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Validity, reliability and factor analysis of the Polish version of the Peritraumatic Distress Inventory

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Summary

Aim. Evaluating validity and reliability of the Polish version of the Peritraumatic Distress Inventory (PDI) and conducting factor analysis of this tool.

Material and methods. A cross-sectional study encompassed 100 employees of the Polish emergency medical system. They completed the author's questionnaire, the Polish version of the Impact Event Scale-Revised and the 13-item PDI validated in this study.

Results. Cronbach's alpha coefficient for the entire scale, ultimately including 12 items, is 0.77. A three-factor structure of the tool has been demonstrated, explaining 60.04% of the variance. This analysis revealed moderate to high values of the factor loadings of all items which form subscales with the exception of the fifth subject. On this basis it was decided to reject the fifth item. Cronbach's alpha for factor 1 (Loss of control and arousal) is 0.75, for factor 2 (Negative emotions) – 0.77 and for factor 3 (Feeling of threat) – 0.68. A strong positive correlation between distress and severity of symptoms of posttraumatic stress disorder ($r = 0.70$, $p < 0.01$) was shown. Additionally, distress strongly and positively correlated with the various symptoms of PTSD: intrusion, arousal and avoidance.

Conclusions. The Polish version of the PDI is a relevant and reliable distress assessment tool.

Key words: Peritraumatic Distress Inventory, Posttraumatic Stress Disorder, emergency medical service workers

Introduction

Emergency medical service (EMS) is dedicated to providing out-of-hospital acute medical care. Staff employed in the system must meet the requirements under the relevant regulations [1]. All personnel (dispatchers, physicians, nurses, and paramedics) every day are exposed to stressful situations related to their occupation. Watching the suffering of others, especially children or relatives and sometimes feeling helpless

despite the implementation of all possible medical procedures, affect the occurrence of a variety of psychopathological symptoms. Emergency services (police, military, EMS workers) are particularly exposed to extreme stress, as confirmed by literature [2–4].

In 1980, the American Psychiatric Association (APA) identified Posttraumatic Stress Disorder (PTSD) as a separate disorder and added it into the third edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-III), and it is present in the subsequent editions of DSM [5]. Twelve years later, the World Health Organization (WHO) coded PTSD into the International Classification of Diseases (ICD) as F43.1 [6]. It can develop in people who have experienced a particularly traumatic event, e.g., car accidents, sudden disability, rape, death of a close person, serious illness, deprivation of liberty. Other circumstances predisposing to PTSD are wars, terrorist attacks, natural disasters, or human-induced disasters. The more emotionally a person is involved in an event, the greater the likelihood of PTSD. It is characterized by the following symptoms: intrusion (manifested in re-experiencing a traumatic event in the form of dreams or memories), avoidance (of feelings, conversations, stimuli or activities related to the experienced event) and hyperarousal (difficulties with concentration but also with falling asleep, general irritability, strong emotional reactions in the case of sudden stimuli, a constant feeling that danger or disaster is nearby) [4].

Nowadays more and more occupational, social or cultural groups are exposed to stress factors, and in some of them PTSD will occur in the future [7–9]. There is no "gold standard" for identifying the characteristics of a critical event that is likely to cause emotional consequences such as PTSD. Due to the complexity of the problem, many tools have been developed to confirm or exclude the diagnosis of PTSD [10]. The Impact of Event Scale-Revised (IES-R), developed by Weiss and Marmar [11], adapted in Polish by Juczyński and Ogińska-Bulik [12] is one of the most popular in Poland. The basic criterion for the diagnosis of PTSD is exposure to dramatic events leading to experiencing extreme anxiety and a sense of helplessness – as described in the DSM-IV as a so-called Criterion A [13, 14]. Within Criterion A, Criterion A1, relating to witnessing or being confronted with an event that involved actual or threatened death or serious injury to self or others, was identified. Criterion A2 described the person's emotional and physiological response which were independent from his or her will, and resulted from autonomic responses to stress [15]. In DSM V, published in 2013, some physiological responses (subjective aspect of peri-traumatic emotions) were excluded from the list; they were recognized as an important indicator of distress, but not PTSD [16].

Seeking relevant and reliable tools, Brunet et al. developed a new questionnaire – the Peritraumatic Distress Inventory (PDI; Pol. Skala Dystresu Okołourazowego). The authors officially published the PDI in 2001 [17]. It is based on 13 items describing the physiological and emotional reactions that may occur during a stressful situation [13]. The authors of the tool argue that there are many reasons why im-

mediate reactions following a traumatic factor should be investigated. As a result of a meta-analysis, it was found that peritraumatic dissociation is a better predictor of PTSD than objective characteristics of trauma, and the mechanisms leading to PTSD also result from the temperament, prior experiences and other genetically or environmentally conditioned factors, including plasticity and "learning" ability in individual neurons [17, 18]. The authors examined the reliability of this tool on a group of policemen-volunteers, comparing their results to the general population. The PDI is a self-report tool, useful in the early selection of individuals at risk of PTSD, validated in several languages [17–23]. To our knowledge, this study is the first official validation in Polish.

Aim

The aim of this study was to adapt the PDI to Polish conditions and to assess the reliability of the Polish version of the PDI in the group of emergency medical system employees. The factor analysis of the Polish version of this tool was also performed.

Material and Methods

Subjects

The study encompassed one hundred EMS workers from four different regions of Poland. All of them were employed in first response settings. Men predominated (72 %). The sample size in the research has an impact on the results of the validation of the scale. The recommended number of subjects is at least 5 times the number of items in the tool [24]. In the current study the ratio was even higher and amounted to 7.7:1.

Tools

Peritraumatic Distress Inventory

The PDI developed by Alain Brunet, an American clinical psychologist, to assess stress-related disorders [17] is the first instrument to assess the recalled amount of distress experienced at the time of a traumatic event. This tool was based on an earlier Peritraumatic Emotional Distress Scale (PED) [25]. The original English-language version is composed of 13 self-report items describing symptoms of experienced discomfort, each scored on a 5-point Likert-type scale [26] (0 – not at all, 1 – slightly, 2 – somewhat, 3 – very, and 4 – extremely true). The highest number of points that can be obtained for 13 items is 52 points, and higher scores indicate increased distress. The task of the person being examined is to recall the most stressful situation he/she experienced (in the case of our study the respondents were asked to recall the most stressful event related to their professional work in the emergency medical service).

Then they were asked to assess their well-being during this event or immediately after this event by marking the appropriate number. If a statement does not address a person, it is marked in the first column as 0.

The PDI explores the emotional physical reactions during or immediately after a traumatic event. The authors proved its time internal stability. It also has good psychometric properties [17]. The inventory was used in the USA, among other countries, to examine rescue system employees, car accident victims (including school children) or Haiti earthquake victims in 2010 [17–22]. Since no other Polish publications were found before the beginning of our own research, it was considered to be the first use with validation in Polish conditions. We obtained permission for adaptation and validation from the author of the PDI.

Impact of Event Scale-Revised

The Impact of Event Scale-Revised is one of the most well-known tools for measuring PTSD by assessing the subjective stress caused by a traumatic event. It contains 22 items, and three factors of PTSD have been identified in factor analysis: arousal (6 items), intrusion and avoidance (8 items for each factor). Arousal is characterized by increased vigilance, anxiety, difficulty in concentrating. Intrusion expresses recurring images, dreams, thoughts or perceptual experience associated with the trauma. Avoidance regards manifested efforts to get rid of thoughts, emotions or conversations associated with the trauma [12].

Validation of the Peritraumatic Distress Inventory

The validation process comprised two parts: translating from English (the original language for the PDI) into Polish and the assessment of the psychometric properties of this translation [25]. The procedure was in accordance with the instructions given in the WHO guidelines concerning the translation and adaptation of research tools [26]. Before we began, we contacted the author of the PDI and obtained permission to use it in our research, as well as to translate and validate the PDI in Polish. Two independent persons translated the original version from English into Polish. Then the Polish version of the PDI was subjected to back translation which is translated back into the original language by a person not familiar with the original English text. Both language versions were very similar, however, Professor Brunet suggested some changes in items 1 and 2 which were introduced. The tools did not differ in terms of the graphic layout.

Similarly as in other adaptations, we determined the validity and reliability of the inventory calculating Cronbach's alpha coefficient as well as the correlations between the PDI and a tool commonly used and validated in Polish conditions: the Impact of Event Scale-Revised [12]. The respondents were given instructions on

how to properly fill out questionnaires and asked to complete sociodemographic data. The survey was completely anonymous and the respondents gave their consent with the understanding that the results will be used collectively and anonymously solely for scientific studies.

Statistical analysis

The statistical analysis was carried out using the results obtained. The values of the data measured in the nominal scale were characterized by number and percentage whereas those measured in the ratio scale were analyzed using mean and standard deviation.

In order to assess the reliability, Cronbach's alpha was used. Suitability of choice of the sample was tested using the Keiser-Mayer-Olkin test. Theoretical validity was assessed using the exploratory factor analysis which was conducted using the principal component analysis with Oblimin rotation with Kaiser normalization. The reliability of the tool was estimated based on values of discriminatory powers making up for dimensions distinguished. To assess coexistence of distress and PTSD symptoms, Spearman's correlation coefficient *rho* was used. A 5% error of inference and related level of significance $p < 0.05$, indicating the existence of statistically significant differences or relationships were assumed.

Statistical analyses were conducted using SPSS software v. 21.

Bioethics Committee

The study is a part of a larger project and was accepted by the Bioethics Committee of the Medical University of Lublin (KE-0254/286/2014). All the data were analyzed anonymously with no possibility of identifying individual participants.

Results

Sample characteristics

The study included 100 EMS workers aged 20–61 years old ($M = 36$, $SD = 10$) whose work experience ranged from six months to 40 years ($M = 13$, $SD = 10$).

Males predominated in the study group – 72% of the respondents. Table 1 shows detailed characteristics of the study sample.

Table 1. **Sample characteristics**

		n	%
Sex	Females	28	28.0
	Males	72	72.0

table continued on the next page

Place of residence	Rural area	76	76.0
	Urban area	24	24.0
Education	High School	36	36.0
	Bachelor	39	39.0
	Master	25	25.0
Occupation	Physician	7	7.0
	Nurse	15	15.0
	Parmedic	76	76.0
	Dispatcher	13	13.0
Employment	MET[1]	72	72.0
	HEMS[2]	5	5.0
	ED[3]	34	34.0
	ECC[4]	19	19.0
Type of employment contract	1 employment contract	44	44.0
	More than 1 contract	32	32.0
	Only mandate contract	4	4.0
	Only contract	20	20.0

MET – Medical Emergency Team; HEMS – Helicopter Emergency Medical Service; ED – Emergency Department; ECC – Emergency Control Centre

Cronbach's alpha coefficient for the PDI, including 13 items, was 0.77. Average severity of distress was 1.14 ± 0.59 points. However, individual symptoms were experienced by the respondents with different intensity. The highest intensity concerned a sense of sorrow and grief (2.07 ± 1.37 points), frustration and anger (1.85 ± 1.36 points), fear (1.69 ± 1.36), and a sense of helplessness (1.63 ± 1.37 points). The lowest intensity of symptoms concerned a sense of threat to one's own life (0.20 ± 0.49 points), feeling of being threatened with loss of consciousness (0.36 ± 0.63 points) and problems with control of physiological functions such as vomiting, the need to urinate or evacuate the bowels (0.48 ± 0.83 points). Descriptive statistics (mean, standard deviation) and discriminatory powers of the PDI are presented in Table 2. It also shows that removing any items does not increase the value of Cronbach's alpha.

Table 2. **Descriptive statistics and discriminatory powers of the PDI items**

	M	SD	Discriminatory power	Cronbach's alpha if removed
I felt helpless	1.63	1.37	0.53	0.77
I felt sadness and grief	2.07	1.37	0.36	0.79

table continued on the next page

I felt frustrated or angry	1.85	1.36	0.45	0.77
I felt afraid for my own safety	1.06	1.21	0.30	0.79
I felt guilty	0.62	.94	0.49	0.77
I felt ashamed of my emotional reactions	0.92	1.01	0.43	0.77
I felt worried about the safety of others	1.37	1.28	0.31	0.79
I had the feeling I was about to lose control of my emotions	0.73	.83	0.63	0.76
I had difficulty controlling my bowel and bladder	0.48	.83	0.36	0.78
I was horrified by what I saw	1.69	1.29	0.48	0.77
I had physical reactions like sweating, shaking, and pounding heart	1.27	1.14	0.58	0.76
I felt I might pass out	0.36	.63	0.38	0.78
I felt I might die	0.20	.49	0.37	0.79

Factor analysis

The value of the Kaiser-Meyer-Olkin Test of sampling adequacy is 0.73 and the Bartlett's test of sphericity showed significant results ($\chi^2 = 441.73$; $df = 78$, $p < 0.001$). Both Kaiser criterion (three loads above the value of one) and the scree plot test suggested a three-factor solution (Figure 1).

These analyses revealed moderate to high values of the factor loadings of all items which form subscales with the exception of the fifth item. On this basis, it was decided to reject the fifth item. The values of factor loadings of items that make up the distinguished dimensions are as follows: for the first factor from 0.43 to 0.90, for the second factor from 0.52 to 0.83 and for the third factor from 0.81 to 0.90. The values of factor loadings of the PDI items are presented in Table 3.

The factor analysis indicates a three-factor structure that explains 60.04% of the total variance. The first factor, explaining 31.26 % of the variance includes 6 items (8, 9, 10, 11, 12, 13 of the original version). The second factor, explaining 18.39% of the variance, includes 4 items (1, 2, 3, 6). The third factor, explaining 10.40 % of the variance, includes 2 items (4, 7 of the original version).

Cronbach's α for the entire scale, covering 12 items, is 0.77. Cronbach's α for factor 1, described by us as Loss of control and arousal, is 0.75; for factor 2 – Negative emotions – 0.77, and for factor – Feeling of threat – 0.68.

Table 3. **Values of factor loadings of the items constituting separate subscales of the PDI**

	Factor		
	1	2	3
I felt helpless		0.83	
I felt sadness and grief		0.83	
I felt frustrated or angry		0.80	
I felt afraid for my own safety			0.82
I felt guilty			*
I felt ashamed of my emotional reactions		0.52	
I felt worried about the safety of others			0.87
I had the feeling I was about to lose control of my emotions	0.43		
I had difficulty controlling my bowel and bladder	0.58		
I was horrified by what I saw	0.49		
I had physical reactions like sweating, shaking, and pounding heart	0.54		
I felt I might pass out	0.90		
I felt I might die	0.77		

* Factor loadings lower than 0.42 were eliminated. The method of extracting factors – the main components.

Factor rotation method – *Oblimin* with Kaiser normalization.

The Respondents obtained the highest scores in the Negative emotions subscale (1.62 ± 0.89), slightly lower in the Feeling of threat subscale (1.22 ± 1.09) and the lowest – in the Loss of control and arousal subscale (0.79 ± 0.61). The Kolmogorov – Smirnov test for the whole scale showed no significant deviation from the normal distribution (K-S = 0.69; $p = 0.20$). Significant deviations from the normal distribution were observed in the case of results of individual subscales: Loss of control and arousal (K-S = 0.16; $p < 0.01$), Negative emotions (K-S = 0.13; $p < 0.01$) and Feeling of threat (K-S = 0.16; $p < 0.01$) (Table 4).

Table 4. **Descriptive statistics and the Kolmogorov-Smirnov test values for the PDI and its subscales**

	Minimum	Maximum	Mean	Standard deviation	Kolmogorov-Smirnov test
Distress	0.00	2.83	1.14	0.59	K-S = 0.69; p = 0.20
LCA	0.00	2.67	0.79	0.61	K-S = 0.16; p < 0.01
NE	0.00	3.75	1.62	0.98	K-S = 0.13; p < 0.01
FT	0.00	4.00	1.22	1.09	K-S = 0.16; p < 0.01

LCA – Loss of control and arousal; NE – Negative emotions; FT– Feeling of threat

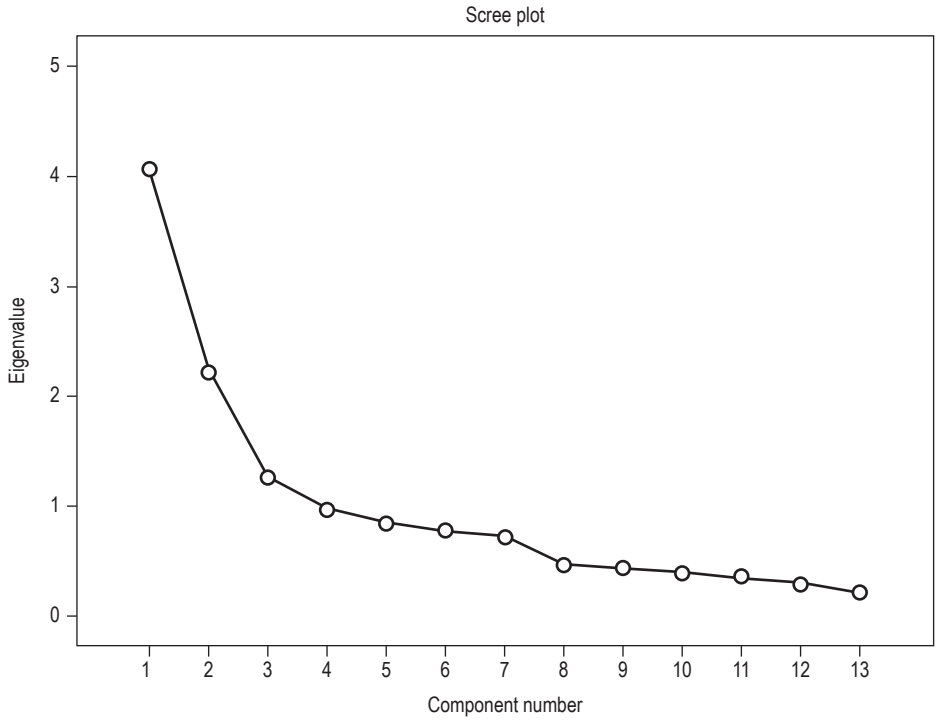

Figure 1. **Scree plot test**

There was a strong positive correlation between distress and severity of posttraumatic stress symptoms (r = 0.70; p <0.01). Additionally, distress strongly and positively correlated with various symptoms of PTSD: Intrusion (r = 0.68; p < 0.01), Arousal (r = 0.70; p < 0.01) and Avoidance (r = 0.59; p < 0.01). Of the PDI subscales, the Loss of control and arousal subscale was most strongly correlated with severity of posttraumatic stress symptoms (r = 0.63; p < 0.01), the Negative emotions subscale was slightly less correlated (r = 0.47; p < 0.01). The weakest correlation was between the Feeling of threat subscale and severity of posttraumatic stress symptoms (r = 0.24; p < 0.05). Similar relationships were observed with respect to individual dimensions of PTSD: Intrusion, Arousal and Avoidance (Table 5).

Table 5. **The correlation matrix: distress, PTSD symptoms, intrusion, arousal and avoidance**

	Distress	LCA	NE	FT	PTSS	Intrusion	Arousal	Avoidance
Distress	1.000							
LCA	0.792**	1.000						
NE	0.727**	0.339**	1.000					

table continued on the next page

FT	0.514**	0.343**	0.084	1.000				
PTSS	0.696**	0.632**	0.469**	0.295**	1.000			
Intrusion	0.675**	0.637**	0.467**	0.239*	0.964**	1.000		
Arousal	0.701**	0.613**	0.461**	0.330**	0.959**	0.910**	1.000	
Avoidance	0.602**	0.515**	0.429**	0.283**	0.923**	0.839**	0.840**	1.000

LCA – Loss of control and arousal; NE – Negative emotions; FT– Feeling of threat; PTSS – Posttraumatic Stress Symptoms; * $p < 0.05$; ** $p < 0.01$

Discussion

The original intention of the authors of the PDI was to create a measure of PTSD criterion A2, which was presented in 2001. So far, it has been validated in several languages in different countries for a variety of populations that may experience PTSD, and according to our knowledge and available sources, this is the first adaptation in Polish, carried out on EMS workers in Poland. The majority of previous PDI validations was performed on groups of police officers, war veterans, or victims of road accidents (including children) [17, 19, 22, 27, 28]. The authors of the tool noted that all main findings obtained in the population of policemen were repeatable among people exposed to different traumatic events. This statement encouraged further research in the general population [17]. Simeon et al. [29] evaluated distress in people who had experienced the September 11, 2001 terrorist attack on the World Trade Center in various ways. The greatest distress was found in survivors evacuated from the buildings, but also in those who lost a spouse or a first-degree relative in this catastrophe. The Minimum level of emotions was aroused only by watching the disaster in the media. This proves that the PDI can be successfully used to compare the intensity of the traumatic experience of people affected by the same tragedy in different ways.

To the best of our knowledge, this is the first study validating the PDI in Polish conditions, moreover, on a population which, in Poland, is much less subjected to tests towards distress in comparison with other emergency services [30]. The sample size was an important issue. Although there are no clear guidelines, it is believed that one determinant is the ratio of the number of participants to the number of items that are analyzed. It is noted that the ratio should be at least 5:1, especially for factor analysis [24].

Our study shows high reliability of the Polish adaptation, comparable to the original version, as well as other validations described in literature, although the study groups ranged from 125 to over 600 participants [17, 19, 22, 29, 32, 33]. Only the researchers from Iran performed the validation of the PDI on a group of only 43 participants of road accidents [22]. The value of Cronbach's alpha > 0.8 is considered as very good,

ranged between 0.6 and 0.8 as good, and < 0.6 as poor reliability of the scale [20]. Therefore, it is recommended to use the entire scale in the assessment of distress in the individual diagnosis, while the subscales, in which the reliability coefficient is lower, may only be used in scientific research. A validation study on the French-speaking population of Canada and individuals who experienced the effects of the attack on the World Trade Center in 2001 in different ways showed Cronbach's alpha greater than 0.8 [31, 32]. A Longitudinal study conducted on a group of 505 children-witnesses of the earthquake in New Zealand showed the reliability of the PDI at 0.89, and thus the highest of the ones published so far [34]. Although One survey on PTSD among paramedics in which the reliability of the PDI was slightly lower with the value of 0.77 still falls within the range described as "good" [21]. It was similar to the value obtained in the present study. Kianpoor et al. [22], validating the PDI on a small group of 43 Iranians (men) injured in road accidents, found no significant correlation with PTSD and the reliability of the tool was 0.73.

The PDI lists specific descriptions of emotional reactions in a comprehensible and concise manner and those reactions are assessed on the scale from 0 to 4 points regardless of the cause of initial traumatic event. In the validation of the French-language version of the PDI, the questionnaire is described as 2-factor, where the first factor includes seven items (1, 2, 3, 5, 6, 8, 12) describing the perception of threat to life. The second factor (items 4, 7, 9, 10, 11, 13) is related to induction of physiological responses. Bui et al. [20] guided by results of the Bartlett's test of sphericity initially determined three, then two factors in the factor analysis. In the population of road accident victims – children of school age, the tool also had a two-factor structure, however, the distribution of items included in factors was slightly different. The first factor included 6 items (1, 2, 3, 6, 7, 10) and the second factor included 7 items (4, 5, 8, 9, 11, 12, 13), and the variance explained was 50.6% [20]. In our study, three-factor structure of the tool was shown. It explained 60.04% of the variance. Simeon et al. [29] studied the reactions of people after the attacks of September 11 in New York and showed four-factor structure of the tool: a threat to life (items: 2, 4, 7, 10, and 13), loss of control (8, 9 and 12), a sense of helplessness or anger (items: 1, 3), and a sense of guilt or shame (items: 5 and 6). Due to the adopted exclusion criteria, item 11 was not taken into account. The total variance explained was 66.1%.

Items 9, 12 and 13 (in particular lack of bowel and bladder control) showed the smallest severity of symptoms, regardless of the population tested both in this study and in other cited studies [17, 22, 33, 34]. Although criterion A2 as a weak predictor of PTSD was not included in the DSM V, the lack of peritraumatic distress is a strong indicator of the absence of PTSD. These conclusions were reached by Boden et al. [33] while assessing peritraumatic stress and factors affecting it depending on the subjects (including mental health, origin). They think that deleting criterion A2 might be a mistake, and that the subjective reaction to the traumatic event is worth considering.

Our study has several limitations. One of them is the examination of a quite homogeneous population represented by EMS employees. The other limitation might be the number of participants, although, as was explained above, for validation of the 13-item tool it is sufficient. Similar limitations along with similar results were reported in other studies cited [18, 19, 29, 31–34].

Conclusions

1. The Polish version of the PDI seems to be a good tool to assess distress level in EMS employees because of its simplicity and conciseness.
2. Different populations are recommended to be examined by means of this tool.

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Polska wersja Skali Dystresu Okołotraumatycznego PDI

Proszę zaznaczyć najlepszą odpowiedź na pytania dotyczące odczuć bezpośrednio po najbardziej stresowej sytuacji w Twoim życiu. Proszę spróbować określić samopoczucie bezpośrednio po niej, zaznaczając odpowiednią cyfrę w skali od 0 (zdecydowanie się tak nie czułem) do 4 (zdecydowanie tak się czułem). Jeśli jakieś pytanie nie dotyczy tej sytuacji, proszę zaznaczyć w pierwszej kolumnie odpowiedź „zdecydowanie nie".

	Zdecydowanie nie	Raczej nie	Umiarkowanie	W znacznym stopniu	Zdecydowanie tak
Czułem bezradność	0	1	2	3	4
Czułem smutek i żal	0	1	2	3	4
Byłem sfrustrowany i wściekły	0	1	2	3	4
Obawiałem się o własne bezpieczeństwo	0	1	2	3	4
Było mi wstyd za moje emocje	0	1	2	3	4
Obawiałem się o bezpieczeństwo innych osób	0	1	2	3	4
Miałem wrażenie, że prawie tracę kontrolę nad emocjami	0	1	2	3	4
Miałem problem z kontrolą czynności fizjologicznych (odruch wymiotny, wymioty, potrzeba oddania moczu lub stolca)	0	1	2	3	4
Byłem przerażony tym, co zobaczyłem (usłyszałem)	0	1	2	3	4
Miałem reakcje fizyczne takie jak: pocenie się, drżenie, kołatanie serca	0	1	2	3	4
Czułem, że mogę zemdleć	0	1	2	3	4
Myślałem, że umrę	0	1	2	3	4