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# Validation of the Italian version of the peritraumatic distress inventory: validity, reliability and factor analysis in a sample of healthcare workers

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**ABSTRACT**

**Background**: Peritraumatic distress as assessed by the *Peritraumatic Distress Inventory* (PDI), has been consistently shown to predict the development of Posttraumatic Stress Disorder (PTSD) after the exposure to a potentially traumatizing event.

**Objective**: The present study aims to validate the Italian version of the PDI in a sample of Healthcare Workers (HCWs) exposed to COVID-19 related potentially traumatizing events.

**Method**: $N = 265$ HCWs who repeatedly experienced the deaths of patients during COVID-19 emergency in Italy, were enrolled from the Azienda Ospedaliero-Universitaria Pisana (Pisa, Italy). They completed the PDI, Impact Event Scale – revised (IES-R) and the *reactions to losses or upsetting events* Trauma and Loss Spectrum – Self Report (TALS-SR) domain.

**Results**: Internal consistency was good with a Cronbach's alpha coefficient was .874. The PDI correlated strongly with measures that was conceptually close (TALS-SR *reactions to losses or upsetting events* domain; $r = .723$, $p < .001$). Participants who scored above the cut-off for PTSD reported significantly higher PDI scores than those who did not (6.47 ± 5.25 vs. 19.11 ± 8.291, $p < 0.001$). The one-month test–retest reliability ($n = 21$) was excellent (ICC = .997). Finally, factor analyses revealed that the PDI exhibited a single-factor structure.

**Conclusions**: the Italian version of the PDI showed good psychometric proprieties and may be used to detect those at risk for developing PTSD.

**HIGHLIGHTS**
• Study aim: to validate the Italian version of the peritraumatic distress inventory (PDI).
• 265 Healthcare Workers completed the PDI the IES-R and the TALS-SR.
• The reliability, internal consistency validity and the temporal stability were good.
• The tool presented a one-factor structure.

## Validación de la versión italiana del Inventario de Distrés Peritraumático: validez, fiabilidad y análisis de factores en una muestra de trabajadores de la salud

**Antecedentes**: Se ha demostrado sistemáticamente que el distrés peritraumático, evaluado por el Inventario de Distrés Peritraumático (PDI), predice el desarrollo del Trastorno de Estrés Postraumático (TEPT) después de la exposición a un evento potencialmente traumático.

**Objetivo**: El presente estudio tiene por objeto validar la versión italiana del PDI en una muestra de Trabajadores de la Salud (TSP) expuestos a eventos potencialmente traumatizantes relacionados con COVID-19.

**Método**: $N=265$ trabajadores de la salud que experimentaron repetidamente la muerte de pacientes durante la emergencia de COVID-19 en Italia, fueron enrolados en la Azienda Ospedaliero-Universitaria Pisana (Pisa, Italia). Completaron el PDI, Escala de Evento de Impacto - revisada (IES-R) y el Trauma y Espectro de Pérdidas- Auto reporte, dominio de las *reacciones a las pérdidas o eventos perturbadores* (TALS-SR).

**Resultados**: La consistencia interna fue buena con un coeficiente alfa de Cronbach de 0,874. El PDI se correlacionó fuertemente con medidas que eran conceptualmente cercanas, (dominio de las reacciones a las pérdidas o eventos perturbadores TALS-SR; $r=.723$, $p<.001$). Los participantes que puntuaron por encima del límite para el TEPT reportaron puntuaciones de PDI significativamente más altas que los que no lo hicieron (6,47±5,25 vs. 19,11±8,291, $p<0,001$). La confiabilidad del test de un mes ($n=21$) fue excelente (ICC=.997). Finalmente, los análisis factoriales revelaron que el PDI exhibía una estructura de un solo factor.

**Conclusiones**: la versión italiana del PDI mostró buenas propiedades psicométricas y puede ser usada para detectar a aquellos en riesgo de desarrollar TEPT.

## 意大利语版《创伤性精神痛苦清单》的效度：医护人员样本中的有效性、可靠性和因素分析

**背景**:根据创伤性精神痛苦清单 (PDI) 评估的创伤性精神痛苦一直被证明可预测暴露于潜在创伤事件后创伤后应激障碍 (PTSD) 的发展。

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**目的**: 本研究旨在一个暴露于COVID-19相关潜在创伤事件的医护人员 (HCW) 样本中验证意大利语版PDI。

**方法**: 从意大利比萨大学医院 (位于意大利比萨) 招募了265名在意大利COVID-19紧急期间反复经历患者死亡的医务工作者。他们完成了PDI, 事件影响量表-修订版 (IES-R) 以及对损失或不安事件反应的创伤和损失谱-自我报告域 (TALS-SR) 。

**结果**: 内部一致性良好, Cronbach的alpha系数为.874。 PDI与概念上相近的测量高度相关 (TALS-SR对损失或不正常事件域的反应 ;r= .723, p<.001) 。得分高于PTSD临界值的参与者报告的PDI得分显著高于得分不高于临界值的人 (6.47±5.25 vs. 19.11±8.291, p<0.001) 。一个月的重测信度 (n = 21) 非常好 (ICC = .997) 。最后, 因素分析显示PDI表现出单因素结构。

**结论**: 意大利语版PDI具有良好的心理测量学特性, 可用于检测发展PTSD的风险人群。

# 1. Introduction

About 50–70% of world population reported at least one lifetime potentially traumatizing event (Benjet et al., 2016; Darves-Bornoz et al., 2008; Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995), with even higher rates in some specific groups, such as military personnel (Goldstein et al., 2016; Schäfer et al., 2018), subjects with severe mental illnesses (Mueser et al., 1998; Carmassi et al., 2020) or health-care workers (HCWs) (Berger et al., 2012; Greinacher, Derezza-Greeven, Herzog, & Nikendei, 2019). In the last edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5, American Psychiatric Association [APA], 2013), the term potentially traumatic event defines a direct or indirect threatened or actual death, serious injury and/or sexual violence. Particularly, the DSM-5 includes "repeated or extreme indirect exposure to aversive details of the event(s), usually in the course of professional duties (eg, first responders, collecting body parts; professionals repeatedly exposed to details of child abuse) in the potentially traumatic events (criterion A4). Nevertheless, only a minority of exposed subjects develops psychopathological reactions such as anxiety, depression and, especially, Post-Traumatic Stress Disorder (PTSD), in response to the potentially traumatizing event (Darves-Bornoz et al., 2008; Kessler et al., 2017; Olff et al., 2019). Among the various factors associated to negative psychopathological outcomes in trauma survivors, peritraumatic distress represents one of the most consistently reported (Brewin, Andrews, & Rose, 2000; Hiar et al., 2016; Lensvelt-Mulders et al., 2008; Letamendia et al., 2012; Ozer, Best, Lipsey, & Weiss, 2003; Peltonen, Kangaslampi, Saranpää, Qouta, & Punamäki, 2017; Shiban et al., 2018; Vance, Kovachy, Dong, & Bui, 2018).

In the framework of a potentially traumatizing event subjects can experience a wide range of feelings, emotions and sensations, besides dissociative symptoms. Literature usually differentiates two distinct kinds of peritraumatic reactions: the distress and the dissociative ones. These two constructs usually co-occur after a potentially traumatizing event. However, they are distinct elements, and each one could be less or more represented in traumatized individuals, depending on subjective and trauma-related factors. Particularly, the peritraumatic distress encompasses several physiological, emotional, and cognitive responses that occur immediately after the potentially traumatizing event, such as: a sense of personal life threat; feelings of fear helplessness and horror; guilt, shame and anger; loss of bowel and bladder control; shaking, trembling, and increased heart rate (Brunet et al., 2001; Vance et al., 2018). Almost 20 years ago, Brunet et al. (2001), developed and validated the questionnaire *Peritraumatic Distress Inventory* (PDI), in order to investigate the immediate response to a trauma. The PDI is self-report questionnaire with good psychometric proprieties, including 13 items scored on a Likert scale from 0 (*not true at all*) to 4 (*extremely true*). Although the instrument was originally developed to assess the DSM-IV PTSD Criterion A2 'fear, helplessness, or horror' in response to potentially traumatizing events (APA, 1994), the PDI has the merit to explore a wider range of acute psychopathological reactions to the trauma. The PDI has the limit to not include all the possible peritraumatic reactions, especially the dissociative ones. Moreover, in a meta-analysis, Thomas, Saumier, and Brunet (2012) reported that the PDI scores tend to decline over time. Despite these flaws, several studies highlighted that it may be useful in predicting PTSD symptom severity besides other psychiatric symptoms, in subjects exposed to potential traumatic events (Thomas et al., 2012; Vance et al., 2018). Furthermore, recent prospective data suggest that peritraumatic distress is a stronger predictor of the development of PTSD symptoms than peritraumatic dissociation (Bui et al., 2010). Due to its utility in clinical and research setting, the tool was validated in various languages (Jehel, Brunet, Paterniti, & Guelfi, 2005; Kianpoor et al., 2016; Nishi et al., 2009; Rybojad & Aftyka, 2018) and in particular populations,

such as children (Bui et al., 2011), elderly (Bui et al., 2010; Brunet et al., 2013), caregivers (Rybojad, Aftyka, & Samardakiewicz, 2018) or HCWs, (Rybojad, Aftyka, & Milanowska, 2019). To the best of our knowledge, to date there are no official validations of the PDI in Italian.

Recent evidence confirmed the Corona VIrus Disease-19 (COVID-19) pandemic as the most serious emergency of this century for the healthcare systems worldwide leading to health, economic, social negative consequences. Furthermore, it also represents a traumatic experience for individuals exposed to contagion, isolation or social-distancing measures and the dead of a loved one (Carmassi et al., 2020; Galletly, 2020; Giallonardo et al., 2020). Italy has been one of the most affected countries in Europe, where COVID-19 has infected to date over 240.000 people and caused the dead of almost 35.000 ones. In this dramatic context, HCWs had to face for months a great burden of stressful situations related to the management of critical ill patients, the extreme decision-making burden, the isolation measures and the risk to be infected themselves. On one hand, HCWs directly experienced to witnessing death related to rapidly worsening dyspnoea and acute respiratory or cardiovascular failure in COVID-19 affected patients; on the other hand, they were repeatedly exposed to indirect aversive traumatic details due to their profession. For all these reasons, some Authors stated that COVID-19 is the '9/11 of health care systems' (DePierro, Lowe, & Katz, 2020). Accordingly, early reports from Asian countries pointed out how the COVID-19 pandemic embody a potentially traumatizing event for HCWs with substantial levels of depressive and anxiety symptoms, besides PTSD rates ranging between 7% and 27% (Chew et al., 2020; Kang et al., 2020; Lai et al., 2020; Song et al., 2020).

In light of the considerations mentioned above, it is of particular interest to have a psychometric instrument, such the PDI, capable of measuring the peritraumatic distress that is one of the most relevant risk factors for PTSD. Hence, the present study aims to validate the reliability, factor structure and internal consistency of the Italian version of the PDI in a sample of HCWs exposed to the COVID-19 HCWs healthcare emergency.

## 2. Methods

### 2.1. Study sample and procedures

A consecutive sample of $N = 265$ HCWs ($n = 181$ (68.3%) females; mean age = 40.43 ± 11.20 years), employed at the Azienda Ospedaliero-Universitaria Pisana (AOUP, Pisa, Italy) during the COVID-19 pandemic, were recruited for the present study. The sample included 85 (32.1%) medical doctors, 133 (50.2%) nurses, and 47 (17.7%) healthcare assistants. The

enrolment was conducted between 1 April and 1 May 2020 at the outpatient service of the Occupational Health Department of the AOUP, specifically dedicated to assess and manage the physical and mental health of the staff in the framework of the COVID-19 emergency. All HCWs enrolled experienced work-related potentially traumatizing events related to the management of patients hospitalized because of the COVID-19, including witnessing multiple patients dying and several acute respiratory failures. Inclusion criteria included being employed in the AOUP during the COVID-19 pandemic and being exposed to multiple patient's death in the framework of the outbreak emergency. Exclusion criteria included poor knowledge of the Italian language or other limits to verbal communication; however, no enrolled subjects met them. A subsample of n = 21 subjects, randomly drawn were re-evaluated within one month of the first evaluation. Assessment also included the *Impact of Event Scale-Revised* (IES-R) to assess PTSD symptoms, and the *Trauma and Loss Spectrum – Self Report* (TALS-SR) that also assesses peritraumatic reactions.

All eligible subjects were asked to provide written informed consent after receiving a complete description of the study and they had the opportunity to ask questions. The study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of Area Vasta Nord-Ovest Toscana (Pisa, Italy, protocol study No. 2020/17151).

### 2.2. Measures

#### 2.2.1. Peritraumatic distress inventory (PDI)

The PDI is a self-report instrument developed to measure retrospectively the distress experienced by the subject at the time of the potentially traumatizing event, or immediately after. It is composed of 13 items, each scored on a 5-point Likert-type scale, ranging from 0 to 4 (0 = not at all, 1 = slightly, 2 = somewhat, 3 = very, and 4 = extremely true), with the total score ranging from 0 to 52 and higher scores indicating increased distress. Items explore cognitive response to the trauma (e.g. *I thought I might die*), emotional distress (e.g. *I was horrified by what happened*) or physical symptoms (e.g. *I had physical reactions like sweating, shaking, and pounding heart*). The PDI demonstrates good test–retest reliability, convergent and divergent validity and good internal consistency (Brunet et al., 2001).

Carmassi, Bui and Pedrinelli translated the original English version of the PDI into Italian. Three translations of the scale followed by consensus agreement among the translators represent the English-to-Italian translation procedure. The second step consisted of the back translation of the Italian-translated PDI into English by C.A. Bertelloni, a bilingual psychiatrist who was not familiar with the original English

version of the instrument. A panel of professionals affiliated with the University of Pisa reviewed both the PDI versions. The panel made only minor adjustment to the PDI Italian version and then approved the final Italian-translated PDI. In according with the aim of the study, the items referred to the experience of 'witnessing someone die' in the framework of their work duties during the Covid-19 emergency.

### 2.2.2. The trauma and loss spectrum – self-report (TALS-SR)

The TALS-SR is an instrument developed for assessing post-traumatic stress spectrum symptoms (Dell'Osso et al., 2009). It includes 116 items exploring the lifetime experience of a range of losses and/or potentially traumatizing events and lifetime symptoms, behaviours and personal characteristics that might represent manifestations and/or risk factors for the development of a stress response syndrome. The instrument is organized into nine domains including: loss events (I); *grief reactions* (II); *potentially traumatic events* (III); *reactions to losses or upsetting events* (IV); *re-experiencing* (V); *avoidance and numbing* (VI); *maladaptive coping* (VII); *arousal* (VIII); and *personal characteristics/risk factors* (IX). The responses to the items are coded in a dichotomous way (yes/no) and domain scores are obtained by counting the number of positive answers. In the Italian version, test–retest/inter-rater reliability was excellent, with interclass correlation coefficient values exceeding .90 for each of the domains. In the present study, we particularly used the domain *reactions to losses or upsetting events* that explores a range of emotional, physical and cognitive symptoms experienced during the loss and/or potentially traumatizing event. As for the PDI all participants were asked to report symptoms related to the experience of 'witnessing someone die' in the framework of his work duties during the Covid-19 emergency.

### 2.2.3. The impact of event scale- revised (IES-R)

The IES-R is a 22-item scale measuring three core features of PTSD (re-experiencing of traumatic events, avoidance, and hyperarousal) and thus items, coded on a 0–4 scale, are divided into three subscales: intrusion, avoidance, and hyperarousal. All items refer to the last week prior to the assessment. The questionnaire has an adequate internal consistency (alpha = 0.80–0.93 for the intrusion; alpha = 0.73–0.84 for avoidance) and high test–retest reliability ($r = 0.93$) (Weiss & Marmar, 1997). The mean score of the items of each subscale determines the subscale score. The IES-r total score is calculated adding the score of each item. A score over 32 represents a cut-off for PTSD. According to the aim of the study, the items referred to the experience of 'witnessing someone die' in the

framework of their work duties during the Covid-19 emergency.

### 2.3. Statistical analysis

In order to estimate the internal consistency of the PDI, we calculated the overall Cronbach's Alpha coefficient for the questionnaire total score, as well as the Cronbach's alpha coefficients evaluated in the case each item was deleted. Pearson's correlation coefficients were calculated to explore the validity of the internal structure of the scale and were performed between each item and the PDI total score. The intraclass correlation coefficient (ICC) was calculated to assess the test–retest reliability of the questionnaire, in a subset of subjects ($n = 21$) re-assessed within one-month (mean time between assessments $28.43 \pm 1.86$ days). The convergent validity examined using Pearson's correlation coefficient between PDI total score and TALS-SR domain IV (*reactions to losses or upsetting events*) score. The Known-groups validity was determined by a Mann-Whitney test comparing mean total scores of the PDI between subjects who scored above the cut-off for PTSD and those who did not. Exploratory factor analyses were conducted using principal factor analysis (PFA). The final number of factor(s) was chosen based on eigenvalues, screeplot, and overall interpretability. Items with a dominant loading (larger than 0.35) on one factor were interpreted to be indicative of that factor. Possible gender differences were assessed by a Mann-Whitney test comparing mean total score of the PDI between males and females. Furthermore, a linear regression model was computed to examine the relationship between the PDI, age and gender and the IES-R score (as the dependent variable).

All statistical analyses were performed using the Statistical Package for Social Science, version 25.0 (SPSS Inc.). Continuous variables were reported as mean ± standard deviation (SD), whereas categorical variables were reported as percentages. All tests were two-tailed and a $p$-value $<.05$ was considered statistically significant.

## 3. Results

Forty-seven (17.7%) participants presented an IES-R score over 32, consistent with a PTSD diagnosis. The mean score (±SD) of the PDI, IES-R and TALS-SR domain IV (*reactions to losses or upsetting events*) were $9.19 \pm 7.94$, $15.55 \pm 19.53$ and $4.04 \pm 3.16$, respectively.

### 3.1. Item statistics

The rate of positive endorsement (scores of 1–4; from *slightly* to *extremely true*) of PDI items ranged from

6.0% (item 5; 'I felt guilt that more was not done') to 82.3% (item 2; 'I felt sadness and grief'). The mean positive endorsement rate was 38.11%. (see Table 1).

## 3.2. Reliability

The reliability for the PDI total score was good, with a Cronbach's alpha coefficient of .874. It was higher than the Cronbach's alpha if deleting each of the 13 items, except for item 5 (*I felt guilty*). The one-month test–retest reliability for the total score on 21 subjects was found to be excellent, with all ICCs above the value of .997. All the PDI items were positively and significantly correlated with the PDI total score (see Table 1).

## 3.3. Convergent validity

Pearson's correlation coefficients for the relationships between the PDI total score and the TALS-SR domain IV (*Reactions to losses or upsetting events*) as the alternative measure of peritraumatic distress was strong ($r = .723$, $p < .001$).

## 3.4. Known-groups validity

In a Mann-Whitney test subjects with probable PTSD reported a statistically significantly higher scores in all the PDI items and in the PDI total score than those without probable PTSD (see Table 2). Furthermore, female HCWs reported significant higher PDI total score than male ones (7.90 ± 8.01 versus 9.78 ± 7.86; $z = 2.596$ $p = .043$). In a multiple linear regression model, the PDI total score predicts IES-R score after controlling for age and sex (see Table 3)

## 3.5. Factorial validity

After obtaining a significant result on Bartlett's sphericity test ($p < .001$) and the Kaiser-Meyer-Olkin Measure of Sampling Adequacy >0.50 (KMO = 0.888), PCA was carried out. A Varimax rotation was performed with factors with an eigenvalue >1. Factors 1, 2 and 3 displayed eigenvalues of 5.37, 1.27 and 1.08, respectively, explaining 41.30, 9.76 and 8.27% of the total variance (59.33%). An inspection of the scree plot (see Figure 1) and eigenvalues obtained suggested that a solution with a single factor might be more adequate. Indeed, looking at the scree plot, only one inflexion is present. Therefore, a forced 1-factor solution was adopted and the obtained single factor explained 41.30% of the variance (Table 1).

## 4. Discussion

The present study provides evidence on the validation of the Italian version of the PDI exploring its psychometric properties. We translated the questionnaire in Italian, adapted it to the original English version, and then tested it in a large sample of HCWs exposed to multiple patient's death and other life-threatening events, such as the high-risk exposure to the COVID-19 infection during the acute phase of the pandemic in Italy. Previous studies on the Polish version of the PDI demonstrated that samples of HCWs could be used for the validation of the tool and highlighted the utility of such instrument in this population (Rybojad & Aftyka, 2018; Rybojad et al., 2019).

The internal consistency of the PDI was satisfactory with Cronbach's alpha of 0.87. The reliability, validity, internal consistency, and the temporal stability of the Italian version of the PDI resulted to be good, falling in the range of those reported in the

**Table 1.** Peritraumatic distress inventory statistics, internal consistency and principal component analysis (PCA).

| PDI item | Endorsement rates N (%) | Mean | SD | Cronbach α if item deleted | Correlation with PDI total score | | Component Matrix Factor 1 |
|---|---|---|---|---|---|---|---|
| | | | | | r | p | |
| Item 1 I felt helpless to do more | 148 (55.8) | 0.88 | 1.03 | .861 | .698 | <.001 | 0.694 |
| Item 2 I felt sadness and grief | 218 (82.3) | 1.66 | 1.22 | .855 | .786 | <.001 | 0.776 |
| Item 3 I felt frustrated or angry I could not do more | 130 (49.1) | 0.82 | 1.06 | .858 | .742 | <.001 | 0.745 |
| Item 4 I felt afraid for my safety | 189 (71.3) | 1.40 | 1.34 | .860 | .742 | <.001 | 0.716 |
| Item 5 I felt guilt that more was not done | 16 (6.0) | 0.12 | 0.54 | .877 | .316 | <.001 | 0.328 |
| Item 6 I felt ashamed of my emotional reactions | 30 (11.3) | 0.17 | 0.53 | .871 | .528 | <.001 | 0.560 |
| Item 7 I felt worried about the safety of others | 207 (78.1) | 1.76 | 1.35 | .867 | .671 | <.001 | 0.631 |
| Item 8 I had the feeling I was about to lose control of my emotions | 56 (21.7) | 0.35 | 0.81 | .864 | .649 | <.001 | 0.672 |
| Item 9 I had difficulty controlling my bowel and bladder | 68 (25.7) | 0.43 | 0.85 | .873 | .472 | <.001 | 0.456 |
| Item10 I was horrified by what happened | 88 (33.2) | 0.56 | 0.97 | .861 | .698 | <.001 | 0.705 |
| Item11 I had physical reactions like sweating, shaking, and pounding heart | 87 (32.8) | 0.55 | 0.96 | .862 | .686 | <.001 | 0.697 |
| Item12 I felt I might pass out | 41 (15.5) | 0.29 | 0.80 | .866 | .618 | <.001 | 0.638 |
| Item13 I thought I might die | 32 (12.1) | 0.20 | 0.64 | .868 | .569 | <.001 | 0.592 |

**Table 2.** PDI item scores in subjects with probable PTSD (N = 47) and in those without (N = 202).

| PDI | | PTSD mean±SD | No-PTSD mean±SD | z | p |
|---|---|---|---|---|---|
| Item 1 | I felt helpless to do more | 1.60 ± 1.210 | 0.66 ± 0.868 | −5.56 | <.001 |
| Item 2 | I felt sadness and grief | 2.96 ± 1.021 | 1.32 ± 1.046 | −7.81 | <.001 |
| Item 3 | I felt frustrated or angry I could not do more | 1.83 ± 1.356 | 0.56 ± 0.791 | −6.41 | <.001 |
| Item 4 | I felt afraid for my safety | 2.57 ± 1.118 | 1.03 ± 1.019 | −7.46 | <.001 |
| Item 5 | I felt guilt that more was not done | 0.32 ± 0.783 | 0.07 ± 0.467 | −3.51 | <.001 |
| Item 6 | I felt ashamed of my emotional reactions | 0.53 ± 0.881 | 0.08 ± 0.351 | −5.24 | <.001 |
| Item 7 | I felt worried about the safety of others | 2.81 ± 1.154 | 1.50 ± 1.255 | −5.93 | <.001 |
| Item 8 | I had the feeling I was about to lose control of my emotions | 0.94 ± 1.223 | 0.18 ± 0.599 | −6.08 | <.001 |
| Item 9 | I had difficulty controlling my bowel and bladder | 1.04 ± 1.233 | 0.25 ± 0.607 | −5.36 | <.001 |
| Item 10 | I was horrified by what happened | 1.34 ± 1.290 | 0.35 ± 0.752 | −6.32 | <.001 |
| Item 11 | I had physical reactions like sweating, shaking, and pounding heart | 1.53 ± 1.365 | 0.29 ± 0.612 | −7.42 | <.001 |
| Item 12 | I felt I might pass out | 0.98 ± 1.359 | 0.08 ± 0.328 | −6.93 | <.001 |
| Item 13 | I thought I might die | 0.66 ± 1.069 | 0.10 ± 0.435 | −5.97 | <.001 |
| PDI total score | | 19.11 ± 8.291 | 6.47 ± 5.25 | −8.88 | <.001 |

**Table 3.** Linear regression model: PDI, age and gender as predictive variables of the IES-R total score in the total sample.

| Predictive factors | b (S.E.) | β | Lower CI95% | Upper CI95% | p |
|---|---|---|---|---|---|
| PDI | 1.84 (0.11) | 0.73 | 1.623 | 2.056 | .000 |
| Female gender | 2.77(1.82) | 0.07 | -.817 | 6.362 | .130 |
| Age | 0.11(0.07) | 0.06 | -.043 | .254 | .162 |
| k | −9.65 (4.60) | - | −18.713 | -.589 | .037 |

$R^2 = 0.542$; $R^2$ corrected = 0.536.
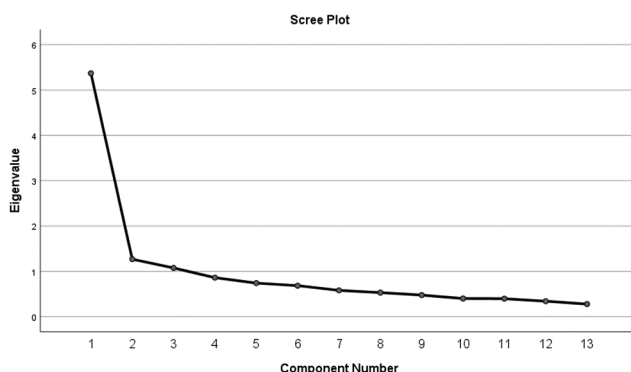


**Figure 1.** Peritraumatic Distress Inventory items Scree Plot analysis.

original validation study (Brunet et al., 2001). Surprisingly, item 5 ('I felt guilt that more was not done') only moderately correlated with the other items. It is in line with a previous study on children to road traffic accident (Bui et al., 2011), suggesting that this item may be less relevant to the 'peritraumatic distress'. Another possibility is that guilt feelings are more relevant in other types of potentially traumatizing events, such interpersonal or war trauma. Moreover, the relationship between guilt and PTSD maintenance and severity is well recognized in literature (Bub & Lommen, 2017; Carmassi et al., 2017; Pugh, Taylor, & Berry, 2015). Future studies should investigate the relevance of guilt in

the peritraumatic reaction on samples affected by different kinds of potentially traumatizing events.

The present results are in line with previous studies (Bui et al., 2010, 2012; Jehel et al., 2005; Rybojad & Aftyka, 2018) on the association between the peritraumatic distress and convergent measures of PTSD. Our data, in fact, corroborated these findings, showing significant higher PDI scores in HCWs affected by PTSD. Consequently, the PDI might be a good instrument to predict PTSD. Furthermore, HCWs with PTSD presented significant higher PDI scores in each PDI items with respect to those without PTSD. Interestingly, despite women reported significant higher PDI total score than men, the relationship between PDI and PTSD was maintained after controlling for age and sex. Most studies, in fact, showed how the PDI could predict the PTSD symptoms independently from age or gender (Vance et al., 2018).

The results of the present study also showed a one-factor structure of the PDI explaining 41.30% of the total variance. Therefore, in our study the tool represents a unique construct encompassing several different manifestations of the peritraumatic reaction, from negative feelings of guilt, shame and anger to physical and somatic symptoms. It is in contrast with previous validation studies of the PDI that showed different factor models. In the original work of Brunet et al. (2001) the instrument presented a two-factor model. The first factor, named 'negative emotions', explained 23% of the variance and included seven items. The second factor 'perceived life threat and bodily arousal' explained 15% of the variance and had six items. A two-factor structure was also showed in most versions of the PDI (Bui et al., 2011; Jehel et al., 2005; Rybojad et al., 2018). However, the Polish version, validated on a sample of 100 emergency HCWs presented a three factor models (Rybojad & Aftyka, 2018), whereas a study on 75 survivors of the 11 September terroristic attack reported a four-factor one (Simeon, Greenberg,

Knutelska, Schmeidler, & Hollander, 2003). All these data suggest that cultural and trauma-related factors may influence on the factor structure of the instrument (Grimm, Hulse, Preiss, & Schmidt, 2012; Olff et al., 2019).

Levels of peritraumatic distress vary widely across studies, depending on samples characteristics and type of trauma investigated. The PDI mean score of our sample appears to be in the mid-range of previous studies (Boisclair Demarble, Fortin, D'Antono, & Guay, 2020; Brunet et al., 2001; Bui et al., 2012; Hargrave, Leathem, & Long, 2012; Nishi et al., 2012; Shiban et al., 2018). For instance, survivors to violent crimes or a high magnitude earthquake reported higher scores (Boisclair Demarble et al., 2020; Nishi et al., 2012), while subjects undergoing spine surgery or individuals experienced the sudden death of a close family member showed lower ones (Hargrave et al., 2012; Shiban et al., 2018). Accordingly, our data confirmed the risk of experience relevant trauma in HCWs during the COVID-19 pandemic. Caring critically ill patients during the outbreak could relate to the development of acute distress reactions in such population (Carmassi et al., 2020).

Our study has some limitations. The first is the examination of a quite homogeneous population represented by HCWs employees. Future studies should investigate the peritraumatic reactions and in different samples, particularly in subjects exposed to complex and prolonged trauma like early childhood maltreatment. In these latter other peritraumatic reactions could be more complex encompassing also dissociative reactions that are not investigated in the PDI. Second, in our study the PDI was not referred to a single potentially traumatizing event but to the feelings related to witnessing multiple deaths during the COVID-19 emergency; however, this is still relevant as the DSM-5 indicates that 'repeated or extreme exposure to aversive details of a traumatic event' as part of professional responsibilities, such as during the COVID-19 emergency, do qualify for traumatic exposure. Subjects might be exposed to other similar potentially traumatizing events due to the pandemic in the last 30 days before the assessment. It could influence the PDI score and the PTSD symptoms prevalence. Third, although it would have been interesting to precisely characterize the variety of potentially traumatizing events in our sample, and their relationship with PDI severity, it was not the primary aim of the present study. Another limitation is the use of self-report instruments, instead of the rating of the clinician, to evaluate PTSD diagnosis. In light of the mentioned limitation, further studies are needed in population exposed to different types of potentially traumatizing events. Furthermore, it will be useful to compare the PDI with other measurements of peritraumatic distress in order to assess the various psychopathological dimensions of the immediate reaction to trauma.

In conclusion, the Italian version of the PDI presents adequate psychometric proprieties. It could represent a useful instrument for the evaluation of distress reaction during a potentially traumatizing event. Furthermore, the PDI appears to relate to the PTSD symptoms in a sample of HCWs exposed to a potentially traumatizing event in the framework of their work. However, other psychometric instruments are still needed to assess psychopathological reactions to potentially traumatizing events not included in the PDI, such as dissociation. Further Italian studies will be able to take advantage of such instrument in order to explore peritraumatic distress reactions and their correlations to trauma-related disorders.

## Data availability statement

## Disclosure statement

The authors declare that the study was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## Funding

## Ethics statement

The study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of Area Vasta Nord-Ovest Toscana (Pisa, Italy, protocol study No. 2020/17151). All eligible subjects were asked to provide written informed consent after receiving a complete description of the study and they had the opportunity to ask questions.

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