Research Paper

Validation of the Global Psychotrauma Screen for adolescents in Greece

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ARTICLE INFO	ABSTRACT
	Introduction: Adolescents are vulnerable to traumatic exposure. However, there is a lack of developmentally appropriate, freely accessible, transdiagnostic screening instruments for trauma in adolescents. The purpose of this study was to examine the psychometric potential of the Global Psychotrauma Screen Teen version (GPS-T) for the assessment of traumatic, dissociative, and other transdiagnostic symptoms among adolescents in Greece. *Method:* This observational study was conducted with adolescents in Greece ($N = 122$) who completed a 55-item questionnaire. *Results:* The results supported satisfactory internal consistency reliability, convergent validity, and divergent validity of the GPS-T. The construct validity findings suggested a three-factor structure of the GPS-T symptoms. The GPS-T domains had acceptable sensitivity and specificity with the cut-off scores of 3 for PTSD and 2 for the dissociation, anxiety, and depression domains respectively. The GPS-T symptoms differed on four levels of severity. *Conclusion:* The findings suggest that the GPS-T is appropriate for screening of traumatic, dissociative, and other transdiagnostic symptoms among adolescents in Greece. Future research should conduct a replication with larger samples and a test-retest phase.

1. Introduction

1.1. Trauma in adolescents

Exposure to potentially traumatic events (PTEs) is common in adolescents (Connell et al., 2018; Darnell et al., 2019), often resulting in trauma-related disorders during this developmental stage that can persist into adulthood (Copeland et al., 2018; Frewen et al., 2024; Kessler et al., 2017; King et al., 2020; McKay et al., 2021). Over 60% of youth are exposed to at least one PTE and between 8%-25% of them develop PTSD before they reach the age of 18 years (Darnell et al., 2019; McLaughlin, 2023). In Greece, the United Nations Children's Fund (UNICEF, 2020) reported that 70% of adolescents were exposed to psychological violence, 47.7% to physical violence, and 9.8% to sexual violence. However, PTSD is underdiagnosed among adolescents in Greece (Belivanaki et al., 2017). Symptoms of PTSD in youth can be comorbid with dissociation (Anderson et al., 2023; Choi et al., 2019; Choi et al., 2017; Howard et al., 2021), depression, anxiety (Cao et al., 2021; Darnell et al., 2019), and sleep disorders (Armour et al., 2014). Such comorbidities require a transdiagnostic assessment using a dimensional approach (Frewen et al., 2021; Olff et al., 2021; Williamson et al., 2021).

1.2. Screening of trauma in adolescents

Several measures for screening of trauma have been developed and validated for adolescents using a discrete-disorder approach; however, they do not account for the transdiagnostic nature of trauma-related symptoms and do not differentiate between the child and adolescent age groups (Grace et al., 2021). The Global Psychotrauma Screen (GPS) was developed by an international group of trauma experts with the Global Collaboration on Traumatic Stress (GCTS) to address the need for

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a free and easily accessible transdiagnostic screening tool for health care providers worldwide (Olff, 2022; Olff et al., 2020). The GPS was developed using the transdiagnostic theoretical framework which posits that the symptoms of trauma are not limited to PTSD and may include a variety of interrelated symptoms of common mental disorders associated with trauma such as depression, anxiety, dissociation, and others (Frewen et al., 2024; Frewen et al., 2021; Havermans et al., 2023; Olff et al., 2020; Olff et al., 2021; Williamson et al., 2021). These interrelated symptoms are influenced by risk factors and have an impact on functioning in major areas of life. Consequently, the GPS is comprised of three parts: (1) GPS Symptoms; (2) GPS Risk Factors; and (3) GPS Functioning. Detailed report on the GPS development provided by Frewen et al. (2021) and Olff et al. (2020); while we summarize the GPS structure and items below.

The GPS Symptoms consists of nine conceptual dimensions or domains that were identified using an expert consensus approach. Each domain was operationalized into empirical dimensions selected from previously validated measures: (1) the PTSD domain consists of five core traumatic symptoms: intrusion, avoidance, hypervigilance, detachment, and blame; (2) the Disturbances in Self-Organization (DSO) domain measures two symptoms of Complex PTSD: worthlessness and anger; (3) the anxiety domain is comprised of the symptoms of anxiety and worry; (4) the depression domain includes depressed mood and anhedonia; (5) the sleep problems domain screens for insomnia; (6) the self-harm domain assesses for the attempts of intentional self-harm; (7) the dissociation domain measures the symptoms of derealization and depersonalization; (8) the other problems domain screens for nonspecific physical, emotional, or social problems; and (9) the substance abuse domain screens for the use of psychoactive substances (Frewen et al., 2021; Olff, 2022; Olff et al., 2020).

The GPS Risk Factors includes five empirical dimensions such as other stressful events, childhood trauma, history of mental illness, the lack of social support, and the lack of psychological resilience (Frewen et al., 2024). The GPS Functioning was operationalized into one empirical item that screens for possible functional impairment in major areas of life (Olff, 2022). The GPS Teen version (GPS-T) was semantically adapted from the original GPS for screening of adolescents aged 11 to 17 years, while retaining the same conceptual and empirical structure (GCTS, 2021; Grace et al., 2021).

1.3. Research aims

The purpose of this observational study was to assess reliability, convergent validity, divergent validity, construct validity, screening accuracy, and severity levels of the GPS-T among adolescents in Greece.

1.4. Hypotheses

Based on the previous validation studies of the GPS (Frewen et al., 2024; Frewen et al., 2021; Grace et al., 2023; Oe et al., 2020; Olff et al., 2021; Rossi et al., 2021; Salimi et al., 2023), we hypothesized that:

1. The GPS-T will have moderate-to-high levels of internal consistency of the total symptoms and domains.
2. The GPS-T will have moderate-to-high levels of convergent validity with CRIES-8, DES-B (items on depersonalization and derealization), GAD-7, PHQ-9, and GAD-F and PHQ-F (functioning items).
3. The GPS-T will have moderate-to-high levels of divergent validity in relation to the DES-B total score.
4. There will be three latent factors underlying the GPS-T manifest variables.
5. The sensitivity and specificity of the GPS-T for probable PTSD, dissociation, depression, and anxiety will be moderate-to-high.
6. The GPS-T Risk Factors will predict higher levels of the GPS-T Symptoms while controlling for demographic and COVID-19 variables.

7. Four levels of the GPS-T Symptoms severity (low, mild, moderate, and extreme) will be statistically different. The more severe categories of the GPS-T Symptoms will predict lower scores on the GPS-T Functioning.

Detailed statistical hypotheses are reported in Supplementary Material.

2. Method

2.1. Ethical considerations

Upon obtaining an approval of the Committee of Research, Morale, and Ethics at the General Hospital "Agios Andreas" in Patras, Greece (ΑΔΑ: 63ΗΛ46906Λ-64Υ), Ioanna Koutsopoulou collected data using convenience sampling in Greece between May 2022–May 2023 (see Table 1). Parental written informed consent and adolescent's assent were obtained prior to data collection. Adolescents were screened for eligibility to participate in the study using two inclusion criteria: 11 to 17 years old and residing in Greece. No monetary or other compensation was provided for participation in this study.

2.2. Measures

The study questionnaire consisted of six research instruments with a total of 55 items. The questionnaire began with demographic items, including age, gender, education, and family status, followed by questions about COVID-19 and other stressors (see Supplementary Material). The validation instrument was GPS-T consisting of 22 dichotomous (yes-no) items for trauma-related symptoms and risk factors, and one functioning item measured on a continuous scale from 1 to 10 (Olff, 2022). The GPS-T was translated into Greek, backtranslated, and developmentally and culturally adapted by a team of three bilingual psychologists, two teachers of English, and a speech therapist, following the procedures from Sousa and Rojjanasrirat (2011) and is available at Global Collaboration on Traumatic Stress (2023). In the present sample, Cronbach's alpha for the GPS-T total symptom score was .88, indicating very good internal consistency.

The reference measures were selected based on their theoretical relevance and validation in previous studies. A reference standard for PTSD was the Children's Revised Impact of Event Scale – 8 (CRIES-8), which has been validated and used internationally, including in Greece

Table 1
Demographic characteristics ($N = 122$).

Characteristics	Participants n (%)
Age	14.8 (*Median* 15; *Min* 11; *Max* 17)
Gender	
Female	70 (57.4)
Male	46 (37.7)
Prefer not to answer	6 (4.9)
Education	
Primary school	17 (13.9)
High school	39 (32)
Senior high school	59 (48.4)
University*	7 (5.7)
Family Status	
Parent(s)	122 (100)
Sibling(s)	72 (59)
Grandparent(s)	15 (12.3)
Other relative(s)	3 (2.5)
Location	
Patras	115 (94.3)
Other cities/villages	7 (5.7)

Note:
* These seven participants started school before the age of 6 years (age 5 and a half years), thus, graduated from high school earlier, and entered university at the age of 17 years and before they reached 18 years.

(Children and War Foundation, 1998; Dow et al., 2012; Dyregrov et al., 1996; Lianos et al., 2023; Perrin et al., 2005; Verlinden et al., 2014). In the current sample, Cronbach's alpha for CRIES-8 was .93, indicating excellent internal consistency. A cut-off score of ≥ 17 on CRIES-8 is recommended for PTSD (Perrin et al., 2005).

We used the Brief Dissociative Experiences Scale (DES-B, Dalenberg & Carlson, 2010) as a reference standard, given its brevity and common utilization for screening of dissociative symptoms. DES-B has been validated for use with adults in Greece (Tzikos et al. 2021) and with adolescents outside of Greece (Howard et al., 2021). In the present sample, Cronbach's alpha for DEB-B was .79, showing good internal consistency. A cut-off score of >16 on DES-B indicates the probability of clinical dissociation (Pietkiewicz et al., 2019). We used the DES-B items on depersonalization and derealization for measuring convergent validity of the corresponding GPS-T Dissociation domain score, and the DES-B total score to assess divergent validity.

The reference measures for anxiety and depression were GAD-7 (Spitzer et al., 2006) and the Patient Health Questionnaire – 9 (PHQ-9; Kroenke et al., 2001) because they have well-established psychometric properties within the adolescent population (Mossman et al., 2017) and are available in Greek. A cut-off score of >10 on each GAD-7 and PHQ-9 confirm generalized anxiety disorder and major depressive disorder (Kroenke et al., 2001; Spitzer et al., 2006). In the current sample, Cronbach's alpha for GAD-7 was .91 and for PHQ-9 was .82, confirming very good internal consistency. Additionally, we used the PHQ-9 and GAD-7 items on sleep-related symptoms to assess convergent validity of the GPS-T Insomnia item. To assess convergent validity of the GPS-T Functioning, we used the PHQ-F and GAD-F items.

2.3. Statistical analyses

The statistical procedures were performed using STATA.17 (StataCorp, 2021) and SPSS.26 (IBM Corp., 2019). The convergent validity and divergent validity of GPS-T were assessed using the Spearman's correlation coefficient. For Exploratory Factor Analysis (EFA), the assumption of homogeneity on key variables (Kyriazos, 2018) was checked by randomly splitting the sample into two halves and comparing them on key variables. The data suitability for factor analysis was checked using the Kaiser–Meyer–Olkin (KMO) test for sampling adequacy and the Bartlett's test of sphericity for the appropriateness of EFA for the data. Tetrachoric EFA was conducted because of the GPS-T's dichotomous item structure. The principal axis factoring with the oblique Promax rotation was applied to identify latent constructs. The sensitivity and specificity analyses were conducted to assess the screening accuracy of GPS-T for detecting transdiagnostic symptoms of trauma, dissociation, depression, and anxiety. The Receiver Operating Characteristic (ROC) analysis was conducted to calculate the Area Under the Curve (AUC), sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and the Likelihood Ratios (LR) of the GPS-T domain scores.

The relationship between the GPS-T Symptoms and Risk Factors was assessed using a hierarchical multiple regression model that included three blocks: (1) four demographic variables; (2) COVID-19 items; (3) GPS-T Risk Factors. For severity analysis, we created the GPS-T Symptoms' severity groups based on the percentile cut-off points as follows: low $\leq 30^{th}$ percentile, mild $31–74^{th}$ percentile, moderate $75–94^{th}$ percentile, and severe $\geq 95^{th}$ percentile (Fissette et al., 2014). The Welch ANOVA, followed by the Games-Howell post-hoc test for pairwise comparisons, was utilized to compare the GPS-T Symptoms' severity groups. The one-way ANOVA with the Scheffé post-hoc test was conducted to compare the GPS-T Functioning scores among the severity groups.

3. Results

3.1. Sample characteristics

A total of 122 participants completed the questionnaire. Demographic information is reported in Table 1. Exposure characteristics including the COVID-19-related stressors and other PTEs are presented in Table 2. Some participants reported clinically established diagnoses (see Table 3). Additionally, two participants had behavioral issues, one participant reported a circumstantial substance use, and one participant had issues related to their gender identity.

3.2. GPS-T symptom and risk factor endorsement

The most frequently reported GPS-T symptom was anxiety, while substance use was the least frequent (see Fig. 1). The mean scores on GPS-T and other measures are reported in Table 4. The GPS-T Symptoms' sum scores were higher in the participants who endorsed the GPS-T Risk Factors such as Childhood Trauma, History of Mental Illness, and Other Events (see Table 5). There was a weak positive correlation of age with the GPS-T Symptoms ($rho = 0.216$; $p = 0.017$) and Risk Factors ($rho = 0.320$; $p < 0.001$). Females had higher sum scores on the GPS-T Symptoms: $t(111) = 3.6$, $p < 0.001$, $r = 0.33$; and the GPS-T Risk Factors $t(112) = 4.8$, $p < 0.001$, $r = 0.41$.

Table 2
Exposure characteristics ($N = 122$).

Characteristics	Participants n (%)
COVID-19 (in descending order)	
Lockdown in the area	118 (96.7)
Change or disruption in education	117 (95.9)
Limited play or sports	102 (83.6)
Limited meetings with peers and others	94 (77)
Home quarantine	78 (63.9)
Impact (had COVID-19)	57 (46.7)
Illness	39 (32)
Death in family	14 (11.5)
Other issues	9 (7.4)
Hospitalization	1 (0.8)
Other Events or Stressors (in descending order)	
Grandparent's death (not related to COVID-19)	11 (9)
Unspecified[1]	8 (6.6)
Exams	8 (6.6)
Bullying incidents	6 (4.9)
Conflicts with parents	3 (2.5)
Emotional abuse	2 (1.6)
Parent's death (not related to COVID-19)	1 (0.8)
Two events (grandparent's death and bullying)	1 (0.8)
Family's financial problems	1 (0.8)
False accusation of sexual abuse	1 (0.8)

Note:
[1] Participants did not wish to disclose the events.

Table 3
Formally diagnosed mental disorders ($N = 122$).

Diagnosis	Participants n (%)
Eating disorders[1]	4 (3.3)
Unspecified[2]	3 (2.5)
Depressive disorders[3]	2 (1.6)
Autism spectrum disorder	2 (1.6)
Obsessive-compulsive and depressive disorders	1 (0.8)
Attention deficit and hyperactivity disorder	1 (0.8)
Dyslexia	1 (0.8)
Dysgraphia	1 (0.8)
Total	15 (12.3)

Notes:
[1] One of the participants also had suicidal thoughts.
[2] These participants did not wish to disclose their diagnoses.
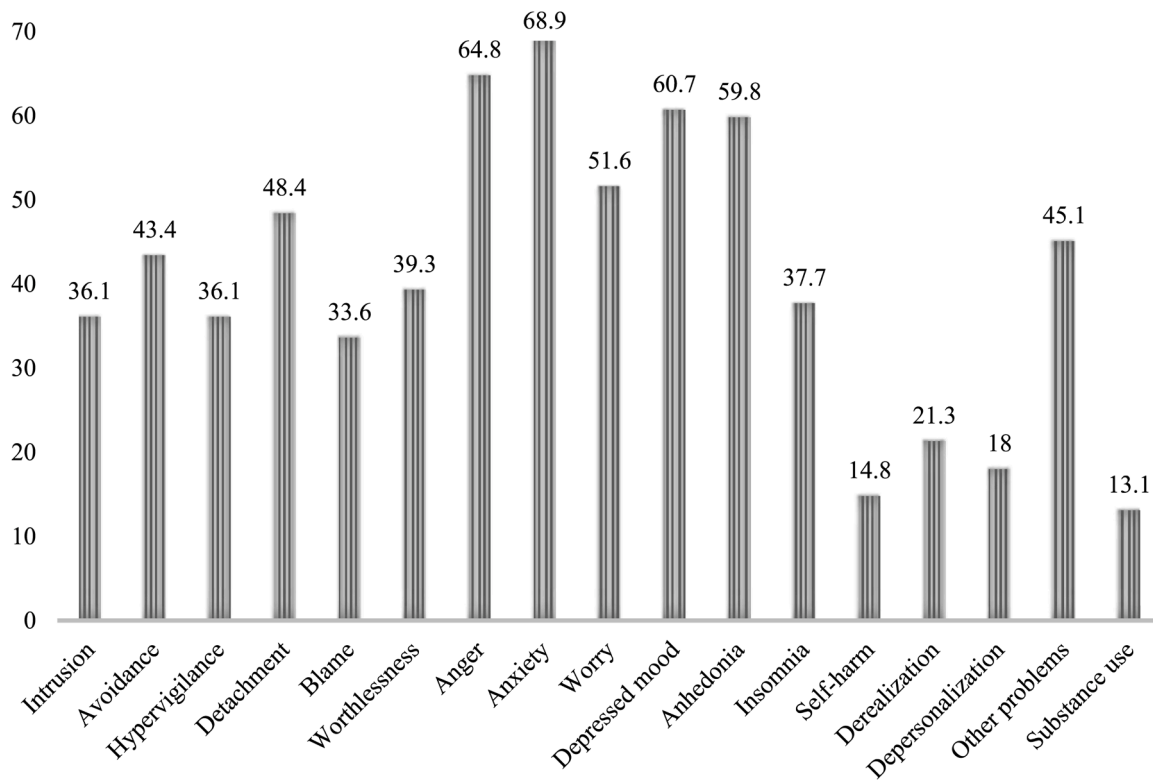[3] One of the participants also reported a past suicidal attempt.

Fig. 1. Frequency distribution of the GPS-T Symptoms (%; $N = 122$).
Fig. 1 Alt text: A bar chart plotting the frequency distribution in percentage for the GPS-T Symptoms based on the responses of one hundred twenty-two participants.

3.3. Reliability of GPS-T

The results presented in Table 6 show acceptable internal consistency reliability of the GPS-T items and domains.

3.4. Convergent validity of the GPS-T

The GPS-T Symptoms and the PTSD, Dissociation, Depression, and Anxiety domain scores had positive correlations with the reference measures, indicating acceptable convergent validity, except for the GPS-T Functioning item which was below the hypothesized (see Table 7). Convergent validity of the GPS-T Insomnia was evident through the higher reference scores in participants endorsing the item: $t(120) = -4.9$, $p < 0.001$, $r = 0.41$.

3.5. Divergent validity of the GPS-T

The low correlations of the GPS-T Symptoms ($rho = 0.36$, $p < 0.01$), PTSD ($rho = 0.27$, $p < 0.01$), Anxiety ($rho = 0.24$, $p < 0.01$), and

Depression ($rho = 0.15$ $p < 0.01$) domain scores with the DES-B sum score indicated satisfactory divergent validity. The divergent validity of the GPS-T Insomnia was supported by the lower reference scores on the sleep-related items of PHQ-9 and GAD-7 in the participants who endorsed the item: $t(120) = -3.1$, $p = 0.002$, $r = 0.27$.

Table 5
Comparison of the GPS-T symptoms by the GPS-T risk factor items ($N = 122$).

GPS Risk Factors	Responses	n (%)	χ^2	p	φ
Other events (#17)	Yes	38 (31.1)	45.81	.001	.613
	No	84 (68.9)			
Lack of social support (#19)	Yes	31 (25.4)	16.59	.413	.369
	No	91 (74.6)			
Childhood trauma (#20)	Yes	35 (28.7)	37.25	.002	.553
	No	87 (71.3)			
History of mental illness (#21)	Yes	33 (27)	26.32	.05	.464
	No	89 (73)			
Resilience (#22)	Yes	49 (40.2)	22.06	.141	.425
	No	73 (59.8)			

Table 4
Mean and standard deviation scores on the study measures ($N = 122$).

Variables	M	SD
GPS Symptoms	6.93	4.43
GPS PTSD	1.98	1.81
GPS CPTSD	3.02	2.23
GPS Anxiety	1.2	0.8
GPS Depression	1.2	0.82
GPS Dissociation	0.39	0.68
GPS Functioning	7.02	2.28
CRIES-8	13.98	12.33
GAD-7	9.36	6.57
PHQ-9	8.84	6.41
DES-B	7.34	6.52

Note: M – mean; *SD* – standard deviation.

Table 6
Internal consistency of GPS-T ($N = 122$).

GPS	α / ρ
Total (α)	0.88
Symptoms (α)	0.87
PTSD (α)	0.79
CPTSD (α)	0.78
DSO (ρ)	0.48
Anxiety (ρ)	0.55
Depression (ρ)	0.57
Dissociation (ρ)	0.60

Note: α - Cronbach's alpha coefficient; ρ - Spearman-Brown's coefficient

3.6. Construct validity of the GPS-T

The assumption of homogeneity between the randomly split two halves of the sample on key variables was met based on the *t*-test or χ^2 results, thus allowing to proceed with EFA. The KMO of 0.82 indicated high sampling adequacy. The Bartlett's test of sphericity confirmed the appropriateness of EFA based on large correlations between items, $\chi^2(136) = 720.456, p < 0.001$.

The initial analysis identified Factors 1, 2, 3, and 4 with Eigenvalues >1, which explained 57% of the total variance (see Table 8). The rotated factor loadings in the initial EFA model showed that Factor 1 was represented by the PTSD, anxiety, and depression symptoms along with other physical, social, or emotional problems. However, some items did not meet the expected thresholds for factor loadings and uniqueness (see Table 9). Factor 2 included the dissociation items of depersonalization and derealization, although the latter did not meet the thresholds for factor loadings and uniqueness. Factor 3 was represented by the items of insomnia, self-harm, and substance use, although substance use exceeded the threshold for uniqueness. Factor 4 was comprised of the two DSO items; however, both items exceeded the uniqueness threshold. Considering the issues with the four-factor model, an additional EFA model was created to test the three-factor structure. The three-factor model improved the factor loadings and uniqueness and explained 51% of the total variance. Factor 1 remained the same as in the initial model, except for the intrusion item. Factor 2 combined the two dissociation items with insomnia, substance use, self-harm, and intrusion. Factor 3 consisted of the two DSO items that were initially in Factor 4. The internal consistency reliability based on the Cronbach's Alpha results was very good in Factor 1, good in Factor 2, and low-to-moderate in Factor 3. (see Table 10).

3.7. Sensitivity and specificity of the GPS-T

The results of the ROC analysis showed high AOC values for the GPS-T PTSD, Anxiety, Depression, and Dissociation domains (see Table 11). For the GPS-T PTSD domain, a cutoff score 3 showed the higher percentage of correctly classified cases while maintaining an optimal balance of sensitivity relative to specificity. The GPS-T Dissociation, Depression, and Anxiety domains achieved optimal sensitivity relative to specificity with a score of 2. See Table 12 for detailed results.

3.8. Severity analysis of the GPS-T symptoms

The distribution of the GPS-T Symptoms' severity levels showed that most participants had a mild level of severity, followed by low, moderate, and high levels (see Table 13). All four severity groups differed from one another on the GPS-T Symptoms: $F(3, 35.46) = 920.79, p = 0.001, \eta^2 = 0.883$. The GPS-T Functioning score differentiated the low and extreme severity groups from all other groups of the GPS-T Symptoms, but the mild and moderate groups did not differ from each other: $F(3, 57.21) = 14.76, p = 0.001, \eta^2 = 0.273$. When controlling for demographics, only the group with low severity of the GPS-T Symptoms

had a lower score on the GPS-T Functioning, $F(3) = 8.25, p = 0.001$, than the other three severity groups, which did not differ from each other.

3.9. Analysis of the GPS-T risk factors

In line with the previous psychometric studies on the GPS in adults (Frewen et al., 2024; Frewen et al., 2021; Grace et al., 2023; Havermans et al., 2023; Oe et al., 2020; Olff et al., 2021; Rossi et al., 2021; Salimi et al., 2023), we tested if the GPS-T Risk Factors would predict the GPS-T Symptoms, while controlling for demographic variables. Because the data were collected during the COVID-19 pandemic, a global emergency that had exacerbated mental health responses (Olff et al., 2021; Magklara et al., 2022), it was important to investigate the GPS-T's ability to differentiate this transitory PTE from more stable risk factors that existed before the pandemic and would likely continue after it. The pandemic-related variables included in this study, such as exposure to COVID-19, death in family, quarantine, hospitalization, disruptions in education and social activities, were identified as stressors earlier in the pandemic (Gassman-Pines et al., 2020; Fitzpatrick et al., 2021).

As hypothesized, the results of the hierarchical multiple regression showed that the GPS-T Risk Factors explained most of the variance in the GPS-T Symptoms (see Table 14). Out of the nine COVID-19-related variables, only being quarantined at home due to the COVID-19 exposure in the family was associated with more GPS-T Symptoms. Among the demographic variables, female gender predicted higher GPS-T Symptoms in Block 1; however, this change was minimal and became insignificant when accounting for the COVID-19 variables in Block 2 and the GPS-T Risk Factors in Block 3.

4. Discussion

4.1. Interpretation of results

The results of this study supported our hypotheses in that the GPS-T items and domains demonstrated acceptable internal consistency, thus supporting the earlier studies on the psychometric properties of the GPS adult version (Frewen et al., 2024; Frewen et al., 2021; Grace et al., 2023; Havermans et al., 2023; Oe et al., 2020; Olff et al., 2021; Rossi et al., 2021; Salimi et al., 2023). Similarly, the GPS-T Symptoms, PTSD, Anxiety, and Depression domains showed satisfactory convergent validity and divergent validity.

The GPS-T Dissociation domain had satisfactory convergent validity in relation to the corresponding DES-B items for depersonalization and derealization. Dissociative symptoms, as indicated by the DES-B total score, were higher in adolescents with more severe levels of the GPS-T Symptoms and those experiencing sleep problems, consistent with

Table 7
Convergent validity of the GPS-T ($N = 122$).

GPS-T Variables	Criterion Variables	Spearman's *rho* or *t*-test
Symptoms	CRIES-8 total	*rho* = 0.758**
PTSD	CRIES-8 total	*rho* = 0.664**
Anxiety	GAD-7 total	*rho* = 0.579**
Depression	PHQ-9 total	*rho* = 0.651**
Dissociation	DES-B sum of items 2 & 5	*rho* = 0.637**
	DES-B total	*rho* = 0.423**
Sleep problems	GAD item 4 & PHQ item 3	$t(120) = -4.9**$
Functioning	GAD-F & PHQ-F	*rho* = 0.41**

Notes:
** $p < 0.001$

Table 8
The EFA total variance ($N = 122$).

Factor	Eigenvalues total	Variance %	Cumulative %
Factor 1	5.539	32.581	32.581
Factor 2	1.933	11.372	43.953
Factor 3	1.264	7.437	51.389
Factor 4	1.067	6.274	57.663
Factor 5	.969	5.700	63.363
Factor 6	.944	5.554	68.918
Factor 7	.779	4.581	73.499
Factor 8	.767	4.510	78.009
Factor 9	.633	3.721	81.729
Factor 10	.573	3.370	85.099
Factor 11	.498	2.929	88.028
Factor 12	.454	2.673	90.701
Factor 13	.411	2.419	93.120
Factor 14	.360	2.117	95.237
Factor 15	.310	1.826	97.063
Factor 16	.255	1.500	98.562
Factor 17	.244	1.438	100.000

Table 9

Four-factor EFA model with rotated factor loadings and unique variances (N = 122).

Variable	Label	Factor 1	Factor 2	Factor 3	Factor 4	Uniqueness
GPS 4	Numbness	.756				.384
GPS 5	Self-blame	.702				.470
GPS 16	Other problems	.677				.463
GPS 2	Avoidance	.672				.506
GPS 3	Hyperarousal	.646				.571
GPS 10	Depressed mood	.602				.443
GPS 9	Worry	.495				.398
GPS 8	Anxiety	.464				.702
GPS 11	Anhedonia	.338				.798
GPS 1	Intrusion	.334				.637
GPS 14	Derealization		.859			.237
GPS 15	Depersonalization		.385			.737
GPS 12	Insomnia			.915		.261
GPS 18	Substance use			.442		.683
GPS 13	Self-harm			.418		.526
GPS 7	Anger				.539	.670
GPS 6	Worthlessness				.413	.640
Cronbach's Alpha		0.857	0.603	0.645	0.477	
Average Inter-Item Covariance		0.096	0.069	0.060	0.074	

Notes: Oblique Promax rotation was used. The rotated factor loadings show which variables represent each factor. Kaiser normalization was on in this model. The factor loadings of > 0.4 and uniqueness of < 0.6 are acceptable (Stevens, 2009).

Table 10

Three-factor EFA model with rotated factor loadings and unique variances (N = 122).

Variable	Label	Factor 1	Factor 2	Factor 3	Uniqueness
GPS 4	Numbness	.761			.407
GPS 5	Self-blame	.707			.474
GPS 2	Avoidance	.677			.519
GPS 16	Other problems	.669			.463
GPS 3	Hyperarousal	.650			.571
GPS 10	Depressed mood	.602			.464
GPS 9	Worry	.499			.461
GPS 8	Anxiety	.479			.695
GPS 11	Anhedonia	.333			.807
GPS 13	Self-harm		.713		.461
GPS 12	Insomnia		.551		.691
GPS 18	Substance use		.530		.682
GPS 14	Derealization		.456		.607
GPS 15	Depersonalization		.439		.749
GPS 1	Intrusion		.373		.633
GPS 7	Anger			.548	.670
GPS 6	Worthlessness			.430	.633
Cronbach's Alpha		0.857	0.720	0.477	
Average Inter-Item Covariance		0.096	0.052	0.074	

Notes: Oblique Promax rotation was used. The rotated factor loadings show which variables represent each factor. Kaiser normalization was on in this model. The factor loadings of > 0.4 and uniqueness of < 0.6 are acceptable.

previous studies that found similar associations (Armour et al., 2014; Choi et al., 2019; Choi et al., 2017; Howard et al., 2021; Hyland et al., 2023). However, it is important to note that dissociative symptoms are not often detected in adolescents after trauma (Anderson et al., 2023; Wamser-Nanney & Cherry, 2018). This could be due to the assessment instruments measuring either the psychoform or somatoform symptoms of dissociation (Pietkiewicz et al., 2019) but not both. In this study,

DES-B and the GPS-T Dissociation domain both measured only the psychoform symptoms of dissociation.

Based on the construct validity results, the three-factor structure of the GPS-T appeared theoretically and developmentally more adequate for adolescents. The earlier evidence on the GPS adult version also suggested the three-factor structure (Grace et al., 2023; Rossi et al., 2021; Salimi et al., 2023). In this study, the symptoms of PTSD, anxiety, and depression represented one factor, highlighting the emotionality of trauma-related responses in adolescents associated with internalizing trauma (Darnell et al., 2019). The second factor grouped together the symptoms involving altered states of consciousness such as dissociative symptoms of depersonalization and derealization, insomnia, substance use, and self-harm. The co-occurrence of these symptoms with intrusion

Table 12

Sensitivity and specificity of the GPS-T domain scores (N = 122).

GPS Cut Points ≥	Sensitivity %	Specificity %	Accuracy %	LR+	LR-
PTSD	CRIES-8				
1	91.1	44.2	61.5	1.63	0.02
2	82.2	67.5	73	2.53	0.26
3	68.9	80.5	76.2	3.53	0.39
4	57.8	88.3	77.1	4.94	0.48
5	28.9	98.7	73	2.25	0.73
Anxiety	GAD-7				
1	90.9	35.8	60.7	1.42	0.25
2	69.1	76.1	72.3	2.89	0.41
Depression	PHQ-9				
1	93.8	37.8	59.8	1.51	0.17
2	79.2	75.7	77.1	3.25	0.28
Dissociation	DES-B				
1	91.6	78.2	79.5	3.84	0.2
2	58.3	94.5	91	9.78	0.49

Note: LR – Likelihood Ratio.

Table 11

ROC analysis of the GPS-T (N = 122).

Reference Standards	GPS	AOC	95% CI		PPV	NPV	Prevalence
			LL	UL	%	%	%
CRIES-8	PTSD	0.819	0.74	0.89	50	65.4	36.7
GAD-7	Anxiety	0.747	0.66	0.83	92	70.6	47.1
PHQ-9	Depression	0.79	0.72	0.87	70	50	53
DES-B	Dissociation	0.888	0.79	0.99	80	82.7	20.2

Note: AOC – area under the curve; PPV – positive predictive value; NPV – negative predictive value; LL – lover limit; UL – upper limit.

Table 13

Differences in GPS-T Symptoms and GPS-T Functioning by severity levels.

Severity Levels	n (%)	GPS-T Symptoms		GPS-T Functioning	
		M	SD	M	SD
Low	37 (30.3)	1.84	1.09	8.32	1.78
Mild	55 (45.1)	7.07	1.97	6.91	1.9
Moderate	23 (18.9)	12.17	1.03	6.35	2.21
Extreme	7 (5.7)	15.43	0.53	3.29	2.63
Total	122 (100)	6.93	4.43	7.02	2.28

suggests that re-experiencing trauma alters consciousness and externalizes into self-destructive behaviors. According to the ICD-11, the symptoms of depersonalization and derealization typically occur in mid-adolescence, and sleep deprivation or substance use can exacerbate their intensity (WHO, 2018). Self-harm was also noted within the pattern of dissociative symptoms (Tzikos et al., 2021). The DSO symptoms representing a separate factor from PTSD was in line with the ICD-11 conceptualization of CPTSD (Kazlauskas et al., 2023; WHO, 2018). Adolescents are more vulnerable to CPTSD than adults (WHO, 2018), because their self-concept and affect regulation are still developing and can be damaged by prolonged or frequent traumas.

This study affirmed the screening accuracy of the GPS-T PTSD domain using a cut-off score of 3 for adolescents, consistent with the psychometric studies on the GPS for adults. A cut-off score of 2 demonstrated accuracy of the GPS-T Dissociation, Anxiety, and Depression domains for adolescents; although, a cut-off score of 1 is recommended for screening of adults using the respective GPS domains (Olff, 2022; Grace et al., 2023).

All four severity levels of the GPS-T Symptoms differed from each other, thereby supporting our hypothesis. However, only the low and extreme levels of severity of the GPS-T Symptoms had differing effects on the GPS-T Functioning score, suggesting that the symptoms had to be extremely severe to detect functional impairment in adolescents. This could be attributed to the convergent validity of the GPS-T Functioning item being lower than hypothesized. Changing the item's response format from continuous (1-10) to dichotomous (yes-no), similar to other GPT-T items, could help adolescents to respond more definitively by distinguishing only between low and severe functional impairment.

The GPS-T Risk Factors had the predicted impact on the GPS-T Symptoms. The demographic and COVID-19 variables did not make significant changes in the GPS-T Symptoms score, except in the case of home quarantine during the COVID-19 pandemic. This finding supports earlier research in Greece, which reported the adverse effects of social and physical isolation on youth during the COVID-19 lockdown (Magklara et al., 2022).

4.2. Limitations and future directions

There are several limitations to the findings of this study. This study could not assess the test-retest reliability of the GPS-T and did not include reference standards for DSO, self-harm, and substance use, to avoid overburdening and emotional risks for the participants. The findings on the construct validity of the GPS-T need replication with a larger sample size. Future studies on the psychometric properties of the GPS-T should aim to address these limitations to enhance psychometric properties of the GPS-T.

4.3. Conclusion

This study provides novel evidence on the psychometric potential of GPS-T in Greece as a valid tool for rapid screening of transdiagnostic symptoms of trauma, dissociation, depression, anxiety, and others that adolescents may experience following PTEs. Screening is important to prevent long-term negative mental health outcomes or to detect symptomatic adolescents and open the way to health care (Olff et al., 2020;

Table 14

Hierarchical multiple regression on the GPS-T Symptoms and GPS-T Risk Factors ($N = 122$).

Block 1: Demographics		$N = 122$	$F(4, 117) = 3.14$	$p = 0.017$	$R^2 = 0.1$
Predictor Variables	Coefficient	Std. error	t	p	95% CI	
					LB	UB
Age	0.503	0.35	1.44	0.153	-0.19	1.19
Gender	-1.441	0.69	-2.1	0.038*	-2.8	-0.08
Education	0.022	0.69	0.03	0.975	-1.35	1.4
Family Size	0.207	1.23	0.17	0.866	-2.23	2.64
cons	1.292	4.12	0.31	0.754	-6.87	9.45
Block 2: COVID-19		$N = 122$	$F(13, 108) = 1.54$	$p = 0.154$	$R^2 = 0.16$	
Predictor Variables	Coefficient	Std. error	t	p	95% CI	
					LB	UB
Age	0.586	0.37	1.56	0.121	-0.16	1.33
Gender	-1.301	0.7	-1.85	0.067	-2.69	0.09
Education	-0.043	0.73	-0.06	0.953	-1.49	1.40
Family size	0.437	1.3	0.34	0.738	-2.15	3.02
COVID illness	-0.64	1.04	-0.62	0.539	-2.7	1.42
COVID hospitalization	-1.592	4.43	-0.36	0.720	-10.38	7.19
COVID quarantine	2.139	0.95	2.25	0.027*	0.25	4.03
COVID death in family	1.292	1.3	0.99	0.324	-1.29	3.88
COVID lockdown	0.58	2.95	0.20	0.845	-5.28	6.44
COVID disruption in education	0.113	2.78	0.04	0.968	-5.4	5.62
COVID lack of play, sports	-0.261	1.7	-0.15	0.878	-3.63	3.11
COVID lack of meetings with friends	-0.103	1.51	-0.07	0.946	-3.09	2.88
COVID other issues	0.072	1.64	0.04	0.965	-3.19	3.33
cons	-1.875	5.01	-0.37	0.709	-11.81	8.06
Block 3: GPS-T Risk Factors		$N = 122$	$F(14, 107) = 6.15$	$p = 0.001$	$R^2 = 0.45$	
Predictor Variables	Coefficient	Std. error	t	p	95% CI	
					LB	UB
Age	0.171	0.31	0.55	0.584	-0.45	0.78
Gender	-0.453	0.58	-0.78	0.439	-1.61	0.7
Education	0.047	0.59	0.08	0.936	-1.12	1.22
Family size	1.087	1.07	1.02	0.31	-1.03	3.2
COVID illness	-1.457	0.85	-1.71	0.09	-3.14	0.23
COVID hospitalization	-1.662	3.61	-0.46	0.646	-8.81	5.49
COVID quarantine	2.426	0.78	3.13	0.002**	0.89	3.96
COVID death in family	1.047	1.06	0.99	0.326	-1.06	3.15
COVID lockdown	1.802	2.41	0.75	0.457	-3	6.58
COVID disruption in education	-1.218	2.27	-0.54	0.593	-5.72	3.29
COVID lack of play, sports	0.153	1.38	-0.11	0.912	-2.9	2.91
COVID lack of meetings with friends	0.47	1.23	0.38	0.704	-1.97	2.91
COVID other issues	1.334	1.35	0.99	0.325	-1.34	4.01
GPS Risk Factors	1.978	0.27	7.48	0.001**	1.45	2.5
cons	-1.444	4.08	-0.35	0.724	-9.53	6.64

Notes:
* p < 0.05;
** p < 0.01.

Verhagen et al., 2022). The present study contributes new findings in adolescents, adding to the international studies on psychometric properties of the GPS in adults, thereby offering health care providers, researchers, and policymakers an opportunity to compare the

trauma-related symptoms in adolescents longitudinally, as they grow up, and cross-sectionally with their parents.

Ethics compliance

The study was conducted in accordance with the Declaration of Helsinki and received an approval by the Committee of Research, Morale, and Ethics at the General Hospital "Agios Andreas" in Patras, Greece (ΑΔΑ: 63ΗΛ46906Λ-64Υ). See details under Method.

Informed consent

Informed consent was obtained from the participants' legal guardians and informed assent was obtained from the participants.

Data availability

The data from this study cannot be made publicly available to protect confidentiality of minor participants.

CRediT authorship contribution statement

Ioanna Koutsopoulou: Conceptualization, Data curation, Investigation, Project administration, Writing – review & editing. **Emma Grace:** Conceptualization, Formal analysis, Methodology, Writing – original draft, Writing – review & editing. **Evgenia Gkintoni:** Conceptualization, Investigation, Writing – review & editing. **Miranda Olff:** Conceptualization, Methodology, Supervision, Writing – review & editing.

Declaration of competing interest

No potential conflicts of interest were reported by the authors.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.ejtd.2024.100384.

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