamination and suicide risk. After accounting for biological sex,

Table 4 Serial indirect effect models

Posttraumatic mental contamination → PTSD symptoms → Thwarted belongingness/perceived burdensomeness → Suicide risk										
	Thwarted belongingness					Perceived burdensomeness				
	β	B	SE	BC 95% CI		β	B	SE	BC 95% CI	
				Lower	Upper				Lower	Upper
Total effect (c)	0.04	0.06	0.12	−0.17	0.29	0.04	0.06	0.12	−0.17	0.29
Serial indirect effects (a_1db_2)										
PTSD-total symptoms	0.02	0.03	0.02	−0.001	0.10	**0.03**	**0.06**	**0.03**	**0.005**	**0.15**
PTSD-re-experiencing	0.01	0.01	0.01	−0.01	0.05	0.02	0.04	0.03	−0.002	0.12
PTSD-avoidance	**0.01**	**0.01**	**0.01**	**0.0002**	**0.05**	**0.02**	**0.03**	**0.02**	**0.004**	**0.09**
PTSD-negative cognitions/mood	0.02	0.03	0.02	−0.0003	0.10	0.02	0.03	0.03	−0.02	0.11
PTSD-arousal/reactivity	**0.01**	**0.02**	**0.02**	**0.0003**	**0.08**	**0.04**	**0.06**	**0.03**	**0.01**	**0.15**

a_1, d, b_2, and c represent model pathway coefficients: c = total effect of posttraumatic mental contamination on suicide risk; a_1db_2 = serial indirect effect via PTSD symptom variable and thwarted belongingness/perceived burdensomeness. BC 95% CI = bias-corrected 95% confidence interval; significant pathways are bolded. Model covariates include biological sex, history of unwanted sexual experience, contact contamination, and depression



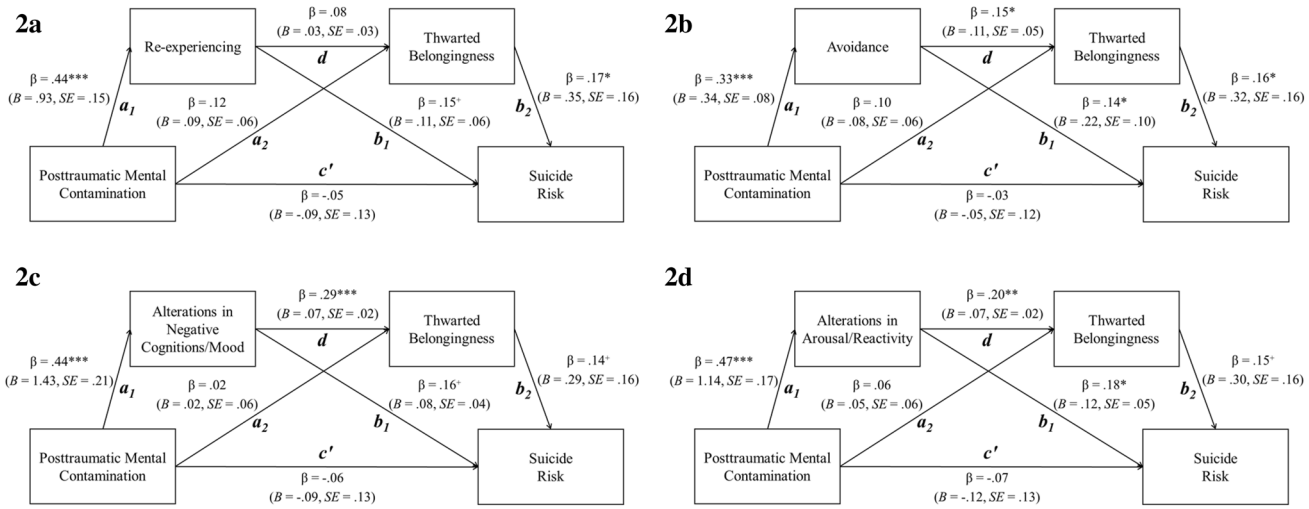


Fig. 1 Model 1a The indirect effect of posttraumatic mental contamination on suicide risk via total PTSD symptoms and thwarted belongingness. Model 1b The indirect effect of posttraumatic mental contamination on suicide risk via total PTSD symptoms and perceived burdensomeness. Model covariates include biological sex, history of unwanted sexual experience, contact contamination, and depression. For total and indirect effect results, see Tables 3 and 4. $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$; $^{+}p < .10$

Fig. 2 Models 2a–2d: The indirect effects of posttraumatic mental contamination on suicide risk via separate PTSD symptom clusters and thwarted belongingness. Model covariates include biological sex, history of unwanted sexual experience, contact contamination, and depression. For total and indirect effect results, see Tables 3 and 4. $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$; $^{+}p < .10$

history of unwanted sexual experience, depression, and contact contamination, posttraumatic mental contamination remained indirectly associated with suicide risk via PTSD total symptoms and symptom clusters. Serial indirect effect models incorporating TB and PB found that only sequential indirect pathways via PTSD avoidance/arousal symptoms and, serially, via TB/PB were significant. The serial indirect pathway including PTSD negative cognitions/mood symptoms (as well as the non-hypothesized pathway including PTSD re-experiencing symptoms) was nonsignificant.

Consistent with hypotheses, mental contamination was linked to suicide risk via alterations in negative cognitions and mood (as well as total symptoms and all other symptom clusters). However, in a notable departure from our hypothesized outcomes, serial pathways incorporating TB/

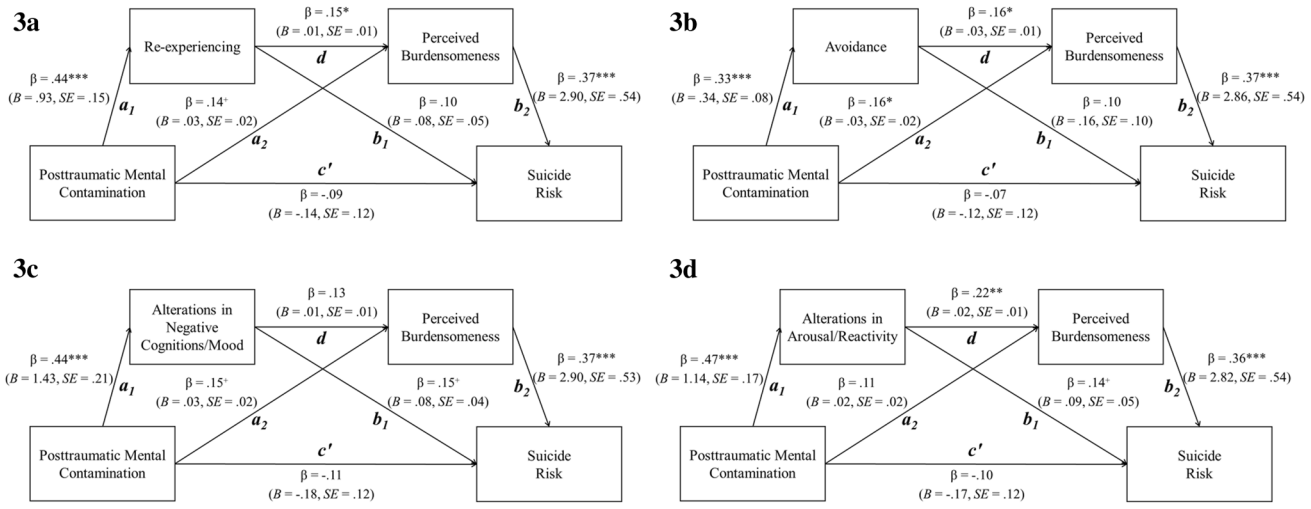


Fig. 3 Models 3a–3d: The indirect effects of posttraumatic mental contamination on suicide risk via separate PTSD symptom clusters and perceived burdensomeness. Model covariates include biological sex, history of unwanted sexual experience, contact contamination, and depression. For total and indirect effect results, see Tables 3 and 4. $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$; $^{+}p < .10$

PB into the models were nonsignificant via PTSD negative cognitions/mood symptoms. These findings suggest that maladaptive changes in one's cognitions and mood are an important pathway by which experiences of posttraumatic mental contamination relate to increased risk for suicide, but that specific interpersonal appraisals of TB and PB do not independently account for a significant portion of this simple indirect pathway. These nonsignificant findings suggest that TB and PB may overlap with PTSD negative cognitions/mood symptoms to such a degree that these specific interpersonal appraisals do not provide incremental utility in predicting suicide risk above and beyond the variance accounted for by the more direct pathway via PTSD negative cognitions/mood alone.

Although not initially predicted, results did show that posttraumatic mental contamination was indirectly related to suicide risk via increased PTSD avoidance and PTSD arousal/reactivity, and subsequently through TB and PB. Pathways via avoidance symptoms may best be understood in the context of maladaptive preventative coping. Researchers have previously speculated that individuals may engage in avoidance of trauma cues to prevent future mental contamination experiences (Badour et al. 2013b), particularly if these experiences are long-lasting and resistant to methods of neutralization (e.g., washing/cleaning). Relevant research has also highlighted that individuals with obsessive–compulsive disorder who experience mental contamination frequently worry about the spread of their contamination to others (Coughtrey et al. 2012), suggesting that individuals experiencing mental contamination may avoid interpersonal contact (e.g., physical contact, sexual intimacy) to minimize perceived risk of contamination spread. As suggested by significant pathways linking PTSD avoidance symptoms and TB/PB in the present models, these forms of maladaptive avoidance may correspond with diminished sense of belonging (e.g., due to avoidant isolation) and perceptions of oneself as burdensome to others (e.g., due to risk of contaminating others). Thus, mental contamination-related avoidance and maladaptive interpersonal appraisals may explain increased suicide risk, particularly if these interpersonal states are believed to be inescapable.

Significant serial pathways via arousal/reactivity symptoms and TB/PB may similarly be explained by persistence of posttraumatic mental contamination long after the traumatic event (Badour et al. 2013a; Fairbrother and Rachman 2004) and disruptions potentially associated with increased contamination-based distress. Research has previously noted that individuals are often hypervigilant to future risk of mental contamination once an initial fear of contamination has been established (Rachman et al. 2015). Additionally, increased reckless or self-destructive behaviors (e.g., self-harm, substance use; included in the DSM-5 PTSD arousal/reactivity symptom cluster) have also been linked to mental contamination in trauma contexts (Brake et al. 2018) and may contribute to further interpersonal impairment. Previous research has also connected PTSD symptoms of sleep disturbance, concentration impairment, and irritability to TB (but not PB), in partial alignment with the present findings. Though these results are preliminary, persistent and unmanageable posttraumatic mental contamination may be linked to increased hypervigilance and worry about future contamination, increased harmful behaviors, elevated irritability, and increased sleep and concentration difficulties; these PTSD arousal/reactivity symptoms may subsequently

link to increased perceptions that one is incapable of reciprocating in relationships and burdensome to others, ultimately elevating contemplation of suicide.

The present study is not without several limitations that should be noted. First, as with many early investigations of novel relationships, these findings are preliminary, utilizing a community sample and self-report methods at a single time point. Notably, the present study utilized a heterogenous trauma-exposed sample whose most common index trauma involved injury, illness, or death of a loved one. Given that prior mental contamination research has often focused on traumatic events involving physical contact (e.g., sexual violence), further research is needed to determine the likelihood of emergent mental contamination from different types of traumatic events, and how such differences may manifest in this model of posttraumatic suicide risk. Present findings may be representative of clinical PTSD samples, given that 15.3% of the present sample met probable PTSD criteria. Previous research has also demonstrated the utility of viewing PTSD as a dimensional disorder (Ruscio et al. 2002) and noted the clinical and empirical relevance of subclinical PTSD symptoms (e.g., Stein et al. 1997). Still, future investigations should aim to replicate these findings in clinical samples over multiple time points with additional interviewer- and observation-based assessment methods. Additionally, as this study design was cross-sectional, causation and temporal precedence cannot be concluded, and it remains possible that these variables may proceed in a different order than those tested in the present models. Future longitudinal designs are needed to determine the strength, directionality, and order of these relationships. Lastly, some measurement limitations should be noted. First, the present measure of suicide risk (i.e., the SBQ-R) included items relevant to both suicidal ideation and likelihood of future suicidal behavior. Thus, links between suicide risk and both TB and PB (suicidal ideation-specific IPTS factors) may have been dampened, and future studies should consider inclusion of suicidal behavior-specific variables such as the capability for suicide (Chu et al. 2017). The present study also utilized an adapted version of a well-established trait-based mental contamination scale (i.e., VOCI-MC) to measure mental contamination specifically resulting from an individual's most distressing traumatic experience. Although these alterations to the VOCI-MC were slight and preliminary psychometric analyses on our trauma-specific measure reported here are promising, further validation of this adapted measure is necessary to ensure its added utility over existing measures.

In conclusion, the present study introduced a newly adapted, posttraumatic version of the VOCI-MC to assess novel relationships between posttraumatic mental contamination, impersonal risk factors of TB and PB, and suicide risk. Posttraumatic mental contamination appears to show initial associations with suicide risk via all clusters of posttraumatic stress symptoms, and suicide risk-related interpersonal appraisals of TB and PB appear to play particularly important roles in explaining links via PTSD avoidance and arousal/reactivity. Future studies should aim to expand these initial findings to improve existing frameworks of posttraumatic mental contamination and the unique role it may play in suicide risk.

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Compliance with Ethical Standards

Conflict of Interest C. Alex Brake, Thomas G. Adams, Caitlyn O. Hood, and Christal L. Badour declare they have no conflict of interest.

Informed Consent Informed consent was obtained from all participants included in the present study.

Animal Rights No animal studies were carried out by any of the authors for this article.

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