Examining the Factor Structure of ICD-11 Posttraumatic Stress Disorder (PTSD) and Complex-PTSD among Prison Staff Exposed to Potentially Traumatic Experiences

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Highlights

- Tested eight alternative models of the latent structure of the ITQ
- Different factor solutions identified depending on item coding and estimation method
- First-order two-factor (PTSD and DSO) model with dichotomized items produced best fit
- Uncertainty remains about the best factor structure to apply to the ITQ

Abstract

The recently released 11th edition of the International Classification of Diseases (ICD-11) classifies posttraumatic stress disorder (PTSD) and complex PTSD (CPTSD) as distinct, yet related, disorders within the spectrum of trauma and stress-related disorders. This study aimed to explore the construct validity of the International Trauma Questionnaire (ITQ), a measure of ICD-11 PTSD and CPTSD symptoms among prison governors (i.e., wardens in the U.S. and Canada). Trauma-exposed prison wardens (*N* = 409) aged 26 to 82 years (*M* = 50.04, *SD* = 7.97) provided their data online anonymously. Confirmatory factor analyses were performed to evaluate the construct validity of ITQ scores. When using the five-point item response scale, our five first-order factor model produced the best fit to the data; however, when using a dichotomous item scale, the first-order two-factor PTSD and disturbances of self-organization (DSO) model produced the best fit to the data. These results indicate that item-coding and estimation methods can significantly impact conclusions about the best-fitting model for this measure among trauma-exposed prison governors.

Keywords: Posttraumatic Stress Disorder; Complex Posttraumatic Stress Disorder; ICD-11; International Trauma Questionnaire; prison governors; prison staff

1. Introduction

Internationally, Prison Governors (i.e., wardens in the U.S. and Canada) play a core role in the prison service, overseeing prisons' management and supervision of staff and prisoners. Potentially traumatic events, including acts of self-harm and violence towards others, are prevalent within prisons (Kinman et al., 2015; Slade & Lopresti, 2014). Consequently, Governors are exposed to challenging and traumatic experiences (Bennett et al., 2013; Crawley, 2004; French, 2015). To date, there is no research investigating the risk of Posttraumatic Stress Disorder (PTSD) and Complex PTSD (CPTSD) among Prison Governors, despite the risk factors they face. However, we must first validate existing measures of PTSD and CPTSD in this population, as the conceptualisation and measurement of trauma-related disorders in this population is a pressing issue. This could improve trauma-related assessment, prevention, and intervention among prison govenors.

1.1. ICD-11 posttraumatic stress disorder (PTSD) and complex PTSD (CPTSD)

The recently published 11th revision of the International Classification of Diseases (ICD-11) includes PTSD and CPTSD as related, yet distinct, diagnoses (Maercker et al., 2013; World Health Organization [WHO], 2018). The ICD-11 model of PTSD is construed as a fear-based response to a specific traumatic event and includes three symptom clusters: re-experiencing of the trauma in the here and now (Re), avoidance of traumatic reminders (Av), and a persistent sense of current threat that manifests in increased arousal and hypervigilance (Th). CPTSD includes the three PTSD symptom clusters and three additional symptom clusters referred to as disturbances of self-organization (DSO). The three DSO clusters are: affective dysregulation (AD), negative self-concept (NSC), and difficulties in forming and maintaining interpersonal relationships (DR). These symptoms represent difficulties that occur pervasively and across different contexts. A diagnosis of CPTSD is typically expected to arise in conditions of cumulative, early, or interpersonal trauma (e.g., cumulative exposure to traumatic childhood experiences, genocide campaigns, child soldiering, severe domestic violence, torture, or slavery; Cloitre et al., 2014; Karatzias et al., 2017). A PTSD diagnosis is required before a CPTSD diagnosis, indicating a hierarchical relation between the two disorders.

The International Trauma Questionnaire (ITQ; Cloitre et al., 2018) was developed for the assessment of ICD-11 PTSD and CPTSD, and it has been used with both community and clinical samples. According to Brewin et al. (2017), emerging evidence supports three possible factor structures: a) a structure with six first-order factors (correlated but non-hierarchical; see Figure 1 Model 2), b) a structure with a single second-order factor (CPTSD) supported by six first-order factors (see Figure 1 Model 4), and c) a two second-order factor model (PTSD and DSO; see Figure 1 Model 5). In general, the first-order model appears to offer a better fit in general population samples (Ben-Ezra et al., 2018; Shevlin et al., 2017); whereas, the second-order model is a better fit in clinical or highly trauma-exposed samples (Vallières et al., 2018).

When reviewing ITQ construct validity papers, inconsistent methodological decisions are evident, complicating the interpretation of previous findings and determining the best-fitting models. The three major inconsistencies relate to the choice of estimator used in the selected confirmatory factor analysis (CFA) models (i.e., maximum likelihood with robust standard errors [MLR] vs. weighted least square mean and variance [WLSMV]), ITQ item response coding, and the criteria used to select the best-fitting model. Different estimators have been reported without always justifying this choice (e.g., Kazlauskas et al., 2020; Murphy et al., 2016). Furthermore, at times, the rationale for choosing one estimator over another has lacked consistency. For example, it has been suggested that WLSMV is preferable to MLR for CFA of the ITQ (e.g., Owczarek et al., 2020), but elsewhere it is argued that MLR is preferable to WLSMV (e.g., Gilbar et al., 2018; Ho et al., 2020), with members of the same research groups presenting both arguments. The coding of the ITQ items is another methodological choice that is not always justified. Some studies transform the ITQ items into binary indicators (e.g., Kazlauskas et al., 2016), whereas others do not (e.g., Kazlauskas et al., 2018; Vallières et al., 2016).

In terms of the criteria to select the best-fitting model, although all prior studies have reported multiple measures of model fit from different families, namely absolute and incremental, studies vary in their reliance on fit statistics when selecting their preferred model. Haselgruber et al. (2020) selected a two-factor higher-order model (PTSD and DSO; see Figure 1 Model 5 as their best-fitting model as it combined high comparative fit index (CFI; .99) and Tucker-Lewis index (TLI; .98), low root mean square error of approximation (RMSEA; .07; 95% CI = [.04, .10]), and Bayesian information criterion (BIC; 5165.74), and was consistent with theory and previous findings. However, a structure with a single higher-order factor (CPTSD) supported by six symptom clusters (see Figure 1 Model 4) provided a stronger fit to the data based on CFI (.99), TLI (.99), and RMSEA (.06; 95% CI = [.03, .09]). The BIC value for this model was greater (5185.72) but was produced using MLR, which was not used to generate the other fit statistics (WLSMV was used). BIC was also used as the primary index for model comparison in other studies when WLSMV was the primary estimator used (Gilbar et al., 2018; Vallières, et al., 2018). In studies using WLSMV, changes in the RMSEA value (ΔRMSEA) were often used to select the best fitting model (e.g., Karatzias et al., 2016; Kazlauskas et al., 2020). However, in other studies using WLSMV, the models deemed to best fit the data did not meet the RMSEA criterion (e.g., Gilbar et al., 2018).

1.2 The Current Study

This is the first study to explore the factor structure of the ITQ in a sample of U.K.-based Prison Governors. We aimed to rigorously evaluate the construct validity of the ITQ, using the various methods employed in the extant literature given that there does not appear to be methodological consensus or consistency. Thus, we investigated the extent to which the best-fitting model was robust to estimation methods and item coding, as these approaches varied in existing literature. We used CFA to test eight alternative models (described in detail below; see Figure 1) of the latent structure of the ITQ with seven based on findings from previous studies and one post hoc model novel to the current study. In addition, to be consistent with the extant literature, each of the eight CFA models was tested using a five-point ordinal response scale and a dichotomous scale, and using either MLR estimation or WLSMV estimation with delta parameterization. Therefore, we attempted to conduct a total of 32 CFA models. In light of the methodological variations evident in prior research, the current study is exploratory rather than hypothesis-driven.

2. Method

2.1. Participants

Participants were 409 U.K. Prison Governors recruited via an email distributed to all members by the Prison Governor's Association. Of those who were invited to participate, 458 agreed to take part in the study. A total of 49 participants were excluded from further data analysis because they did not report exposure to a potentially traumatic event, as defined by Kazlauskas et al. (2018). See Table 1 for sample characteristics.

TABLE 1 ABOUT HERE

2.2. Procedure

Participants were recruited via an email distributed to all Prison Governor's Association (PGA) members. The PGA is a union representing operational and senior operational managers in Her Majesty's Prison and Probation Service (HMPPS), Senior Civil Servants with a background in operational prison management, Governors, Deputy Governors and other governor grades in public and private sector prisons in England and Wales, Scotland and Northern Ireland, and it had 1,055 members at the time of survey distribution. Individuals who were interested in participating completed the study using an online survey platform that allows for secure remote data collection by distributing anonymous, secure links to the study protocol. The purpose of the research (i.e., "to examine correlates of stress and trauma-related disorders [e.g., posttraumatic stress disorder]"), procedures, and rights as research participants were stated in full on the survey-landing page. Participants were required to consent before the survey was presented online, and participation was voluntary, and no inducements or obligations were used. All participants were debriefed and given phone numbers for local mental health services. The ethical review board of the institution to which two of the authors are affiliated granted ethical approval for the study.

2.3. Measures

2.3.1. Exposure to potentially traumatic experiences. The Life Events Checklist (LEC-5: Weathers et al., 2013) is a 17-item self-report measure designed to screen for potentially traumatic events in a respondent's lifetime. The LEC assesses lifetime exposure to 16 traumatic events (e.g., Natural disaster, Physical assault, Life-threatening illness/injury), and the 17th item, "Any other very stressful event/experience", can be used to indicate exposure to a trauma that was not listed. For each item, the respondent checks whether the event *Happened to me* (1), *Witnessed it happening to somebody else* (2), *Learned about it happening to someone close to me* (3), *Part of my job* (4), *Not sure it applies* (5), *Doesn't apply to my experience* (6). Consistent with Kazlauskas et al. (2018), participants were considered exposed to a traumatic event if they reported that they experienced or witnessed the event. For traumatic events of sudden accidental death and sudden violent death, participants learning about it happening to someone else were also considered to have been exposed to a traumatic event. Item 17 ("Any other very stressful event/experience") was excluded from the analyses, as the nature of the trauma could not be identified. Previous studies of the psychometric properties of the LEC-5 have indicated good test-retest reliability, convergent validity, and significant association with PTSD symptomology (Gray et al., 2004).

2.3.2. ICD-11 PTSD and CPTSD. The International Trauma Questionnaire (ITQ; Cloitre et al., 2018; https://www.traumameasuresglobal.com/itq) is a self-report measure designed to capture the ICD-11 diagnoses of PTSD and CPTSD. The measure includes six items measuring PTSD symptoms (re-experiencing, avoidance, and sense of threat) and six items measuring DSO symptoms (affective dysregulation, negative self-concept, and disturbed relationships). Additionally, three items measure functional impairment (in the domains of social, occupational, and other important areas of life) related to the PTSD and DSO symptoms, respectively. Individuals respond to each PTSD item, concerning their most distressing traumatic event, in terms of how much they have been bothered by that symptom over the past month, and to each DSO item in terms of how they typically feel, think about themselves, and relate to others. All items are measured using a five-point Likert scale ranging from 0 (*Not at all*) to 4 (*Extremely*). PTSD and DSO symptoms range from 0 to 24, with higher scores reflecting greater symptomatology. The reliability and validity of the ITQ have been demonstrated in other populations, including refugees, trauma samples, and adolescents and young adults exposed to mass shootings (for a review, see Brewin et al., 2017); however, as reviewed in the Introduction section, methods have been inconsistent. The internal reliability, as measured by Cronbach's alpha (α), was acceptable in the current study; PTSD α = .85 (mean inter-item correlation = .50); DSO α = .87 (mean inter-item correlation = .53); full scale α = .90 (mean inter-item correlation = .42).

2.4. Data Analysis Strategy

We conducted categorical CFAs (i.e., modeling all indicators as categorical) using Mplus version 8 (Muthén &Muthén, 1998-2017). Only participants meeting our LEC-5 trauma exposure inclusion criteria were included in the analyses (*n* = 409; 90.45% of the total sample). We tested seven CFA model structures that were consistent with previous literature. An eighth, post hoc model was also tested (detailed below; see Table 2 for the model description and citations; see Figure 1 for model diagrams). For all models, the error variances were uncorrelated, the loadings were freely estimated from the correlation matrix, and the variances of the latent variables were constrained at unity to ensure models were identified. In the hierarchical CFA models, the second-order factor variances were constrained at unity, and the first-order factor variances were freely estimated. Given inconsistencies in the ITQ literature regarding how items were coded and modeled (five-point ordinal scale vs. dichotomous) and the estimators that were used (MLR vs. WLSMV), we took a rigorous and thorough approach to identify the best-fitting and most reliably fitting CFA model.

TABLE 2 ABOUT HERE

For each of the eight CFA models, we tested the models using a five-point ordinal response scale and a dichotomous scale (0 = scores less than 2, 1 = scores greater than 1; consistent with Kazlauskas et al., 2018) using either MLR estimation or WLSMV estimation and delta parameterization. Therefore, we conducted a total of 32 CFA models. Furthermore, given that our indicators were either ordinal or binary, which are inherently categorical, we did not model the indicators as continuous. It should also be noted that WLSMV has been promoted as the most efficient and accurate estimator for categorical indicators (Brown, 2006; Muthén & Muthén, 1998-2017); however, a simulation study has demonstrated that MLR and WLSMV are both viable estimator options for categorical CFA (Lei & Shiverdecker, 2019). The suitability of estimators may, however, be somewhat dependent on the number of response categories for each item; there is evidence that WLSMV is more appropriate when indicators have five or fewer response categories, as, in this context, MLR tends to underestimate factor loadings (Rhemtulla et al., 2012; Wirth & Edwards, 2007). For the MLR CFA models, we used Monte Carlo Integration with 5,000 integration points and Mplus start value defaults.

The WLSMV estimation allows for fit indicators to be calculated for categorical indicators. The goodness of fit for the competing WLSMV models was assessed using CFI (Bentler, 1990) and TLI (Tucker & Lewis, 1973). Given that χ^2 statistic is sensitive to sample size (Hu & Bentler, 1999), we did not evaluate this statistic for model fit. CFI and TLI values greater than .90 were considered to reflect an acceptable fit (Hu & Bentler, 1999). In addition, the RMSEA was reported with values less than .05 indicating excellent fit, and .05 to .08 indicating acceptable fit (Browne & Cudeck, 1993). Weighted Root Mean Square Residual (WRMSR) is also a recommended model fit indicator for categorical CFA indicators where values less than 1.0 indicate good model fit (DiStefano et al., 2018).

When using the MLR estimator, which does not produce CFI, TLI, RMSEA, or WRMSR fit indices when indicators are categorical, we used the following methods to evaluate model fit. Akaike Information Criterion (AIC), BIC, sample size adjusted BIC (ABIC) were used to assess the models' relative fit. The model with the lowest BIC was considered the better model, and a difference greater than 10 was considered to be indicative of a "significant" difference (Raftery, 1995).

3. Results

3.1. Data Analysis, Preparation, and Descriptive Statistics

SPSS version 26 (IBM Corporation, 2019) was used to examine missing data patterns. Of the participants who met inclusion criteria for analysis, there was a total of 2.48% data missing for LEC-5 and ITQ items across all participants. Little's Missing Completely at Random (MCAR) test indicated that data were MCAR (χ^2 [2966, N = 409] = 2856.842, p = .923). The estimation method for each model (i.e., MLR or WLSMV) was used to estimate missing data. See Table Supplementary Tables 1 and 2 for the ITQ item-level frequency data, including item-level missing data (missingness ranging from 7.1% to 11.7% per item with more missing data on the DSO items) and the ITQ item-level bivariate correlations, respectively. As seen in these tables, few participants reported the more severe response options. Furthermore, all of the ITQ item-level bivariate correlations were statistically significant at $p < .001$ for the five-point scale and dichotomous coding. The correlation between the AD items (r = .33 and .29 for five-point scale and dichotomous coding, respectively) was weaker than the correlations between the items for other factors.

Participants reported an average of 2.90 (SD = 2.13, median = 3.0) lifetime traumatic experiences, ranging from 0 to 12 traumatic events on the LEC-5. Participants also reported witnessing an average of 4.91 (*SD* = 3.06, median = 5.0) lifetime traumatic events, ranging from 0 to 14. Experiencing one traumatic event was reported by 17.18% (*n* = 73), 2 to 3 traumatic experiences were reported by 41.32% (*n* = 169), 4 to 5 traumatic experiences were experienced by 19.80% (*n* = 81), and ≥ 6 experiences were reported by 11.25% (*n* = 46) of participants. The most common traumatic experiences were physical assault (65.8%), a transportation accident (60.9%), assault with a weapon (29.1%), and a fire or explosion (26.2%; see Supplementary Table 3 for LEC-5 item-level frequencies).

3.2. CFA Model Fit

The model fit statistics across the CFA models are presented in Table 3. It should be noted that models that do not include fit statistics in Table 3 did not converge, and some models that produced fit statistics yielded a Mplus error warning against interpreting model estimates, which could be a sign of model misspecification, problems related to two-indicator factors, and/or a small sample size (Bandalos, 2018; Kyriazos, 2018). Latent variables with just two-indicators, such as Models 2 through 5, are known to be unstable (Kline, 2005). We increased the Monte Carlo Integration points and start values to attempt to improve model convergence, but this was ineffective. As seen in Table 3, there are inconsistencies across estimation methods and item coding regarding which model is the best fitting.

3.2.1. Five-point item indicators. Of the models tested in previous literature, the first-order two-factor (PTSD and DSO) model (Model 6) fit the data best using WLSMV estimation (CFI = .95, TLI = .94, RMSEA = .14, WRMSR = 1.78); however, Model 6 still had mediocre to acceptable fit. Using the MLR estimation, of the models tested in previous literature, the six first-order factor model (Model 2; AIC = 9641.14, BIC = 9882.28, sample size adjusted BIC =

9688.74) fit the data significantly better than the other models that converged when examining the BIC values.

For the six correlated first-order factors model (Model 2), there were inadmissible parameter estimates due to the DR items creating a model interpretation warning in Mplus. Therefore, we conducted a post hoc analysis, estimating Model 2 with the DR items removed, to see if this led to convergence and plausible model estimates. This produced a five correlated first-order factor model (Model 3; novel to this study). Model 3 produced the best fit with both the WLSMV (CFI = .99, TLI = .99, RMSEA = .04, WRMSR = 0.43) and MLR (AIC = 7897.61, BIC = 8134.80, sample size adjusted BIC = 7944.43) estimators when using the five-point item scale. This model produced excellent model fit with the WLSMV estimator and was significantly better than the other models that converged when examining the BIC values.

3.2.2. Dichotomous item indicators. Of the models tested in previous literature, Model 6 fit the data best using WLSMV estimation and demonstrated excellent model fit (CFI = .98, TLI = .98, RMSEA = .08, WRMSR = 1.32). Although Models 2 and 3 produced model fit statistics (Table 3), these models were not interpretable per Mplus warning messages. Using the MLR estimation of the models tested in previous articles, Model 6 also fit the data significantly better than the other models that converged when examining the BIC values (AIC = 3955.01, BIC = 4053.85, sample size adjusted BIC = 3974.52).

TABLE 5 ABOUT HERE

3.2.3. Summary. The lack of model convergence and interpretability and the inconsistency in identifying the best-fitting model, depending on the item coding and estimation method, indicates weaknesses for the ITQ and counters previous literature. These findings also suggest that the item-coding and estimation method can significantly impact conclusions about the best-fitting model for this measure. When using the five-point item scale, our five first-order factor model (Model 3) produced the best fit to the data; however, when using dichotomous items, the first-order two-factor model (PTSD and DSO; Model 6) produced the best fit to the data. Given that WLSMV estimation has been accumulated strong support for categorical indicators (Muthén &Muthén, 1998-2017), we provide further details on the best-fitting WLSMV models.

3.3. Best-fitting Models' CFA Factor Loadings

3.3.1. Five-point item indicators. Table 4 presents the standardized item loadings and factor correlation for Model 3 (our five first-order factor model) using WLSMV estimation. All factor loadings were moderate to strong (ranging from .57 to .98) and statistically significant at $p < .001$. In addition, the correlations between the five factors ranged from moderate ($r = .57$, $p < .001$) to strong ($r = .87$, $p < .001$).

3.3.2. Dichotomous item indicators. Table 4 presents the standardized item loadings and factor correlation for Model 6 (the first-order two-factor PTSD and DSO model) using WLSMV estimation. All factor loadings were moderate to strong (ranging from .63 to .98) and statistically significant at $p < .001$. The correlations between the PTSD and DSO factors was strong ($r = .69$, $p < .001$).

TABLE 6 ABOUT HERE

4. Discussion

4.1. Factor structure of the ITQ

This study aimed to examine the latent structure of the ITQ, using data drawn from a large sample of prison governors. To test the construct validity of this new scale, a series of eight alternative factor analytic models (seven consistent with previous literature, and an eighth post hoc model; see Table 2 and Figure 1) were specified and tested using CFA. Due to inconsistencies in the literature regarding ITQ item coding and modeling, and the estimator used for analyses, we took a rigorous and thorough approach to identify the best and most reliably fitting model. In light of the methodological variations evident in prior research, the current study was exploratory rather than hypothesis-driven.

Results indicated different factor solutions, depending on the analytical decisions made (i.e., item coding, estimation method, and interpretation of the fit indices). When we retained the five-point item indicators, the first-order two-factor (PTSD and DSO) model (Model 6) provided the best fit to our data without producing any Mplus interpretation warnings with the WLSMV estimator; however, this model only had mediocre to acceptable fit. Model 2 (six correlated first-order factors model) was the best fitting model for the five-point item indicators and MLR estimator. Given that WLSMV has been supported for categorical indicators and that Model 2 with the WLSMV estimator produced an interpretation error, we conducted a post hoc, five-correlated first-order factor model (with DR items removed; Model 3). Model 3, which was novel to this study, better fit to our data than the other models with both estimators when using five-point response scale indicators. It is unclear why omitting the interpersonal DSO factor from our model allowed for plausible model estimates and improved model fit, but this may be due to strongly correlated indicators of a factor with only two indicators (Kline, 2005). However, this indicates that refinement of items in this specific symptom clusters may be warranted. When we dichotomized item indicators, consistent with Kazlauskas et al. (2016), Model 6 (two first-order PTSD and DSO factors) fit the data best when using WLSMV estimation and demonstrated excellent model fit. This same model also fit the data significantly better than the other models when using the MLR estimator and produced interpretable model estimates when examining the BIC values.

Given that WLSMV estimation has accumulated strong support for categorical indicators, Model 3 (five correlated first-order factors) is our best-fitting solution when retaining the five-point item indicators, and Model 6 (two first-order PTSD and DSO factors) is the best fitting when using dichotomous item indicators. This finding is somewhat consistent with work conducted elsewhere using general population and non-clinical samples (e.g., Ben-Ezra et al., 2018; Ho et al., 2019, 2020; Kazlauskas et al., 2020), as well as a recent study of combat-exposed soldiers in the Philippines (Mordeno et al., 2019).

There are two possible explanations for the above finding. First, the low levels of PTSD and CPTSD symptomology in our non-clinical sample of prison governors precluded generating more unique differentiations between PTSD and DSO symptom clusters. This is consistent with previous research showing that the second-order model provides a better fit than the first-order model in clinical and highly traumatized samples (e.g., Kazlauskas et al., 2018; Murphy et al., 2020), and the first-order model provides a better fit in population studies (e.g., Ben-Ezra et al., 2018; Ho et al., 2019; Ho et al., 2020; Karatzias et al., 2016, Karatzias et al., 2020). Second, it is possible that PTSD and DSO do not form a common dimension (i.e., CPTSD), but are instead two correlated sets of problems in a sample with what would be considered regular occupational exposure to trauma (Bennett et al., 2013; Crawley, 2004; French, 2015). Further research is required to clarify the distinctiveness of PTSD and DSO symptomatology in prison staff, particularly if this measure is to be used to contribute to an important specific need, namely the systematic assessment of stress-related disorders in prison governors.

Notably, most models fit our data poorly. Furthermore, several of the tested models resulted in inadmissible and uninterpretable solutions (i.e., led to the generation of error messages), that is, non-convergence or out-of-bound parameter estimates. One potential explanation for these convergence problems is the reliance on latent variables with just two indicators, which is problematic within latent variable modeling (Kline, 2005). This may explain why the two-factor model with six indicators per factor converged more consistently, and also why we had to remove the interpersonal DSO factor from our model to achieve satisfactory model fit. However, the ITQ was purposefully designed to be a short instrument (Cloitre et al., 2018), so that it would align with the ICD-11 principle that disorders should focus on a limited but central set of symptoms to maximize clinical utility. Consequently, although the ITQ is not ideal from a psychometric modeling perspective, this may be a necessary trade-off for having a brief scale that maximizes clinical utility. Nonetheless, as CPTSD is a new diagnostic entity, it could be valuable for research purposes to have additional items that would allow for the examination of a broader set of symptom indicators within each symptom cluster.

Furthermore, it is notable that our sample of prison governors reported a relatively high level of trauma exposure but low PTSD and CPTSD symptoms. Further, there were low levels of PTSD and CPTS caseness. It is possible those more affected by trauma exposure leave the profession earlier, and so were less likely to be recruited for this study, or that individuals who are less susceptible to PTSD and CPTSD after a traumatic experience are more likely to work in prisons. Hence, the population may be distinct from those sampled in other studies using the ITQ (e.g., veterans who have left the armed forces). However, this study importantly highlights how methodological differences can affect CFA study results, and this point remains very relevant to research using the ITQ and psychiatric research more generally, and we would expect the impact of methodological variation to hold even amongst clinical samples with higher levels of PTSD and/or CPTSD.

4.2. Limitations

Several study limitations should be taken into consideration when interpreting the results and to offer future research directions. First, our measure of traumatic life events encompassed a wide spectrum of experiences, some of which may not have been experienced as traumatic by the respondents. Second, the present study did not consider comorbidities such as anxiety, depression, or borderline personality symptomology, leaving the possibility of unrecognized comorbidity affecting the results. Third, our CFA models may not generalize to other populations with a history of potentially traumatic experiences (e.g., police officers, firefighters, soldiers, and security personnel). Therefore, it is important for research to continue validating the ITQ in other professions that have a high potential for trauma. Finally, we acknowledge that the sample size was modest, predominately male and White, and consisted of self-selecting individuals. It is unclear how these results would generalize to samples with a higher overall symptom burden and to predominantly female samples. However, the demographic profile is broadly consistent with the overall composition of PGA members.

4.3. Recommendations

Although not the primary aim of this study, we have illustrated how analytic decisions can have a substantive impact on results and the associated conclusions and interpretations of findings, a point that remains very relevant psychiatric research, despite our non-clinical population. Based on this, we echo suggestions that authors pre-register their data analytic approach before undertaking their analysis (Ioannidis, 2014; Nosek et al., 2015). This suggestion not only applies to others, but also this research team, as our study was not preregistered. This preregistration should clearly define: a) all theoretically relevant competing models that they propose to test, b) any analyses that will be conducted to assess whether missing data will be deemed ignorable and how missing data will be handled, c) fit indices (including a priori specification of cutoff criteria) that will be used to assess the relative fit of models, and which will be considered as the primary index for model comparison, d) how items will be coded (i.e., maintaining the five-scale points or dichotomization), and e) the estimation method to be used (i.e., MLR or WLMSV).

4.4. Conclusion

The results indicate that uncertainty remains about the best factor structure to apply to the ITQ. Of the previously suggested models from the literature, Model 6 (the first-order PTSD and DSO two-factor model), with dichotomized items, was the consistently best-fitting and may be a preferred option to adopt in future research. The lack of model convergence, unreliable estimates, and inconsistency in identifying the best-fitting model depending on the item coding and estimation method indicates possible weaknesses for this measure and counters previous literature. Further, as defensible, yet subjective, analytic choices can influence research results, there is scope for problematic research practices, such as adapting analyses to improve fit. As such, pre-registration of data analytic plans on established platforms such as the Open Science Framework (https://osf.io) is recommended to clarify the distinction between planned and unplanned research by reducing unnoticed flexibility. This will help to improve the credibility of findings and calibration of uncertainty.

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Table 1 *Demographic Characteristics of the Sample (N = 409)*

Variable	*n*	%
Gender		
Men	291	71.1
Women	108	26.4
Sexual orientation		
Straight/heterosexual	384	93.9
Gay/lesbian	15	3.7
Bisexual	2	0.5
Sexual orientation not specified	7	1.7
Race		
White	384	93.9
Black	7	1.7
Asian	6	1.5
Multi-racial	10	2.4
Relationship status		
Single	16	3.9
In a relationship	57	13.9
Divorced or separated	20	4.9
Widowed	5	1.2
Married	311	76
Establishment type worked in		
Women's prison	33	8.1
Men's prison	247	60.7
Male YOI	30	7.3
Mixed Male Adult/YOI	84	20.5
Other (e.g., secure hospital, IRC)	13	3.2
Security category of establishment[1]		
Category A	45	11
Category B	141	34.5
Category C	155	37.9
Category D	28	6.8
Other (e.g., secure hospital, IRC)	24	5.9
Current grade		
Custodial manager	2	0.5
Governor grade	399	97.6
Other	8	2
Country worked in		
England	388	94.9
Wales	11	2.7
Scotland	8	2
Northern Ireland	2	0.5

Note. Percentages may not sum to one due to a small among of missing data on some variables. YOI = Youth Offender Institution, IRC = Immigration Removal Centre. [1] Adult prisoners may be held in one of four security categories. Category A: Prisoners whose escape would be highly dangerous to the public or the police or the security of the State and for whom the aim must be to make escape impossible. Category B: Prisoners for whom the very highest conditions of security are not necessary but for whom escape must be made very difficult. Category C: Prisoners who cannot be trusted in open conditions but who do not have the resources and will to make a determined escape attempt. Category D: Prisoners who present a low risk; can reasonably be trusted in open conditions and for whom open conditions are appropriate.

Table 2 *Confirmatory Factor Analysis (CFA) Models Tested and The Supporting Literature*

CFA Models Tested	References
1. CPTSD one-factor (Unidimensional)	Ben-Ezra et al. (2018), Gilbar et al. (2018), Haselgruber et al. (2020), Ho et al. (2019), Kazlauskas et al. (2018), Kazlauskas et al. (2020), Karatzias et al. (2016), Mordeno et al. (2019), Murphy et al. (2018), Murphy et al. (2020), Owczarek et al. (2019), Vallières et al. (2018)
2. Six correlated first-order factors (Re, Av, Th, AD, NSC, DR)	Ben-Ezra et al. (2018), Gilbar et al., (2018), Haselgruber et al. (2020), Ho et al. (2019), Ho et al. (2020), Kazlauskas et al. (2018), Kazlauskas et al. (2020), Karatzias et al. (2016), Mordeno et al. (2019), Murphy et al. (2018), Murphy et al. (2020), Owczarek et al. (2019), Vallières et al. (2018).
3. Five correlated first-order factors (Re, Av, Th, AD, NSC)	Novel
4. One second-order CPTSD factor, six first-order factors (Re, Av, Th, AD, NSC, DR)	Ben-Ezra et al. (2018), Gilbar et al. (2018), Haselgruber et al. (2020), Ho et al. (2019), Kazlauskas et al. (2020), Karatzias et al. (2016), Mordeno et al. (2019), Murphy et al. (2018), Murphy et al. (2020), Owczarek et al. (2019), Vallières et al. (2018)
5. Two second-order factors (PTSD, DSO), six first-order factors (Re, Av, Th, AD, NSC, DR)	Ben-Ezra et al. (2018), Gilbar et al. (2018), Haselgruber et al. (2020), Ho et al. (2019), Ho et al. (2020), Kazlauskas et al. (2018), Kazlauskas et al. (2020), Karatzias et al. (2016), Mordeno et al. (2019), Murphy et al. (2018), Murphy et al. (2020), Owczarek et al. (2019), Vallières et al. (2018)
6. Two first-order factors (PTSD, DSO)	Gilbar et al. (2018), Haselgruber et al. (2020), Karatzias et al. (2016), Mordeno et al. (2019)
7. Two-factor second-order model (PTSD, DSO), with PTSD measured by 6 Items and DSO by three first-order factors (AD, NSC, DR)	Gilbar et al. (2018), Haselgruber et al. (2020), Karatzias et al. (2016), Mordeno et al. (2019)
8. Two-factor second-order model (PTSD, DSO), with PTSD measured by three first-order factors (Re, Av, Th) and DSO by 6 items	Gilbar et al. (2018), Haselgruber et al. (2020), Karatzias et al. (2016), Mordeno et al. (2019)

Note. CFA = Confirmatory Factor Analysis; CPTSD = Complex Posttraumatic Stress Disorder; PTSD = Posttraumatic Stress Disorder; Re = Re-experiencing in the here and now; Av = Avoidance; Th = Sense of current threat; AD = Affect dysregulation; NSC = Negative self-concept; DR = Disturbances in relationships; PTSD includes Re, Av, and Th clusters; DSO = Disturbances in self-organization. DSO is comprised of AD, NSC, and DR clusters. CPTSD is comprised of the PTSD and DSO factors.

Table 3 *Model Description and Fit Indices of the Confirmatory Factor Analysis (CFA) Models*

Item Coding	Estimator	Model	Model Fit Indices						
			χ^2 (*df*), *p*	CFI	TLI	RMSEA [90% CI]	WRMSR	AIC	BIC (ABIC)
5-point scale	WLSMV	1	821.94 (54), < .001	.91	.89	.19 [.18, .20]	2.72	---	---
		2*	94.95 (39), < .001	.99	.99	.06 [.05, .08]	0.60	---	---
		3	**41.85(25), .019**	**.99**	**.99**	**.04 [.02, .06]**	**0.43**	**---**	**---**
		4	---	---	---	---	---	---	---
		5	---	---	---	---	---	---	---
		6	460.91 (23), < .001	.95	.94	.14 [.13, .15]	1.78	---	---
		7	---	---	---	---	---	---	---
		8	---	---	---	---	---	---	---
	MLR	1	---	---	---	---	---	9901.89	10139.08 (9948.71)
		2	---	---	---	---	---	9300.16	9596.66 (9358.69)
		3						7897.61	8134.80 (7944.43)
		4	---	---	---	---	---	---	---
		5	---	---	---	---	---	---	---
		6	---	---	---	---	---	9641.14	9882.28 (9688.74)
		7	---	---	---	---	---	---	---
		8	---	---	---	---	---	---	---
Binary	WLSMV	1	334.65 (54), < .001	.954	0.943	.12 [.10, .13]	1.98	---	---
		2*	37.80 (39), .524	1	1	.00 [.00, .03]	0.46	---	---
		3*	22.02 (25), .635	1	1	.00 [.00, .04]	0.41		
		4	---	---	---	---	---	---	---
		5	---	---	---	---	---	---	---
		6	**174.76 (53), < .001**	**.98**	**.98**	**.08 [.07, .09]**	**1.32**	**---**	**---**
		7	---	---	---	---	---	---	---
		8	---	---	---	---	---	---	---
	MLR	1	3887.35 (4057), .972	---	---	---	---	4064.14	4159.01 (4082.87)
		2*	1939.74 (4042), > .999	---	---	---	---	3838.21	3992.39 (3868.65)

	3	---	---	---	---	---	---	---
	4	---	---	---	---	---	---	---
	5	---	---	---	---	---	---	---
	6	3068.48 (4054), > .999	---	---	---	---	3955.01	4053.85 (3974.52)
	7	---	---	---	---	---	---	---
	8	---	---	---	---	---	---	---

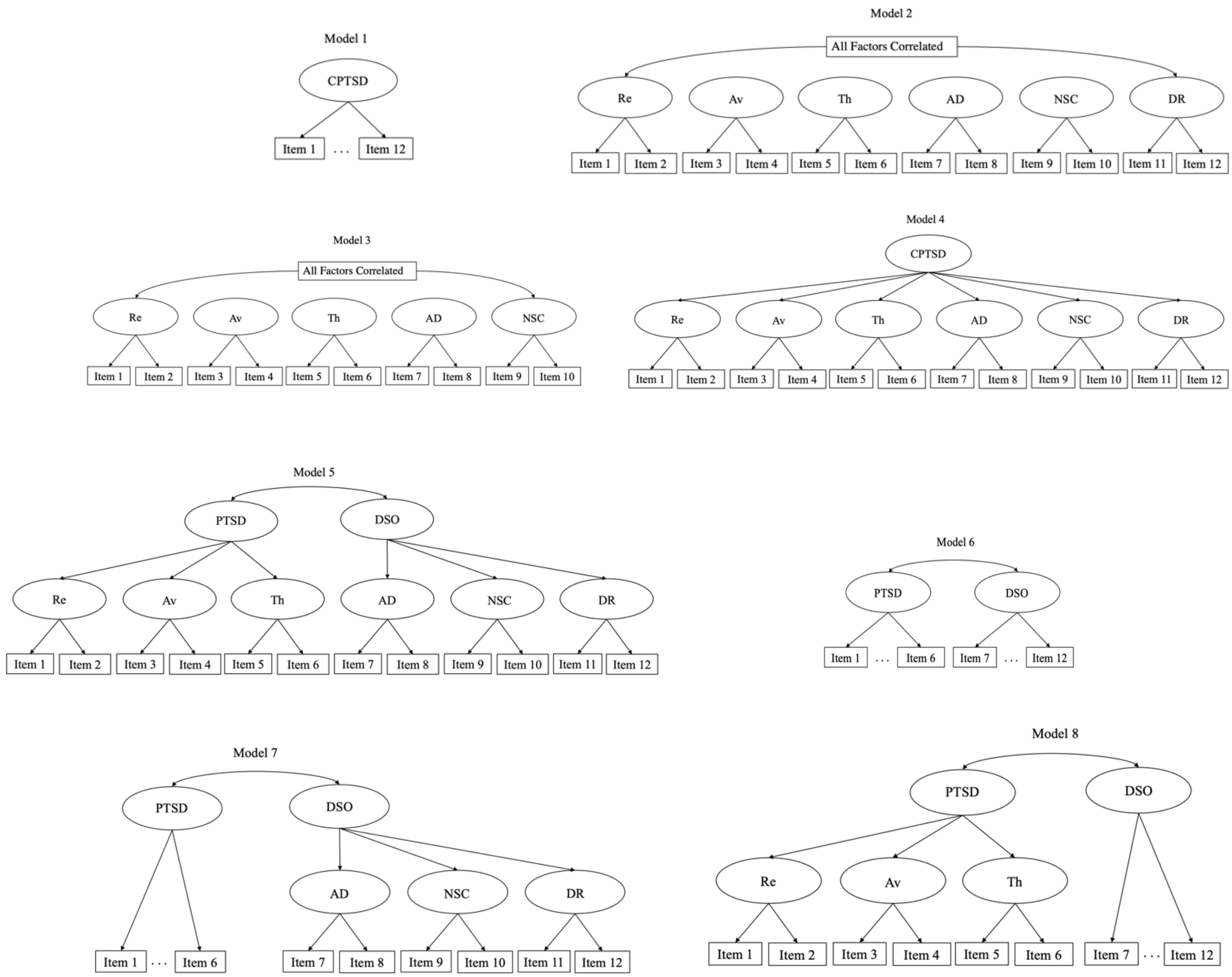
Note. Models that do not include fit statistics did not converge in Mplus or an error prevented the model from computing; * = Model converged but produced an Mplus warning against interpreting model estimates. Bolded Models = Best-fitting models; WLSMV = Weighted least square mean and variance; MLR = Maximum likelihood with robust standard errors; CFA = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root mean square error of approximation; WRMSR = Weighted root mean square residual; AIC = Akaike information criterion; BIC = Bayesian information criterion; Model 1: CPTSD one-factor (unidimensional); Model 2: six correlated first-order factors; Model 3: five correlated first-order factors (CPTSD interpersonal items removed); Model 4: one second-order CPTSD factor, six first-order factors; Model 5: two second-order factors (PTSD, DSO), six first-order factors; Model 6: first-order two-factors (PTSD, DSO); Model 7: two-factor second-order model with PTSD measured by 6 Items and DSO by three first-order factors; Model 8: two-factor second-order model with PTSD measured by three first-order factors and DSO by 6 items.

Table 4 *Standardized Factor Loadings, Standard Errors, and Factor Correlations for Models Three and Six*

	Model 3 Factor Loading (*SE*)						Model 6 Factor Loading (*SE*)	
Item	Re	Av	Th	AD	NSC	DR	PTSD	DSO
1. Re 1	.87 (.03)						.72 (.06)	
2. Re 2	.88 (.03)						.76 (.05)	
3. Av 1		.91 (.02)					.91 (.03)	
4. Av 2		.92 (.02)					.90 (.03)	
5. Th 1			.80 (.03)				.75 (.05)	
6. Th 2			.93 (.03)				.81 (.05)	
7. AD 1				.57 (.05)				.63 (.06)
8. AD 2				.70 (.05)				.74 (.05)
9. NSC 1					.96 (.02)			.98 (.02)
10. NSC 2					.98 (.02)			.98 (.02)
11. DR 1						---		.90 (.03)
12. DR 2						---		.81 (.04)
	Model 3 Factors *r* (*SE*)						Model 6 Factors *r* (*SE*)	
Factor	Re	Av	Th	AD	NSC	Factor	PTSD	DSO
Re	---					PTSD	---	
Av	.72 (.04)	---				DSO	.69 (.05)	---
Th	.70 (.04)	.63 (.05)	---					
AD	.63 (.05)	.71 (.06)	.74 (.06)	---				
NSC	.58 (.05)	.57 (.05)	.59 (.05)	.87 (.05)	---			

Note. All item loadings are standardized; All factor loadings and correlations are statistically significant ($p < .001$); CPTSD = Complex posttraumatic stress disorder items from the International Trauma Questionnaire; PTSD = Posttraumatic stress disorder item from the International Trauma Questionnaire; DSO = Disturbances in self-organization; Model 3: five correlated first-order factors (CPTSD interpersonal items removed); Model 6: first-order two-factors (PTSD, DSO); Re = Re-experiencing in the here and now; Av = Avoidance; Th = Sense of current threat; AD = Affect dysregulation; NSC = Negative self-concept; DR = Disturbances in relationships.

Figure 1 *Confirmatory Factor Analysis (CFA) Measurement Models Tested in the Literature and Current Study*



Note. This figure shows the conceptual CFA models tested in the current study, and models that have been tested in existing literature (see Table 2). CPTSD = Complex Posttraumatic Stress Disorder; PTSD = Posttraumatic Stress Disorder; Re = Re-experiencing in the here and now; Av = Avoidance; Th = Sense of current threat; AD = Affect dysregulation; NSC = Negative self-concept; DR = Disturbances in relationships; PTSD includes Re, Av, and Th clusters; DSO = Disturbances in self-organization. DSO is comprised of AD, NSC, and DR clusters. CPTSD is comprised of the PTSD and DSO factors. Model 1: CPTSD one-factor (unidimensional); Model 2: six correlated first-order factors; Model 3: five correlated first-order factors (CPTSD interpersonal items removed); Model 4: one second-order CPTSD factor, six first-order factors; Model 5: two second-order factors (PTSD, DSO), six first-order factors; Model 6: first-order two-factors (PTSD, DSO); Model 7: two-factor second-order model with PTSD measured by 6 Items and DSO by three first-order factors; Model 8: two-factor second-order model with PTSD measured by three first-order factors and DSO by 6 items.