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PTSD symptom severity and sensitivity to blood, injury, and mutilation in U.S. army special operations soldiers

James A. Naifeh, Robert J. Ursano, Natasha Benfer, Hongyan Wu, Michelle Herman, David M. Benedek, Dale W. Russell, K. Nikki Benevides, Tzu-Cheg Kao, Tsz Hin H. Ng, Pablo A. Aliaga, Gary H. Wynn, Lei Zhang, Robert D. Forsten, Carol S. Fullerton

ABSTRACT

Sensitivity to blood, injury, and mutilation (SBIM) may increase risk for posttraumatic stress disorder (PTSD), given that traumatic events often involve actual or perceived threat of bodily harm to oneself and/or others, including exposure to blood and other mutilation-related stimuli. A self-report questionnaire was administered to male, active duty, U.S. Army Special Operations Command soldiers who had deployed to Iraq and Afghanistan (n = 694 males). We first used exploratory factor analysis to examine whether the 30-item Mutilation Questionnaire (Klorman et al., 1974) comprised a unitary measure of SBIM, finding that 10 of the items form a cohesive SBIM factor. Summed, those 10 SBIM items had a significant bivariate correlation with PTSD symptom severity. In a multiple regression analysis that included demographic characteristics and lifetime trauma exposure, SBIM was positively associated with PTSD symptom severity. Other significant multivariate predictors were high lifetime trauma exposure and junior enlisted rank. When trait neuroticism was added to the model to test the robustness of these findings, the association of SBIM with PTSD symptom severity remained significant. The results suggest that SBIM may be a risk factor for PTSD in male soldiers. Further research is warranted to improve measurement and understanding of SBIM.

1. Introduction

Military service members who deployed in support of the wars in Iraq and Afghanistan are at risk of developing posttraumatic stress disorder (PTSD), with average post-deployment prevalence estimates of approximately 5% in the total population to 13% in operational infantry units that directly engaged in combat (Kok et al., 2012). In addition to its adverse effects on the wellbeing and functioning of individual service members, PTSD strains families and impairs interpersonal relationships (Monson et al., 2009). Identification of risk factors that are present prior to enlistment may improve our understanding of PTSD risk among service members, yet research on pre-existing factors that influence post-deployment PTSD, particularly trait-like vulnerabilities, remains limited. One potentially relevant characteristic is sensitivity to blood, injury, and mutilation (SBIM), which is used here to refer to fears of being injured, seeing another person injured, and exposure to mutilation-related stimuli (e.g., blood, wounds).

The association between combat exposure and PTSD is well established (Kok et al., 2012). Meta-analytic findings also highlight the importance of pre-existing risk factors and vulnerabilities in understanding risk (Brewin et al., 2000; Ozer et al., 2003; Xue et al., 2015). Prior research has found that PTSD among service members is associated with a number of demographic characteristics, including female gender, younger age, lower education, and minority race or ethnicity (Brewin et al., 2000; Xue et al., 2015). Military rank, which varies as a function of age, education, and time in service, has demonstrated a negative association with post-deployment PTSD, with risk being highest among lower-ranking enlisted soldiers (Xue et al., 2015). Other predisposing factors, such as history of trauma exposure and adversity (Agorastos et al., 2014; Xue et al., 2015) and personality characteristics (e.g., neuroticism) (Bernsten et al., 2012; Koffel et al., 2016), have also been found to influence the risk and trajectory of post-deployment PTSD symptoms in military personnel. SBIM may also...
play an important role in risk for PTSD symptoms, given that traumatic events typically involve exposure to fear-relevant stimuli, such as actual or threatened bodily harm to oneself or others, and possibly exposure to blood and other mutilation-related stimuli. This is particularly relevant for soldiers in a combat environment, where bullets and explosive ordinance increase the likelihood of experiencing or witnessing devastating and grotesque injuries.

Fear of injury has been characterized as one of the fundamental sensitivities in humans (Taylor, 1993). An early epidemiological study estimated that fear of injury was present in 182 per 1000 people, with 23 per 1000 having a fear of injury intense enough to interfere with responsibilities at work and home (Agras et al., 1969). However, evidence suggests that fear of injury to oneself is just one of several related sensitivities. Factor analytic research indicates that fears related to injury, blood, surgical procedures, illness, and death comprise a distinct dimension of common fears (with others being animal fears, social fears, and agoraphobia), and that this dimension is invariant across clinical and non-clinical samples, cross-national samples, and gender (Arrindell et al., 1984, 1991; Arrindell and van der Ende, 1986). These correlated sensitivities may have a biological basis. For example, heritability research with twins has found evidence of a specific genetic component related to blood-injection-injury phobia (Kendler et al., 2002; Loken et al., 2014). Exposure to images depicting injury and mutilation is associated with physiological and behavioral reactivity, as well as self-reported arousal, negative affect, and disgust (Azevedo et al., 2005; Bradley et al., 2001, 2003; Lang et al., 2008; Levenson, 1992; McC Carroll et al., 1995b).

Self-report measures of SBIM-related constructs often span injury to self and others, accidents and medical/surgical procedures, as well as stimuli that are primary (e.g., being cut, receiving an injection) and secondary (e.g., blood, hospitals). The 30-item Mutilation Questionnaire (MQ; Klorman et al., 1974), which was designed to assess the cognitive-verbalexpression of gruesome tasks or events where bodily injury is possible, is an SBIM-focused measure that appears to cover many of these areas and has previously demonstrated utility in military mental health research. Among both experienced and inexperienced military mortuary workers, greater self-reported SBIM was associated with anticipatory inhibition and avoidance symptoms of handling human remains during the Persian Gulf War (McC Carroll et al., 1995a). Although these findings provide evidence of a relationship between SBIM and stress responses to potentially traumatic stimuli, SBIM has not been examined as a risk factor for developing PTSD symptoms after trauma exposure. Furthermore, the structural properties of the MQ among military personnel have yet to be evaluated. A factor analysis of college student data by Kleinnecht and Thordrude (1990) found that the MQ may not be a cohesive measure of a unitary construct, with 11 factors generating eigenvalues of >1. While these authors argued that a two-factor solution (which they labeled “rejection and revulsion of blood, injury, and mutilation” and “fear of bodily damage”) was most parsimonious, their findings indicate a significant degree of MQ item heterogeneity.

To begin addressing these gaps in the extant literature, this study of active duty, previously deployed U.S. Army soldiers first examined the factor structure of the MQ. The resulting factor structure was then used to examine the association of SBIM with PTSD symptom severity, first at the bivariate level, then after adjusting for other pre-existing factors, including demographics, lifetime trauma exposure, and trait neuroticism.

2. Methods

2.1. Participants

Male, active duty, U.S Army Special Operations Command (SOC) soldiers who had previously deployed (n=694) were recruited between 2009 and 2011 as part of a larger study on genetic biomarkers of traumatic stress approved by the Institutional Review Board at the Uniformed Services University of the Health Sciences. Members of the research team recruited groups of soldiers by explaining the purpose of the study and informing them that participation was voluntary and confidential. Those who chose to participate provided written informed consent and completed a de-identified self-report questionnaire assessing mental health outcomes and psychosocial risk factors. For the current study, we excluded participants who reported no lifetime exposure to traumatic events (n=19) and those with missing data on more than 20% of items on the PTSD Checklist, measuring of PTSD symptom severity (n=4). This resulted in an analytic sample of 671 soldiers, most of whom were white (71.24%), senior enlisted or officer rank (≥E5) (67.85%), married (63.93%), and had more than a high school education (72.43%). Age ranged from 18 to 57 years (M=30.00, SD=7.34) (Table 1).

2.2. Measures

2.2.1. Posttraumatic stress disorder

The PTSD Checklist-Civilian version (PCL-C) is a 17-item self-report instrument corresponding to Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition-Text Revised (DSM-IV-TR; American Psychiatric Association, 2000) (DSM-IV-TR criteria for PTSD (Weathers et al., 1993). Respondents are asked to indicate the degree to which they have been bothered by each symptom using a 5-point Likert-type scale (1= Not at all, to 5= Extremely). Items are summed to create a total score indicating PTSD symptom severity, which served as the primary outcome variable in the current study. For descriptive purposes, we also classified soldiers according to probable PTSD diagnosis based on endorsement of items corresponding to DSM-IV-TR diagnostic criteria (one re-experiencing, three avoidance, and two hyperarousal symptoms; American Psychiatric Association, 2000), plus a PCL-C total score of ≥50 (e.g., Hoge et al., 2004). This instrument has strong psychometric support in both civilian and military populations (Ruggiero et al., 2003). In the current sample, the PCL-C demonstrated strong internal consistency (α=0.96).
22.2. Sensitivity to blood, injury, and mutilation

The Mutilation Questionnaire (MQ; Kllorman et al., 1974) is a 30-item self-report measure assessing the verbal-cognitive component of fear related to gruesome tasks or events involving the potential for bodily injury (e.g., injuries, accidents, blood, etc., bother me more than anything else; I feel sick or faint at the sight of blood; I could never swab out a wound) (the full measure is available in Antony, 2001). Items are rated as true or false, then summed to create a total severity score. Validity of the MQ is supported by evidence that individuals scoring high on the MQ rate pictures of mutilation as significantly more unpleasant and arousing than controls, and have potentiated startle responses (eye blink) during viewing of mutilation versus neutral images (Hamm et al., 1997). In the current sample, the MQ demonstrated good internal consistency (α=0.76).

2.2.3. Lifetime trauma exposure

The Life Events Checklist (LEC; Blake et al., 1990) is a 17-item self-report measure assessing lifetime exposure to a broad range of potentially traumatic events (e.g., accident, sexual assault, combat). Respondents rate their degree of exposure to each event using a 5-point nominal scale (1=happened to me, 2=witnessed it, 3=learned about it, 4=not sure, and 5=does not apply). The LEC has demonstrated adequate test–retest reliability, as well as convergent validity (Gray et al., 2004) with an established measure of traumatic event exposure (Traumatic Life Events Questionnaire; Kubany et al., 2000). Endorsed items (responses of either 1=happened to me or 2=witnessed it) were summed to create a total score indicating the number of different types of traumatic events experienced. Internal consistency of the LEC in the current sample was 0.76.

2.2.4. Neuroticism

The neuroticism subscale of the NEO-Five Factor Inventory (NEO-FFI; Costa and McCrae, 1992) is a 12-item self-report measure. Respondents are asked to indicate their level of agreement with each item (I=Strongly Disagree to 5=Strongly Agree). Items are summed to create a total score for the subscale, with higher scores indicating higher levels of trait neuroticism. The NEO-FFI neuroticism subscale had good internal consistency in the current sample (α=0.88).

2.2.5. Demographic characteristics

We collected demographic information using a self-report questionnaire. A four-category race variable (American Indian/Alaskan Native, Asian/Pacific Islander, Black, White) was dichotomized for analyses (white vs. other). Military rank, which was assessed as an open-ended question, was dichotomized into junior enlisted (E1-E4) and senior enlisted or officer (≥E5). Participants indicated if they were currently married (yes vs. no) and their highest level of education (less than 12th grade, high school/GED, some college/technical school, bachelor’s degree, graduate degree), which was dichotomized for analyses (high school or less vs. more than high school). Age was assessed and analyzed as a continuous variable.

2.3. Data analysis

All analyses were conducted using SAS version 9.3 (SAS Institute Inc, 2011). We first examined the structure of the MQ using principal-axis factor analysis with Promax rotation. Next, bivariate correlations were used to examine associations among all variables. A multiple regression analysis examined the association of SBIM (based on the MQ factor analysis results) with PTSD symptom severity (PCL-C total score) while adjusting for other predictors that were significant at the bivariate level. We then tested the robustness of the SBIM association by adding trait neuroticism to the multivariate model. We report the standardized beta coefficients (β) for the regression, as well as squared semi-partial correlations, which indicated the unique variance explained by each predictor in the model.

3. Results

3.1. Descriptive statistics

PTSD symptom severity ranged from 17 to 85 (M=29.61; SD=13.06), with 10.43% (n=70) meeting criteria for probable PTSD. The number of different types of lifetime traumatic events ranged from 1 to 17 (M=8.17, SD=3.21), with combat exposure the most frequently reported type of event (86.12%). To ensure PTSD cases were represented across levels of trauma exposure, we dichotomized the count of LEC events based on the median among those who met criteria for PTSD (high >9, low ≥9). MQ total score ranged from 0 to 25 (M=5.15, SD=3.55), and trait neuroticism ranged from 8 to 56 (M=29.57, SD=7.64) (Table 1).

3.2. MQ factor analysis results

The internal reliability (standardized Cronbach's alpha =0.81) and factorability of the items (Kaiser's Measure of Sampling Adequacy =0.84) suggested that the MQ was suitable for factor analysis. Examination of the correlation matrix revealed extremely low correlations (|r|<0.1) between the six reverse-scored MQ items and the remaining MQ items. We used principal-axis factor analysis, which does not require distributional assumptions for MQ items (Fabrigar et al., 1999), and Promax rotation. The analysis generated support for a two-factor solution: the first factor had an eigenvalue of >1, while the second factor had an eigenvalue of 0.99; and the scree plot had an ‘elbow’ at the second factor. The inter-factor correlation was 0.37. The co-variance of MQ items explained by factor 1 was 3.6 (12.1%, based a total variance of 30 for the 30 MQ items), and 1.1 (3.6%) by factor 2. Ten items loaded on factor 1 at ≥0.40, and three items (all reverse-scored) loaded on factor 2 at ≥0.40 (Table 2). Although the remaining 17 items did not load on any factor with a coefficient of ≥0.40, it is noteworthy that 22 of the 30 MQ items loaded on factor 1 at ≥0.30. The

| Table 2 |
| Factor Loadings (≥0.40) of Mutilation Questionnaire Items. |

<table>
<thead>
<tr>
<th>Item</th>
<th>Abbreviated/Paraphrased Item Content</th>
<th>Rotated Factor Loadingsb</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Factor 1: “SBIM”</td>
<td>Factor 2: “Medical Interest”</td>
</tr>
<tr>
<td>19.</td>
<td>Sharp knives make me nervous</td>
<td>0.545</td>
</tr>
<tr>
<td>20.</td>
<td>Cuts and wounds upset me</td>
<td>0.525</td>
</tr>
<tr>
<td>29.</td>
<td>Open wounds nauseate me</td>
<td>0.508</td>
</tr>
<tr>
<td>15.</td>
<td>Injuries, accidents, blood bother me...</td>
<td>0.504</td>
</tr>
<tr>
<td>3.</td>
<td>Turn away from badly injured person on TV</td>
<td>0.481</td>
</tr>
<tr>
<td>4.</td>
<td>I dislike looking at pictures of accidents</td>
<td>0.473</td>
</tr>
<tr>
<td>11.</td>
<td>Power tools make me nervous</td>
<td>0.463</td>
</tr>
<tr>
<td>10.</td>
<td>Feel faint if I saw a wounded eye</td>
<td>0.455</td>
</tr>
<tr>
<td>26.</td>
<td>Shoulder when I think of cutting myself</td>
<td>0.418</td>
</tr>
<tr>
<td>25.</td>
<td>Frightened I might have to help an injured person</td>
<td>0.501</td>
</tr>
<tr>
<td>21.</td>
<td>Interesting to see the action of internal organs (reverse scored)</td>
<td>0.460</td>
</tr>
<tr>
<td>14.</td>
<td>Enjoy articles about medical techniques (reverse scored)</td>
<td>0.441</td>
</tr>
<tr>
<td>9.</td>
<td>Career as a doctor is attractive (reverse scored)</td>
<td></td>
</tr>
</tbody>
</table>

SBIM = sensitivity to blood, injury, and mutilation

a Factor loadings for the additional Mutilation Questionnaire items are available upon request.
b Promax rotation.
10 items in factor 1 (which we labeled “SBIM”) items appear to assess sensitivity to actual or threatened injury to others or oneself, as well as sensitivity to blood, wounds, and other mutilation-related stimuli. The three items in factor 2 (which we labeled “Medical Interest”) appear to be primarily related to interest in medical procedures. Items in each factor were summed to create total scores for use in subsequent analyses. The SBIM and Medical Interest factors were correlated with the MQ total score at 0.64 (p < 0.0001) and 0.63 (p < 0.0001), respectively.

3.3. Association of SBIM with PTSD symptom severity

PTSD symptom severity was negatively correlated with age (Spearman ρ = −0.20, p < 0.0001), education (ρ = −0.13, p = 0.0007), and rank (ρ = −0.20, p < 0.0001), and positively correlated with lifetime trauma exposure (ρ = 0.22, p < 0.0001), the SBIM factor (ρ = 0.13, p = 0.0007), and neuroticism (ρ = 0.45, p < 0.0001). PTSD symptom severity was not associated with race (ρ = 0.06, p = 0.10) or marital status (ρ = −0.05, p = 0.17). Importantly, the Medical Interest factor was not correlated with PTSD symptom severity at the bivariate level (ρ = 0.06, p = 0.14), and therefore was not included in subsequent analyses. The SBIM factor was positively correlated with neuroticism (ρ = 0.15, p = 0.0002) and trended toward a significant negative correlation with lifetime trauma exposure (ρ = −0.07, p = 0.05) (Table 3).

A multiple regression model that included age, education, rank, lifetime trauma exposure, and the SBIM factor significantly predicted PTSD symptom severity, F(5, 611) = 16.04, p < 0.0001, with the full model accounting for 11% of the variance (adjusted R² = 0.11). Increased PTSD symptom severity was associated with junior enlisted rank (β = −0.16, p = 0.0003), high lifetime trauma exposure (β = 0.20, p < 0.0001), and higher levels of SBIM (β = 0.19, p < 0.0001). The association with education trended toward significance (β = 0.08, p = 0.06). Squared semi-partial correlations indicated that SBIM uniquely accounted for 3.4% of the variance, similar to the unique variance accounted for by lifetime trauma exposure (3.9%), and more than the unique variance accounted for by rank (1.9%), education (0.5%), and age (0.34%) (Table 4). Given the trend toward a significant negative correlation between the SBIM factor and lifetime trauma exposure, as well as the potential relevance of prior traumatic experiences to both SBIM and PTSD symptom severity, we examined the interaction of SBIM and lifetime trauma exposure in predicting PTSD symptom severity after adjusting for their main effects and the other covariates. The interaction term suggested that the effect of SBIM is significantly stronger among those with higher lifetime trauma exposure (β = 0.16, p = 0.02).

We then added trait neuroticism to the model that included SBIM and the other covariates (age, education, rank, lifetime trauma exposure) in order to examine the robustness of the SBIM association. SBIM remained a unique predictor of PTSD symptom severity (β = 0.10, p = 0.007), along with neuroticism (β = 0.37, p < 0.0001), lifetime trauma exposure (β = 0.21, p < 0.0001), and rank (β = −0.10, p = 0.03).

Lastly, we used stepwise regression to examine the associations of individual items from the SBIM factor with PTSD symptom severity, using entry and exit criteria of 0.05. Adjusting for age, education, rank, and lifetime trauma exposure, three of 10 items from the SBIM factor were retained in the model: If a badly injured person appears on TV, I turn my head away (β = 0.11, p = 0.006); Not only do cuts and wounds upset me, but the sight of people with amputated limbs, large scars, or plastic surgery also bothers me (β = 0.10, p = 0.009); and I shudder when I think of accidentally cutting myself (β = 0.09, p = 0.03).

4. Discussion

Among U.S. Army SOC soldiers, SBIM trends toward a negative association with lifetime trauma exposure but increases risk for PTSD symptoms, and the relation between SBIM and PTSD symptom severity appears to be modified by level of lifetime trauma exposure. These findings suggest that some individuals with high levels of SBIM may be less likely to experience traumatic events, perhaps through avoidance of certain risky situations (e.g., diabetic patients with fear of blood and injury perform fewer blood glucose measurements, resulting in poorer glycemic control; Berlin et al., 1997), but more likely to develop PTSD symptoms when trauma exposure is unavoidable (e.g., war, disasters). SBIM accounted for more unique variance than well-established demographic risk factors (age, education, rank), and approximately the same amount of unique variance as lifetime trauma exposure. Although moderately correlated with trait neuroticism, SBIM maintained a unique association with PTSD symptom severity even after accounting for trait neuroticism. These results expand on prior evidence suggesting that SBIM may constitute a pre-existing vulnerability to trauma-related psychopathology in military personnel (McCarroll et al., 1995a). Interestingly, this robust association was observed despite low endorsement of SBIM-related items. Even when considering all 30 MQ items, the SOC soldiers in our sample had a mean score of only 5.15, which is lower than what has been reported in previous studies of male college students (M = 8.10–8.45) (KleinKnecht and Thorsdike, 1990) but closer to the mean of 6.2 reported in male military mortuary workers (McCarroll et al., 1995a).

Table 3

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Bivariate Spearman correlations.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>1. Age</td>
<td></td>
</tr>
<tr>
<td>2. Race</td>
<td></td>
</tr>
<tr>
<td>3. Education</td>
<td>0.44****</td>
</tr>
<tr>
<td>4. Marital status</td>
<td>0.34****</td>
</tr>
<tr>
<td>5. Rank</td>
<td>0.59****</td>
</tr>
<tr>
<td>6. Lifetime trauma exposure</td>
<td>0.15****</td>
</tr>
<tr>
<td>7. MQ total score</td>
<td>0.05</td>
</tr>
<tr>
<td>8. SBIM (MQ Factor 1 total score)</td>
<td>0.04</td>
</tr>
<tr>
<td>9. Medical Interest (MQ Factor 2 total score)</td>
<td>0.04</td>
</tr>
<tr>
<td>10. PTSD symptom severity</td>
<td>−0.29****</td>
</tr>
<tr>
<td>11. Neuroticism</td>
<td>−0.29****</td>
</tr>
</tbody>
</table>

Variable coding: Race (white non-Hispanic =1, other =0); Education (> high school =1, ≤ high school =0); Marital status (married =1, single =0); Rank (≥ E5=1, E1-E4=0); Lifetime trauma exposure (high =1, low =0), based on a median split of items endorsed (Happened to me, Witnessed it) by PTSD cases on the Life Events Checklist (high > 9 events, low ≤ 9 events).

MQ = Mutilation Questionnaire; SBIM = sensitivity to blood, injury, and mutilation; PTSD = posttraumatic stress disorder

**** p < 0.0001, ** p < 0.01, * p < 0.05, . p < 0.10

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or neutral images (Azevedo et al., 2005). Exposed to threatening stimuli, relative to when they viewed pleasant (1995a) found that military mortuary workers who had volunteered during military training. Consistent with self-selection, McCarroll et al. (2009) noted that volunteers.

Squared semi-partial correlation = unique proportion of variance explained by the predictor.

PTSD risk is not yet known. One possibility is that high levels of SBIM exposure), those with high levels of self-reported SBIM exhibit cardiac acceleration, providing evidence of defensive reactions among those most fearful of these stimuli (Klorman et al., 1977; Levenson, 1992).

Three limitations to current study are noteworthy. First, the cross-sectional nature of these data precludes determination of a causal relationship between SBIM and PTSD symptom severity. Longitudinal research is needed to understand how SBIM and prior trauma history may interact to increase risk of subsequent PTSD, as well as whether the onset of PTSD symptoms increases the severity of SBIM. Second, these results may not generalize beyond male SOC soldiers. Those who successfully complete the rigorous selection process and training for special operations may have unique psychological, behavioral, and biological characteristics (Bartone et al., 2008; Morgan et al., 2008; Vythilingam et al., 2009) that make them more resilient than other service members (Hanwella and de Silva, 2012). Third, it is unknown how well soldiers' self-reported mutilation fear corresponds to observable physiological and behavioral fear indices, or whether such indices would demonstrate similar associations with PTSD symptom severity.

Within the context of these limitations, the findings contribute to our understanding of PTSD risk. Future research should be undertaken to improve the measurement of SBIM in order to understand its potential role in the etiology of traumatic stress responses. Given the factor analytic results from this study and Kleinknecht and Thorndike (1990), research on SBIM would benefit from the refinement of existing self-report measures, particularly the MQ, or the development of entirely new measures. For example, researchers might examine whether PTSD risk is differentially associated with items assessing primary (e.g., fear of injury) versus secondary (e.g., fear of knives, doctors) stimuli. With improved measurement, it will also be important to consider the role of SBIM in treating PTSD. Unaddressed SBIM may complicate or prolong treatment by contributing to the persistence of emotional and physiological reactivity to trauma-related stimuli. As with other fear-based phenomena, SBIM is likely amenable to cognitive and exposure-based interventions. Interventions could be integrated into existing PTSD psychotherapies with strong empirical support, such as prolonged exposure therapy and cognitive processing therapy (Institute of Medicine, 2008). To the extent that SBIM constitutes a vulnerability factor, addressing it during PTSD treatment may promote resilience to subsequent posttraumatic stress and other forms of psychopathology.

Acknowledgements

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### Table 4

<table>
<thead>
<tr>
<th>Predictors</th>
<th>Association with PTSD symptom severity</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>β = Standardized regression coefficient (beta).</td>
<td>p</td>
<td>Squared semi-partial correlation</td>
<td>Adjusted model R²</td>
</tr>
<tr>
<td>Education (&gt; high school = 1, ≤ high school = 0)</td>
<td>-0.07</td>
<td>0.17</td>
<td>0.003</td>
<td>0.11</td>
</tr>
<tr>
<td>Rank (≥ E5 = 1, E1-E4 = 0)</td>
<td>-0.08</td>
<td>0.06</td>
<td>0.005</td>
<td></td>
</tr>
<tr>
<td>Lifetime Trauma Exposure (high = 1, low = 0)</td>
<td>-0.16 ***</td>
<td>0.0003</td>
<td>0.019</td>
<td></td>
</tr>
<tr>
<td>SBIM</td>
<td>0.20 ***</td>
<td>&lt; 0.0001</td>
<td>0.039</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.19 ***</td>
<td>&lt; 0.0001</td>
<td>0.034</td>
<td></td>
</tr>
</tbody>
</table>

β = Standardized regression coefficient (beta).

Squared semi-partial correlation = unique proportion of variance explained by the predictor.

SBIM = Sensitivity to blood, injury, and mutilation (total score of factor 1 derived from the Mutilation Questionnaire)

* Based on a median split of items endorsed (Passed to me, Witnessed it) by PTSD cases on the Life Events Checklist (high > 9 events, low ≤ 9 events).

*** p < 0.001,

**** p < 0.0001.

Table 4
Multivariate associations of SBIM, number of lifetime traumatic events, and demographic characteristics with PTSD symptom severity.

Our SOC sample may reflect self-selection into dangerous military service by individuals with lower SBIM, or possibly the effects of military training. Consistent with self-selection, McCarroll et al. (1995a) found that military mortuary workers who had volunteered for those duties had significantly lower MQ total scores than non-volunteers.

In addition to the factor analytic support previously noted (Arrindell et al., 1984, 1991; Arrindell and van der Ende, 1986), diverse evidence suggests that SBIM may be a fundamental psychological phenomenon. For example, exposure to SBIM-related stimuli elicits fearful responding in a variety of non-human species. An early study found that monkeys react with fear when exposed to stimuli representing conspecific injury, such as a disembodied model of a monkey head (Hebb, 1946). Similarly, rats confronted with muscle tissue and blood from other rats exhibit a variety of fear reactions, including elimination, freezing, and retreating (Stevens and Gerzog-Thomas, 1977). In humans, viewing pictures of mutilated bodies is associated with greater self-reported and psychophysiological arousal (increased skin conductance and startle reflex potentiation) relative to other negative images, as well as broad activation of the visual cortex hypothesized to represent defensive activation and motivated attention toward survival-relevant stimuli (Bradley et al., 2001, 2003). Individuals viewing images of mutilation also exhibit activation of the anterior insula and other brain regions involved in emotional experience (Wright et al., 2004), and they demonstrate reduced postural sway, analogous to the freezing behavior observed in other animals exposed to threatening stimuli, relative to when they viewed pleasant or neutral images (Azevedo et al., 2005).

The specific mechanism(s) through which SBIM is associated with PTSD risk is not yet known. One possibility is that high levels of SBIM may increase vulnerability by affecting the interpretation of threat and the subsequent nature and severity of psychophysiological responses to traumatic events. Whereas individuals without SBIM exhibit heart rate deceleration upon exposure to mutilation images (Baldaro et al., 2001; Gross and Levenson, 1993; Palomba et al., 2000; Steptoe and Wardle, 1988), those with high levels of self-reported SBIM exhibit cardiac acceleration, providing evidence of defensive reactions among those most fearful of these stimuli (Klorman et al., 1977; Levenson, 1992).

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