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Research paper

# Sexual trauma is more strongly associated with tonic immobility than other types of trauma – A population based study

Juliana Kalaf[a,*], Evandro Silva Freire Coutinho[b], Liliane Maria Pereira Vilete[a], Mariana Pires Luz[a], William Berger[a], Mauro Mendlowicz[a,c], Eliane Volchan[d], Sergio Baxter Andreoli[e], Maria Inês Quintana[e], Jair de Jesus Mari[e], Ivan Figueira[a]

[a] Institute of Psychiatry, Universidade Federal do Rio de Janeiro (IPUB-UFRJ), Rio de Janeiro, RJ, Brazil
[b] Department of Epidemiology, Escola Nacional de Saúde Pública (ENSP-FIOCRUZ), Rio de Janeiro, RJ, Brazil
[c] Universidade Federal Fluminense, Brazil
[d] Institute of Biophysics Carlos Chagas Filho, Universidade Federal do Rio de Janeiro (IBCCF-UFRJ), Rio de Janeiro, RJ, Brazil
[e] Department of Psychiatry, Universidade Federal de São Paulo, São Paulo, SP, Brazil

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ABSTRACT

*Background:* Tonic immobility is an involuntary motor and vocal inhibition reaction, considered the last-ditch response of the defensive cascade model. It is elicited in context of inescapable threat and perception of entrapment. Our aim was to investigate the association between different traumatic events and peritraumatic tonic immobility (PTI) in a representative sample of the general population.

*Methods:* This is a cross-sectional study of general population from Rio de Janeiro and São Paulo with 3231 victims of traumatic events aged 15–75 years who completed the Tonic Immobility Scale (TIS). We calculated the frequency of the different traumatic events and estimated the mean scores with 95% confidence intervals for each traumatic event, controlling for the potential confounders using multiple linear regression models. Finally, we calculated the proportion of individual scoring zero in TIS for the 16 traumatic events.

*Results:* PTI scores in child sexual abuse and adult sexual violence were almost twice as high as in other types of traumatic events, even when controlled for gender and educational level. Torture and war also showed high PTI scores, but these were based on very small number of cases and need to be interpreted with caution. Furthermore, victims of sexual trauma had the lowest proportion of individuals with total absence of PTI symptoms.

*Limitations:* This is a cross-sectional study and causal inferences must be drawn with caution.

*Conclusions:* Peritraumatic tonic immobility is more strongly associated with sexual trauma, particularly in childhood, than to other types of trauma in the general population.

## 1. Introduction

Tonic immobility is an involuntary motor and vocal inhibition reaction associated with analgesia, tremors, and preserved awareness of the environment. Traditionally it is considered the last-ditch of the defensive cascade within a sequence of responses: freeze, flight, fight and tonic immobility (Ratner, 1967). Recent models also include other defensive stages such as immobility under attack (Bastos et al., 2016; Volchan et al., in press), flag/flaccid immobility (Schauer and Elbert, 2010) and faint/collapsed immobility (Bracha, 2004; Kozlowska et al., 2015; Schauer and Elbert, 2010). Freezing/attentive immobility occurs when a potential threat is detected. It is characterized by heightened vigilance to threat cues and increased responsivity to stimuli (Marks, 1987). Freezing behavior is occasionally confused with tonic immobility but they are very different (Marks, 1987; Ratner, 1967). Tonic immobility is a state of unresponsiveness, catatonic-like immobile posture, parkinsonian-like tremors, suppressed vocal behavior and analgesia elicited in a context of inescapable threat and perception of entrapment (Marx et al., 2008). It occurs when all methods of escape have failed and has evolutionary and adaptive significance (Ratner, 1967). Being immobile decreases the chance of detection by a predator. If an attack starts, tonic immobility may decreases the probability of continued violence and facilitates escape since a predator may believe that its prey is a “dead meal” and releases it, providing the prey a chance for escape (Bracha et al., 2004; Ratner, 1967). Empiral studies with animals documented that those who adopted tonic immobility

* Correspondence to: Juliana Kalaf, Avenida Epitácio Pessoa, 4720/702, Lagoa, 22471-003, Rio de Janeiro, RJ, Brazil.
*E-mail address:* jukalaf@gmail.com (J. Kalaf).

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defensive were more likely to survive (Edelaar et al., 2012).

Although described in animals for over three hundred years (Maser and Gallup, 1977), tonic immobility is still underappreciated in humans. Tonic immobility was first reported in female victims of sexual assault (Burgess and Holmstrom, 1976; Bovin et al., 2008; Fusé et al., 2007; Galliano et al., 1993; Heidt et al., 2005; Humphreys et al., 2010), and then in mixed-gender samples exposed to different types of trauma (Bados et al., 2008). When this defensive response occurs in the immediate aftermath of traumatic event, it is called peritraumatic tonic immobility (PTI).

Peritraumatic dissociation is another type of acute reaction that occurs during and immediately after a traumatic event that should not be confused with PTI. It is characterized by feelings of unreality, alterations in perceptions of time, place, and person (depersonalization) and tunnel vision (Cardeña and Spiegel, 1993). Although PTI and peritraumatic dissociation can occur separately, they are often found in association as part of an emotional response to traumatic events (Abrams et al., 2009; Fusé et al., 2007; Heidt et al., 2005). It is unclear whether PTI may increases the occurrence of dissociative symptoms (Heidt et al., 2005; Fusé et al., 2007; Marx et al., 2008), or if they should be considered aspects of the same phenomenon (Abrams et al., 2012). Thus, peritraumatic dissociation is a factor that should be controlled when assessing PTI (Zoellner, 2008).

PTI has been acknowledged as an important clinical predictor for the development (Maia et al., 2015; Portugal et al., 2012), severity (Fiszman et al., 2008; Rocha-Rego et al., 2009) and poor therapeutic response to standard pharmacotherapy (Fiszman et al., 2008; Lima et al., 2010) of post-traumatic stress disorder (PTSD). In the general population of trauma-exposed individuals, our group reported that the severity of PTI were significantly higher in individuals who did develop PTSD, as compared to those who did not. In addition, PTI was found to be more common and severe in women than in men (Kalaf et al., 2015).

Despite the critical clinical role of PTI on development of PTSD, the association between different traumatic events and PTI has been under researched. The only study to date was conducted in a convenience sample of university students (Bados et al., 2008). Aiming to fulfill this fundamental gap in the literature, we analyzed data from a large representative sample of the general population to describe which types of traumatic events were more associated with peritraumatic tonic immobility.

## 2. Material and methods

### 2.1. Participants and design

The participants in this study came from a cross-sectional study survey carried out in a representative sample of residents in the two largest cities in Brazil, São Paulo and Rio de Janeiro (N=2536 and 1208 respectively), aged 15–75 years old (Andreoli et al., 2009).

The city of São Paulo had nearly 11 million inhabitants and Rio de Janeiro had 6 million in 2006. A multistage cluster sampling scheme was conducted to obtain the sample. Firstly, seven strata within the two cities were built and ranked according to their homicide rates. In the second stage, all the census sectors within each stratus were recognized and randomly selected. Then, in the third stage, we randomly selected 43 households (São Paulo) or 30 households (Rio de Janeiro) within each census segment. All inhabitants aged 15–75 years from each included household were enumerated, and one of them was selected based on Kish's method. The estimated sample size was determined to be 1500 interviews in Rio de Janeiro and 3000 in Sao Paulo, assumed an expected refusal rate of 20%. We oversampled the most violent strata in Sao Paulo to recognize more existing PTSD cases to be referred to a case–control study and a clinical trial (Andreoli et al., 2009; Ribeiro et al., 2013).

In the present study, only participants who had experienced traumatic events and who responded to the Tonic Immobility Scale (N=3231) were selected. The traumatic events were listed in the Composite International Diagnostic Interview (CIDI 2.1) and 21 events were added to the original list as described by Ribeiro et al. (2013). Participants were asked to choose the worst experience among those they had. The symptoms of PTSD and PTI were assessed in relation to their worst trauma.

### 2.2. Procedures

The Brazilian Institute of Public Opinion and Statistics (IBOPE), which is experienced in household assessments, performed data collection. For quality control, the supervisors revisited not less than 20% of all the households to reassure that the interview had been conducted according to the protocol of the study. A methodological description of this study, including sampling procedures, can be found in the studies by Andreoli et al. (2009) and by Ribeiro et al. (2013).

The participants were informed of the research procedures and risks and give written content, submitted to and approved by the Ethical committee of the Federal University of Sao Paulo.

### 2.3. Measures and covariates

The interview comprised a number of fully structured questionnaires and scales related to demographic variables, psychiatric diagnoses, and history of exposure to traumatic events (Andreoli et al., 2009). In the present analysis, the following variables derived from the original study were included:

#### 2.3.1. Traumatic events

We assessed lifetime PTSD and exposure to traumatic events using the Composite International Diagnostic Interview (CIDI 2.1). To adapt the original list of traumatic events to the Brazilian social and cultural context, 21 new events were added to the original 11, such as "fast kidnap", "blackmailing telephone calls" and "witnessing a shoot-out or being victim of stray bullet" (Ribeiro et al., 2013). For the present study, we classified the traumatic events reported by the participants according to a literature-based categorization of traumatic events. This categorization was based on a thorough review of PTSD mainstream literature considering the words and expressions used to define each category of traumatic event. For more details, see Luz et al. (2011). Trauma intensity was defined using the self-perception of intensity of trauma evaluated with a five-point Likert scale and stratified as 1–3: low/moderate; 4–5: severe.

#### 2.3.2. Peritramatic tonic immobility

The Tonic Immobility Scale (TIS) is a self-report measure designed to recognize the presence and severity of specific features of tonic immobility in humans. The original version has ten items, each one with a seven-point Likert scale, and physical immobility and fear as two independent factors (Fusé et al., 2007). Reichenheim et al. (2014) validated a Brazilian version of the TIS. The authors used the same sample in the current work, concluding for a one-factor solution and reducing the number of items from ten to six. In this Brazilian version, scores range from 0 to 36. The TIS scores were based on the worst experienced trauma.

### 2.4. Statistical analysis

At first, we calculated the frequency of the different traumatic events in the whole sample. Then, we estimated the mean scores and respective 95% confidence intervals for the TIS scale for each traumatic event. In order to compare these means controlling for the potential confounding effect of gender and educational level, the means were estimated using multiple linear regression model.

Finally, we calculated the proportion of individual scoring zero in TIS for the 16 traumatic events.