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Support for a Three-Factor Model

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Testing Previously Proposed Models of the Tonic Immobility Scale in a Peritraumatic Sample of Israeli Civilians: Support for a Three-Factor Model

Abstract

Objective: Tonic immobility (TI) is a peritraumatic response to extreme threat. It is associated with trauma psychopathology and poor treatment outcomes. Yet, previous psychometric evaluations have yielded inconsistent results regarding the number of latent factors of the Tonic Immobility Scale (TIS). Moreover, the TIS has never been validated in a Hebrew-speaking population. This study had two objectives: 1) to reassess previously proposed models of the TIS to determine whether it is best represented by a one-factor model of TI, a two-factor model of TI and fear, or a three-factor model of TI, fear, and detachment; and 2) to validate the TIS in a Hebrew translation.

Methods: A sample of Israeli adults was culled from an online survey following rocket attacks. Confirmatory Factor Analysis was applied to test the previously proposed models, and Pearson's correlations were used to test the association between each of the subscales representing the latent factors and psychological distress.

Results: The best representation of the data was provided by a three-factor model with latent constructs of TI, fear, and detachment. All three peritraumatic responses had significant correlations with peritraumatic distress. Moreover, internal consistency of the TIS was good for the three subscales; this supports the reliability of the Hebrew version.

Conclusion: This study supports using a three-factor model with latent constructs, and the scale appears to be psychometrically sound when translated into Hebrew. Future research should seek to replicate these findings in different trauma populations and should study the unique association of trauma symptomatology.

Keywords: Tonic Immobility, Fear, Detachment, Dissociation, Tonic Immobility Scale

Clinical Implication Statement: Tonic immobility (TI) is associated with severe trauma psychopathology and poor treatment outcomes. Applying the TIS with the three underlying factors of tonic immobility, fear, and detachment can provide clinicians with greater insight into the client's peritraumatic response. Specifically, differentiating between different peritraumatic responses can assist practitioners in helping victims understand their responses to trauma. Furthermore, awareness of different peritraumatic responses is important when planning treatment.

Testing Previously Proposed Models of the Tonic Immobility Scale in a Peritraumatic Sample of Israeli Civilians: Support for a Three-Factor Model

Tonic immobility (TI) is a peritraumatic response characterized by strong motoric inhibition and paralysis of movement, thought, emotion, and vocalization (Gallup, 1977). It is an involuntary physical response that can occur when humans or other animals are exposed to mortal danger or physical restraint, and can be described as the feeling of being paralyzed or frozen while under attack, a state that prevents the victim from resisting or calling for help (Fuse et al., 2007). TI in humans has primarily been studied in relation to rape and childhood sexual abuse (Galliano, 1993; Humphreys, 2010; Marx, 2008), and has previously been referred to as "rape-induced paralysis" (Fuse et al., 2007; Heidt et al., 2005). Nevertheless, TI has been linked with a variety of other traumatic events, including physical assault, torture, war, robbery, motor vehicle accidents, disasters, and even childhood emotional abuse (Abrams et al., 2012; Hagenaars, 2016; Kalaf et al., 2017; Rizvi, 2008; Rocha-Rego et al., 2009).

Although TI is a defensive mechanism intended to protect humans and other animals from physical harm or death, it has been linked with long-term psychological distress, including post-traumatic stress disorder (PTSD), depression, anxiety, and peritraumatic dissociation (de Kleine, 2018; Marx, 2008; Möller, 2017). TI has been associated not only with PTSD severity (de Kleine,

2018; Fiszman et al., 2008; Möller, 2017), but, also, with poorer treatment outcomes (Fiszman et al., 2008; Lima et al., 2010), even after controlling for other peritraumatic responses, such as dissociation and panic (Lima et al., 2010; Rocha-Rego et al., 2009).

The Tonic Immobility Scale (TIS; Forsyth et al., 2000) is the most common way of measuring TI in trauma-exposed individuals. It consists of 10 characteristics derived from animal studies. These include motor inhibition, supressed vocal behavior, tremors, fear, changes in temperature, and analgesia, all of which reflect the behavioral and physiological features associated with TI (Fuse et al., 2007). The scale also includes two items that assess the dissociative features believed to accompany TI and fear in humans, and that are difficult to study in animals (Fuse et al., 2007). Several studies have examined the latent structure of the TIS, and the results have been inconsistent (Covers et al., 2021; Fuse et al., 2007; Reichenheim et al., 2014).

Previous Psychometric Evaluations of the TIS

Fuse and colleagues (2007) were the first to examine the factor structure of the TIS in two independent samples of female undergraduate psychology students who had been victims of non-consensual sexual experiences. Their findings, from an Exploratory Factor Analysis (EFA) in the first sample [N = 88, M_{age} = 19.4], followed by Confirmatory Factor Analysis (CFA) in the second sample [N = 191, M_{age} = 20.0], revealed that the best fit for the data was a two-factor solution, with two latent constructs: TI (7-items; *i*1, *i*2, *i*4, *i*5, *i*6, *i*8, *i*9) and Fear (3-items; *i*3, *i*7, *i*10). Although the authors disclosed some misspecification of the model and argued that the scale could benefit from refining the wording of items and including more indicators for the construct of fear, the study remained the only psychometric evaluation of the scale until Reichenheim and colleagues (2014) reassessed its dimensional structure.

Reichenheim et al. (2014) examined the factor structure of the TIS in two large surveys of violence and mental health conducted in the two largest cities of Brazil. The authors argued that the

available evidence was too narrow to apply the TIS to a broader trauma population, as the scale had only been evaluated among female victims of sexual abuse. Reichenheim et al. (2014) first reassessed the two-factor structure proposed by Fuse et al. (2007) in Sample 1 [N = 2,148, M_{age} = 40.0/39.0 for female/male], and found the model to be a poor fit for the data. The authors then followed the original procedure and applied an EFA in the first sample, followed by a CFA in the second sample [N = 1,075, M_{age} = 43.6/40.8 for female/male]. The results suggested that the best representation of the data was a reduced one-factor solution that removed four of the original items (i.e., *i1 'froze or felt paralyzed,' i3 'trembling/shaking during the event,' i8 'felt as though you were going to die,'* and *i10 'felt detached from what was going on around you'*) due to potential content redundancies, which were indicated by residual correlations.

Building on these contradictory results, Covers et al. (2021) offered an additional examination of the factor structure of the TIS, arguing that the studies by Fuse et al. (2007) and Reichenheim et al. (2014) differed considerably by population, age, and gender, and that this might explain their inconsistent results. Therefore, Covers et al. (2021) applied an EFA in a clinical sample of adolescent and young adult victims of rape [N = 131, M_{age} = 16.4]. Contrary to previous findings, their results suggested that the best representation of the data was a three-factor solution with latent constructs of TI (three items: *i*1, *i*2, *i*4), fear (five items: *i*3, *i*5, *i*6, *i*7, *i*8), and detachment (two items: *i*9, *i*10).

The identification of the third factor, 'detachment,' is meaningful when looking at item nine, *feeling detached from yourself*, and item 10, *feeling detached from what was going on around you*. Although research has clearly demonstrated that TI and dissociation (here, detachment) are two distinct phenomena that can occur independently of each other, they nevertheless appear to be associated (Marx, 2008). In Fuse et al. (2007), item nine loaded on the construct of TI, while item 10 loaded on fear. In Reichenheim et al. (2014), however, item nine also loaded on TI, but item 10

was excluded. The difference in loadings for items nine and 10 was theoretically explained by the argument that detachment from the self might occur during TI, as this response leads the individual to attend to the external environment more closely as they scan for ways to escape – a response that has been observed in non-human animals (Fuse et al., 2007; Marx, 2008). However, dissociation is also associated with symptoms of depersonalization, derealization, out-of-body experiences, and emotional numbness, all of which could also explain the feelings of detachment described in items nine and 10 (Lanius, 2015; Thompson-Hollands et al., 2017). Recent findings by Covers et al. (2021) further challenged the explanation of the factor loadings, and questioned whether the one-factor and two-factor models for TIS actually measure symptoms of both TI and detachment/dissociation.

Inconsistencies in the psychometric evaluations of the TIS have led researchers to use different versions of the scale when studying TI. Some have used one or both subscales proposed by Fuse and colleagues (Fiszman et al., 2008; Fragkaki et al., 2016; Fuse et al., 2007; Hagenaars, 2016), while others have used the reduced one-factor scale proposed by Reichenheim et al. (2014; Kalaf et al., 2017). Finally, some researchers have also applied a further reduced scale, based on an unpublished EFA (Lima et al., 2010), which includes only four physical immobility items (Lima et al., 2010; Portugal et al., 2012; Rocha-Rego et al., 2009; Volchan et al., 2011). The four-item scale included an additional item, *felt unable to escape*, that was not a part of the original scale. Despite the obvious discrepancies in the applied measures, different versions of the TIS have been taken to reflect the underlying construct of TI, and this limits our ability to compare results and to trust the underlying construct and prevalence of TI.

The psychometric evaluations of the TIS, described above, show the need for further investigation into the dimensional structure of the scale. First and foremost, results by Covers et al. (2021) should be confirmed in a second sample. Moreover, the role of age and gender is relevant for

analysis, as these factors have varied across studies, and may therefore have contributed to the inconsistent findings. As suggested by Covers et al. (2021), age might influence the factor structure, as young adults may have distinct peritraumatic reactions, due to differences in coping mechanisms or emotional regulation (Covers et al., 2021; Skinner & Zimmer-Gembeck, 2007). Hence, it is relevant to examine whether findings by Covers et al. (2021) can be replicated in an older sample that includes male participants. Furthermore, peritraumatic reactions may differ across populations, or between clinical samples and convenience samples. Finally, if confirmed, it is important to examine the association between the underlying construct of detachment on the TIS and peritraumatic dissociation.

Limitations of Previous Findings

In addition to the noticeable differences in sample characteristics that might influence the results and explain the inconsistencies, previous studies had significant limitations. Except for Reichenheim et al. (2014), sample sizes were relatively small (Covers et al., 2021; Fuse et al., 2007), and could benefit from replication in larger samples (Kyriazos, 2018). Another shared limitation is the amount of time between the traumatic event and the collection of data. Only Fuse et al. (2007) reported an average time since last assault of approximately 30 months, while the other two studies assessed lifetime experiences and did not report the time estimate (Covers et al., 2021; Reichenheim et al., 2014). Having to recall a peritraumatic response can result in memory bias, misinterpretation of items, social desirability bias, and careless responding (Fuse et al., 2007), all of which can, inevitably, affect the results. To date, no studies have attempted to evaluate the dimensional structure of the TIS based on peritraumatic data collected at the time of the traumatic event.

Objective

The present study was conducted among Israeli civilians exposed to rocket attacks during Operation Guardian of the Walls. This operation lasted for 11 days in May 2021, during which time 4,360 rockets and mortar shells were fired at Israel. The data presented here are unique, as they were collected during the Operation itself, from the fifth day of the attack until several hours after ceasefire. Data were collected from an adult sample comprising both male and female participants affected by the attacks.

Building on existing knowledge and previous evaluations of the dimensional structure of the TIS, the present study reassesses the three proposed models by applying CFA (Covers et al., 2021; Fuse et al., 2007; Reichenheim et al., 2014), while also validating the psychometrics in a Hebrew version. Examining the factor structure of the TIS in a peritraumatic dataset may help to clarify the underlying construct of the scale and determine the best representation of the data. Given the most recent findings from a clinical sample, we expect to identify a three-factor solution with latent constructs of TI, fear, and detachment (Covers et al., 2021) as the best representation of the data. We further aim to test the association between the latent construct of the TIS and peritraumatic symptoms, i.e., psychological distress, including dissociation, peritraumatic posttraumatic stress symptoms, somatization, depression, and anxiety.

Methods

Participants and Procedure

A convenience sample of Israeli adults was drawn from an online survey distributed from the fifth day of Operation Guardian of the Walls, May 14th, 2021, until ceasefire on May 21st, 2021. Participants were recruited through a Facebook advertisement. Facebook users were eligible for this study if they were ≥ 18 years old and living in Israel. All participants had been directly exposed to the rocket attacks, as their residences were under attack during the Operation. Each time a rocket was fired, sirens sounded, and residents were advised to seek shelter. The advertisement consisted

of a headline, main text, and a link to the survey. The survey was advertised as a study exploring the implications of rocket attacks, and was accessible through Qualtrics, a secure web-based survey data collection system (QualtricsLabs, inc., Provo, UT, US). Completion time ranged from 15 to 30 minutes.

A total of 794 individuals participated in the survey, of which N = 739 (93.1%) had been directly exposed to rocket attacks during Operation Guardian of the Walls, and thereby qualified for inclusion in the current study. Of the current sample, 139 (18.8%) reported witnessing rockets landing in the vicinity of their home, 54 (7.3%) reported witnessing another person being physically or mentally injured by the attacks, and a small minority reported experiencing damage to their homes or possessions (n = 5, 0.7%).

While the survey was not limited to any sub-population or ethnic group, respondents were all Jewish, with 508 (78.7%) describing themselves as secular. The mean age of participants was M = 36.8 (SD = 36.0). Most of the participants were female (83.1%), and, regarding education, the largest subgroup had an undergraduate degree (33.2%). In terms of income, 272 (36.8%) reported a below-average income, 184 (24.9%) reported an average income, and 283 (38.3%) indicated an above-average income level. The average level of income in Israel is §3800.

Ethics

The [masked for review] institutional review board (IRB) approved all procedures and instruments. Participants were notified regarding the nature of the questions, the research goals, and that the study had been approved by the relevant IRB. The respondents signed a consent form, which stated that they could withdraw their participation at any point without repercussions, and that the survey was anonymous.

Measures

Background Variables

Participants completed a brief demographic questionnaire. Variables assessed included age, gender, education, income, and religion.

Tonic Immobility Scale (TIS)

The TIS measures TI on a 10-item scale designed to reflect the presence and severity of specific features of TI as derived from animal literature. The TIS is assessed on a 7-point Likert sale ranging from "*0 = not at all*" to "*6 = completely*" (Forsyth et al., 2000; Fuse et al., 2007). In the present study, a Hebrew version of the TIS was used. The original inventory (Forsyth et al., 2000) was separately translated into Hebrew by two independent translators. These translations were discussed, differences resolved in consensus, and a final translation was done, which was then back-translated into English. After comparing the back-translation to the original, several minor revisions were made. Internal consistency, as measured by Cronbach's alpha, was good for the full scale used in the current study ($\alpha = .87$).

PTSD Checklist (PCL-5)

The PTSD Checklist was applied to assess for possible peritraumatic posttraumatic stress symptoms (Weathers et al., 2013). The 20-item self-report measure asks participants to indicate the extent to which they experienced each PTSD symptom, i.e., intrusion, avoidance, negative alteration, and arousal, on a 5-point Likert scale ranging from "*0 = not at all*" to "*4 = extremely.*" Items correspond to PTSD symptom criteria for the latest version of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association, 2013). The instructions for the scale were adapted for the current study to assess the peritraumatic posttraumatic stress symptoms by changing the timeframe from "in the past month" to "since Operation Guardian of the Walls," with the index event being Operation Guardian of the Walls. The scale was administered in Hebrew. Previous research has suggested that score of 33 or higher indicates possible clinical symptomatology (Bovin et al., 2016). Therefore, a cut-off score of 33 was used in the present study

to indicate clinically elevated levels of peritraumatic stress symptoms. The PCL-5 has demonstrated high internal consistency and test-retest reliability (Bovin et al., 2016). In the current study, internal consistency measured by Cronbach's alpha was good for intrusion, avoidance, negative alterations in mood and cognition, and hyperarousal, as well as for the total scale (α = .87, 78, .84, .84, and .94 respectively).

The Brief Symptom Inventory-18 (BSI-18)

The BSI-18 is a self-report symptom checklist consisting of 18 items. The scale assesses three dimensions: anxiety, depression, and somatization, and includes six items for each of these dimensions. Moreover, the global severity index (GSI) refers to the sum of all the dimensions. Participants were asked to indicate the extent to which they had experienced each symptom since Operation Guardian of the Walls on a 5-point Likert scale ranging from "*0 = not at all*" to "*4 = extremely*." The BSI-18 has previously demonstrated good psychometric properties with internal consistency coefficients ranging from .82 to .93 (Franke et al., 2017). Internal consistency**,** measured by Cronbach's alpha, was good in the current study for somatization, depression, anxiety, and for the GSI (α = .89, .85, .90, and .94, respectively).

Peritraumatic Dissociative Experiences Questionnaire (PDEQ)

The PDEQ (Marmar et al., 1997) was applied to assess dissociative experiences during Operation Guardian of the Walls. The PDEQ consists of eight items and is scored on a 5-point Likert scale ranging from "*1 = not at all true*" to "*5 = extremely true.*" The scale assesses experiences of peritraumatic dissociation, such as derealization, depersonalization, amnesia, out-of-body experiences, altered time perception, and body image. One item on the PDEQ refers to physical injury. This item was removed, since less than 1% of the participants had suffered a physical injury in the attacks. The PDEQ has previously demonstrated internal consistency and

satisfactory test-retest reliability (Marshall et al., 2002). In the present study, internal consistency, measured by Cronbach's alpha, was good for the total scale (α = .86).

Data Analysis

Data analysis proceeded in three linked stages. First, descriptive statistics and bivariate correlations were calculated for all study variables and for the original 10-item TIS. Second, four different measurement models of TI were specified using CFA. The four CFA models tested previously proposed models of TI based on the TIS (Covers et al., 2021; Fuse et al., 2007; Reichenheim et al., 2014). Model 1 represented a one-factor baseline model with all 10 items, Model 2 proposed a two-factor model with latent constructs of TI and fear, Model 3 proposed a one-factor model of TI with reduced items, and Model 4 proposed a three-factor model with latent constructs of TI, fear, and detachment. Models 1-4 are displayed in Figure 1.

Model fit was evaluated with reference to incremental and absolute fit indices, as well as to parsimony-corrected fit-indices. Specifically, the three Information Criteria Akaike (AIC), Bayesian (BIC), and the Sample-Size Adjusted BIC (SSABIC) were all used to determine which model was the best fit, with smaller values indicating better representation of the data. For absolute fit indexes, a non-significant χ^2-square, SRMR- (Jöreskog & Sörbom, 1993) and RMSEA-values (Steiger, 1990) with a 90 % confidence interval of less than .08 and .05 indicated acceptable and excellent fit, respectively. Finally, values above .90 and .95 indicated acceptable and excellent fit, respectively, in the incremental CFI- (Bentler, 1990) and TLI- (Tucker & Lewis, 1973) fit statistics. Missing data in the measurement models were handled using the full information maximum likelihood estimator.

Based on the best-fitting model, the clinical objective was addressed in the third stage by using Pearson's correlation to test the association between each of the subscales representing latent factors and psychological distress, i.e., intrusion, avoidance, negative alterations, arousal, PCL-

total, peritraumatic dissociation, somatization, depression, anxiety, and the total GSI. Finally, the identified subscales were tested for the reliability of the internal consistency measured by Cronbach's alpha. Stages one and three of the analyses were conducted using SPSS 28, while stage two was conducted using Mplus Version 8.

Results

Pearson's correlations for most of the study variables and for the original 10-item TIS are shown in Table 1. Overall, the TIS correlated with medium to large effect size for all outcomes of peritraumatic psychological distress. Independent t-tests further revealed that women experienced higher levels of TI, $t(185,92) = 6.15$, $p < .001$ and peritraumatic stress symptoms, $t(184.37) = 6.33$, $p < .001$, than did men.

TABLE 1 APPROXIMATELY HERE

Fit indices for the four measurement models are presented in Table 2. The Information Criteria (AIC, BIC and SSABIC) suggested that Model 3 was the best fit due to this model having the lowest values. However, the Information Criteria cannot be used to compare models with different numbers of variables, and the RMSEA, SRMR, CFI, and TLI preferred Model 4 as having acceptable and excellent fit. For all models, χ^2-square was significant; however, this test-statistic is sensitive to sample size and, therefore, significant results are not sufficient grounds to reject a model (Tanka, 1987). The factor loadings of Model 4 are shown in Table 3. All items loaded significantly with one of the three items: TI (three items), fear (four items), and detachment (three items), so Model 4 was deemed to be the best fit.

TABLES 2 & 3 APPROXIMATELY HERE

The female participants scored significantly higher on all three subscales than did the male participants: TI, $t(194.51) = 2.65$, $p = .009$ [$M = 1.06$, $SD = 2.61$ vs $M = .51$, $SD = 1.79$], Cohen's $d = .25$, fear, $t(233.70) = 8.56$, $< .001$, [$M = 5.44$, $SD = 5.45$ vs. $M = 2.01$, $SD = 3.47$], Cohen's $d =$

.75, and detachment, t(182.70) = 2.33, p = .011 [M = 1.61, SD = 3.33 vs. M = .96, SD = 2.45], Cohen's d = .22. Correlation coefficients between the identified latent factors and psychological distress are shown in Table 4. The TI subscale correlated, with medium effect size, with the subscales of fear (r = .54) and detachment (r = .51), and the subscale of fear correlated with the subscale of detachment (.47), as per Cohen's guidelines for Pearson's correlations (1992). All three subscales significantly correlated with all psychological distress symptoms; i.e., intrusion, avoidance, negative alterations, arousal, somatization, depression, and anxiety; with predominantly medium effect sizes (r ranging from .37 to .74). Moreover, peritraumatic dissociation correlated with TI (r = .51) and fear (r = .53) with medium effect sizes, and with detachment with a large effect size (r = .71), as per Cohen's guidelines (1992). Finally, internal consistency, measured by Cronbach's alpha, was good for the three subscales TI, fear, and detachment (α = .81, .87, and .87, respectively).

TABLE 4 APPROXIMATELY HERE

Discussion

The validity of the TIS has been a matter of ongoing discussion among researchers since Fuse et al. (2007) first tested the factor structure of the scale. Later psychometric evaluations by Reichenheim et al. (2014) and Covers et al. (2021) have yielded inconsistent results and created confusion about the number of latent factors, and whether the TIS measures only TI; TI and fear; or TI, fear, and detachment. The present study contributes to this discussion by evaluating the TIS in a sample of Israeli civilians affected by rocket fire, collected at the time of the traumatic event. Results lend support to the three-factor model with latent constructs of TI, fear, and detachment. These results lay the groundwork for future research by providing a psychometric validation of the Hebrew version of the TIS.

TI, fear, and detachment (i.e., symptoms of dissociation) are all peritraumatic responses that can be difficult to differentiate from each other due to their similar expressions and inverse relationships (Bovin et al., 2008; Marx, 2008; Volchan et al., 2017). Across the different psychometric evaluations, there are important discrepancies with several items. Overall, these studies agree that items *i*1 (*froze or felt paralyzed*), *i*2 (*unable to move*), and *i*4 (*unable to call out or scream*) load on TI, while items *i*3 (*body trembling/shaking*) and *i*7 (*fear/panic*) load on fear.[1] Less clear are the factor loadings for the remaining five items.

Item six (*i*6, *felt cold*) was included in the TI-factor for both Fuse et al. (2007) and Reichenheim et al. (2014), while Covers et al. (2021) and the present study found it to load on fear. Similarly, Fuse et al. (2007) found *i*8 (*feared for your life or felt as though you were going to die*) to load on TI; Reichenheim et al. (2014) removed the item from the one-factor model; and both Covers et al. (2021) and the present study found *i*8 to load on fear. Finally, for the detachment items, *i*9 (*detached from yourself*) has previously been found to load on TI (Fuse et al., 2007; Reichenheim et al., 2014), while *i*10 (*detached from environment*) loaded on fear in Fuse et al. (2007) and was removed from the final scale by Reichenheim et al. (2014). In the present study, *i*5 (*felt numb or no pain*) loaded only on detachment, in contrast to the study done by Covers et al. (2021), which found it to load on fear, while it had previously loaded on TI (Fuse et al., 2007; Reichenheim et al., 2014). Discrepancies at item-level are likely to reflect overlaps in expressions of the peritraumatic responses, co-occurrence of symptoms, and potential problems with the inclusion and wording of the items.

Fear is a necessary condition for TI to occur. As proposed in the stage model by Volchan and colleagues, fear is central to the TI-paradigm. Prior to the motoric inhibition that characterizes TI, states of both 'attentive immobility,' i.e., when, having detected a threat, the individual becomes

[1] Except for Reichenheim et al. (2014), who found *i*7 to load on TI, and removed *i*1 from the one-factor model

motionless and monitors the source of danger to avoid being noticed and prepare for escape; and 'immobility under attack,' i.e., when escape is perceived to be impossible and the individual responds with a more active motoric state; occur, both of which are characterized by intense fear (Volchan et al., 2017). However, during the state of TI, when survival is severely threatened, fear appears to be suppressed, only to reemerge in the aftermath of TI, suggesting an inverse relationship between fear and TI (TeBockhorst et al., 2015).

Regarding dissociation, of which detachment is a key symptom, researchers have also suggested that TI and dissociation appear to be related, yet distinct, peritraumatic constructs (Lima et al., 2010). Although both peritraumatic dissociation and TI have been linked with trauma psychopathology, the relationship remains unclear. Some researchers have found TI to be the strongest predictor of PTSD, after controlling for peritraumatic dissociation (Hagenaars, 2016; Lima et al., 2010), while others have found the opposite (Abrams et al., 2012). However, Abrams et al. (2012) used a composite score from subscales of both peritraumatic dissociation and TI; this illustrates the problem of studying unique associations based on scales that measure overlapping constructs. This challenge might also be true for the TIS, as detachment was found to correlate with peritraumatic dissociation with a large effect size, indicating that the two constructs are strongly associated and may overlap to some degree. Returning to the item-level of the present study, *i*5 (*felt numb or no pain*) exemplifies how one item can include symptoms of both TI and detachment, and how participants might be confused by the wording of such an item. For instance, emotional numbness and shutdown is a key symptom of dissociation (Lanius, 2015), while analgesia, i.e., loss of the sensation of pain, is associated with TI (Marx, 2008).

TI is a peritraumatic response believed to be strongly associated with the development of guilt, shame, and trauma symptomatology in the post-traumatic phase (Bovin et al., 2008; Hagenaars, 2016; Heidt et al., 2005; Marx, 2008). It is further believed to influence the

effectiveness of treatment (Fiszman et al., 2008; Lima et al., 2010) and, therefore, can have important clinical implications. Hence, it is paramount that we understand the construct of TI, as well as the validity of the scale used to measure it. As stated in the introduction, different researchers have used various versions of the TIS based on the different psychometric evaluations available, and this has likely impacted their results. Furthermore, items on the TIS are derived from animal literature (Fuse et al., 2007) and, although TI in humans has been produced in laboratory settings (Hagenaars & Putman, 2011; Kuiling et al., 2019; Mooren, 2014; Niermann, 2017; Norte, 2019; Schmidt, 2008), it might be more challenging to separate TI from other peritraumatic reactions on a self-report measure, due to the strong association between detachment and peritraumatic dissociation. Future research should reassess the appropriate number of items, as well as their wording, to ensure a clear conceptualization of the underlying constructs. This includes the consideration of including the item '*felt unable to escape,*' as proposed by Lima et al. (2010). Most importantly, it is paramount that future research examines the relationship between TI, peritraumatic dissociation, and subsequent trauma symptomatology. Such findings can help determine whether the TIS should be adjusted for a clearer conceptualization of TI that omits items measuring detachment and other peritraumatic responses that are not unique to TI.

The present study should be understood in the context of both its limitations and its strengths. First and foremost, all the tested models presented an insignificant χ^2-square value. Although this test statistic is sensitive to sample size (Tanaka, 1987), and is therefore insufficient grounds to reject a model, it could nonetheless imply some misspecification of the model. Moreover, the study relies on a convenience sample from an online survey, which resulted in a lower response rate from male participants. It is possible that the overrepresentation of female participants influenced the results, as females scored significantly higher on the total TIS in the present study and are generally at greater risk of developing PTSD than are men (Olff et al., 2007). Despite these limitations, this

study had important strengths. It is based on a larger sample than previous studies (except for Reichenheim et al. (2014)), and the inclusion of both males and females, as well as of mental health outcomes, are of clinical importance. Moreover, these data were collected at the time of the traumatic event, giving them an advantage over retrospective data, which might be influenced by recall bias. Finally, this study is the first to validate the TIS in a Hebrew-speaking population, which means that future research could benefit from replicating these findings in different cultural settings.

Drawing on the three-factor model identified by Covers et al. (2021), the authors discussed whether the discrepancies with previous studies could be explained by lower educational level, lower age, higher psychopathology, or type of trauma experienced by participants in their samples. However, the present study supports a three-factor model based on a sample that differs considerably in all these aspects. Nevertheless, previous research has illustrated that the type of trauma does influence TI severity (Hagenaars, 2016), so future research should seek to replicate these findings in different trauma populations, and study the association with TI, fear, and detachment, respectively, for different trauma types. Finally, the present study showed that TI, fear, and detachment are associated with peritraumatic posttraumatic stress symptoms. Future research should examine data relying on a peritraumatic evaluation followed by a prospective mental health assessment to study both the unique association between these factors and mental health, and the ways in which these factors interact with each other.

In conclusion, the present study supports the three-factor model of the TIS and its underlying constructs, as identified by Covers et al. (2021), and shows that the scale appears to be psychometrically sound when translated into Hebrew. The three factors are distributed in theoretically meaningful ways across the three latent constructs of TI, fear, and detachment. Future studies should seek to replicate these findings in different trauma populations and cultures, study

their association with trauma psychopathology, and examine how the three factors interact with one another. Finally, future research should reassess which items are included, in order to clearly conceptualize all three factors.

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