Alternative models of DSM-5 PTSD: Examining diagnostic implications

Siobhan Murphy[a]

Maj Hansen[a]

Ask Elklit[a]

Yoke Yong Chen[b]

Siti Raudzah Ghazali[b]

Mark Shevlin[c]

[a] National Centre of Psychotraumatology, University of Southern Denmark, Odense, Denmark

[b] Faculty of Medicine and Health Science, Universiti Malaysia Sarawak, Sarawak, Malaysia

[c] Psychology Research Institute, Ulster University, Derry, Northern Ireland

Abstract

Background: The factor structure of DSM-5 factor structure of posttraumatic stress disorder (PTSD) has been extensively debated with evidence supporting the recently proposed seven factor Hybrid model. However, despite myriad studies examining PTSD symptom structure few have assessed the diagnostic implications of these proposed models. This study aimed to generate PTSD prevalence estimates derived from the 7 alternative factor models and assess whether pre-established risk factors associated with PTSD produce consistent risk estimates. Methods: Seven alternative models were estimated within a confirmatory factor analytic framework using the PTSD Checklist-for DSM-5 (PCL-5). Data was analysed from a Malaysian young adult sample (n=531) of which 60.8% were female, with a mean age of 18.63 years. Results: The results indicated seven factor Hybrid model provided superior fit to the data. The prevalence estimates varied substantially ranging from 22.8% for the DSM-5 model to 10.4% for the Hybrid model. Estimates of risk associated with PTSD found mixed evidence, with substantial variation emerging for sexual victimisation. Conclusions: These findings have important implications for research and practice as they underscore the importance of examining the diagnostic implications emerging from the alternative models of PTSD.

Keywords: Posttraumatic stress disorder; confirmatory factor analysis; diagnostic implications; PTSD Checklist-for DSM-5.

Alternative Models of DSM-5 PTSD: Examining Diagnostic Implications.

Introduction

The underlying latent structure of posttraumatic stress disorder (PTSD) has been extensively studied and debated (Armour, Müllerová, & Elhai, 2016). Most research into PTSD symptoms of the Diagnostic and Statistical Manual for Mental Disorders (DSM-IV; American Psychiatric Association, 1994) has supported and demonstrated superior fit of two alternative four factor models over the three factor DSM-IV PTSD model; the Emotional Numbing model (King, Leskin, King, & Weathers, 1998), and the Dysphoria model (Elhai & Palmieri, 2011; Simms, Watson, & Doebbeling, 2002; Yufik & Simms, 2010). More recently, Elhai and colleagues (2011) proposed a five factor Dysphoric Arousal model which spilt the hyperarousal symptom cluster into dysphoric and anxious arousal symptoms. This separation was based on evidence documenting the difference between general distress/dysphoria (D1-D3) and fear based symptoms (D4-D5) (Watson, 2005; 2009).

The current DSM-5 conceptualisation of PTSD is more closely aligned to the Emotional Numbing model and includes four symptom clusters; re-experiencing, avoidance, negative alternations in cognitions and mood (NACM), and alternations in arousal and reactivity. Notable differences in the DSM-5 criteria is evidenced by the narrowing definition of what constitutes a traumatic event in criterion A; the removal of criterion A2 (i.e., the peri-traumatic fear, helplessness, or horror); the separation of the DSM-IV Criterion C of active avoidance and emotional numbing into two separate clusters; and the addition of three symptoms blame, persistent negative emotions, and reckless or self-destructive behaviour (Weathers, 2017).

Following the release of the DSM-5 new evidence emerged suggesting that the factor structure of PTSD is better conceptualised as six factors; namely, the Anhedonia model (Liu et al., 2014) and Externalizing Behaviours model (Tsai et al., 2015). The most recent model is a seven-factor Hybrid model (Armour et al., 2015) which has generated superior empirical support across multiple studies(Armour et al., 2016). This hybrid model integrates features of both 6 factor models including the re-experiencing, avoidance, externalizing behaviours, anxious arousal and dysphoric arousal factors (from the externalizing behaviours model), and the anhedonia and NACM factors (from the anhedonia model). Collectively, evidence suggests an overall tendency for the Dysphoric Arousal model to provide superior support for

DSM-IV symptoms and the Hybrid model to be superior for DSM-5 symptoms (Armour et al., 2016).

Importantly, despite the theoretical and empirical support for each PTSD model there are several questions that emerge in terms of the implications on research and clinical practice. Firstly, as argued by Shevlin, Hyland, Karatzias, Bisson, and Roberts (2017), there is a lack knowledge about the impact of these models on the diagnostic criteria for PTSD as none of these studies have provided a diagnostic algorithm to base the PTSD diagnosis on. Secondly, considering these concerns, Shevlin and colleagues developed a diagnostic algorithm for the seven existing DSM-5 models. The results found significant variation in prevalence estimates with the highest estimate generated by the DSM-5 model and the lowest from the Hybrid model. Thirdly, the Shevlin et al. (2017) study indicated that the relationship between known risk factors for PTSD and the estimated PTSD prevalence rates vary depending on the use of the different diagnostic algorithms. Specifically, they found that the odds ratios for an estimated PTSD diagnosis following childhood maltreatment varied between 1.89 and 3.50 for the Hybrid model and the DSM-5 model respectively. The authors conclude that it is unclear which estimate is correct, but the magnitude of variation in child maltreatment as a risk factor for PTSD raises important implications for whether PTSD is being consistently diagnosed across all models.

The current study therefore aims to replicate and expand the findings of Shevlin and colleagues using a community sample of Malaysian young adults. The first aim was to generate prevalence estimates from the existing seven PTSD models. The fit of these seven models were estimated that included; the 4-factor DSM-5 model, the 4-factor Dysphoria model, the 5-factor Dysphoric Arousal model, the 6-factor Anhedonia model, the 6-factor Externalizing Behaviours model, the 6-factor Alternative Dysphoria model and the 7-factor Hybrid model (see Table 1 for model specifications). Based on previous research (Armour et al., 2016), we hypothesised that the 7-factor Hybrid model would provide the best fit to the data. The second aim was to extend the findings of Shevlin and colleagues study to examine whether a broader range of traumatic exposures were differentially associated with PTSD depending on the model used to derive the diagnosis. Based on literature documenting risk factors for PTSD we examined whether exposure to a natural disaster (e.g., Cao, McFarlane, & Klimidis, 2003; Galea et al., 2007; Neria, Nadi, & Galea, 2008), transportation accidents (e.g., Murray, Ehlers, & Mayou, 2002), childhood neglect and sexual victimisation (Cutajar

et al., 2010; Fergusson et al., 2013; Jonas et al., 2010) conferred relatively similar estimates of risk irrespective of which model of PTSD is used.

Insert table 1 here

Method

Participants and Procedure

Participants were recruited based on multistage sampling. Participants were contacted through the head of the villages and the school administrations. Written consent for participation was obtained. Permission from parents or legal guardians were obtained for underage participants. All participants were informed about their rights, the possible risks of the study and issues of confidentiality. All participants completed the demographic questionnaire themselves. The total sample consisted of 675 participants, 418 (61.9%) females and 257 (38.1%) males. The majority of the sample were young adults with a mean age of 19.06 years (SD = 7.44, Range 10-75). Ethnicity was self-reported as predominantly Malaysian 489 (72.4%) and the remaining participants were from Chinese, Indian, Bidayuh, and Ibans origin. The majority of the sample were single 92.7% (n=626) and still living with both parents (74.7%).

Measures

Traumatic Exposure

Participants were presented with a list of traumatic and negative life events. Thirteen items were derived from the Life Events Checklist for DSM-5 (Weathers et al., 2013a) these questions included direct and indirect exposure to a natural disaster, transportation accident and sexual assault. An additional five items were added to capture events e.g., near drowning experiences, robbery, and childhood neglect. Participants were also asked to endorse their most traumatic event. The data was then screened to ensure that only participants who reported traumatic exposure were included. Of the full sample, 144 participants did not report traumatic exposure and were therefore removed from the analyses, leaving a final sample of 531. The majority of this sample were female 60.8% with a mean age of 18.63 years. Four items were selected from this checklist to examine the association of pre-established risk factors for PTSD which included; exposure to a natural disaster, experiencing a transportation accident, childhood neglect and lifetime sexual victimisation (sexual assault or rape).

PTSD Checklist for DSM-5 (PCL-5; Weathers et al., 2013b).

PTSD was assessed using Malay version of the PCL-5 (Bahasa Mayalsia). The PCL-5 consists of 20 items that correspond to the DSM-5 PTSD symptoms. Participants are asked to indicate "how much have you been bothered by the problem in the past month" and responses are rated on a five-point Likert scale (0=Not at all, 1 =A little bit, 2 Moderately, 3 =Quite a bit, 4 =Extremely). To establish diagnostic rates the DSM-5 algorithm was applied which requires at least; one intrusion item (B1-B5), one avoidance item (C1-C2), two items from the negative alternations in cognition and mood (NACM; D1-D7) and two hyperarousal items (E1-E6). A rating of 2 (i.e. moderately) or higher for an item is treated as the presence of a symptom. The psychometric properties of the PCL-5 have been assessed across a variety of trauma-exposed samples and the scale has demonstrated satisfactory reliability and validity (e.g., Blevins, Weathers, Davis, Witte, & Domino, 2015; Bovin et al., 2015). In the current sample the internal reliability for the full scale was satisfactory (= .92), and each subscale: intrusions (= .81), avoidance (= .77), NACM (= .84), and hyperarousal (= .77).

Statistical analysis

The latent structure of the PCL-5 was tested using confirmatory factor analysis (CFA) based on responses to the 20 items. Six models were specified and estimated by Mplus 7.1 (Muthen & Muthen, 2013) using the robust weighted least squares estimator (WLSMV) based on the polychoric correlation matrix of latent continuous response variables and robust maximum likelihood estimation (MLR: Yuan & Bentler, 2000). The models are presented in Table 1.

In order to assess the goodness of fit for each model using both estimators a range of fit statistics were examined including; the comparative fit index (CFI; Bentler, 1990), and the Tucker-Lewis Index (TLI; Tucker & Lewis, 1973). A non-significant χ^2 and Root Mean Square Error of Approximation (RMSEA; Steiger, 1990). Specifically, a CFI/TLI above 0.95 indicate a good fit between the model and the data. A moderate fit is indicated by a CFI above 0.90 and a RMSEA below 0.08. Additionally, the Root Mean Square Error of where a value less than .05 indicated close fit and values up to .08 indicated reasonable errors of approximation (Jöreskog & Sörbom, 1993). The Weighted Root Mean Square Residual (WRMR) was inspected when using the WLMSV estimator whereby values less than 1 are indicative of acceptable model fit. For MLR estimation the Standardised Root-Mean Square

Residual (SRMR: Joreskosg & Sorbom, 1996) was used with values of less than .06 indicating excellent fit and values less than .08 indicative of acceptable model fit. The Bayesian Information Criterion (BIC: Schwarz, 1978) was also used to evaluate and compare models, with the smallest value indicating the best fitting model. In examining BIC differences, it has been suggested that a difference of 6-10 indicates strong evidence of model superiority and a difference >10 indicates very strong evidence of model superiority (Rafferty, 1996).

The second phase of the analysis involved generating probable self-report based prevalence rate of PTSD for each model based on a score of 2 (moderately) or greater being indicative of a symptom present. The symptom-based diagnostic algorithm for each model was developed by Shevlin et al. (2017) and are presented in Table 2.

Insert Table 2 here

The third phase of the analysis was to explore a range of traumatic experiences that have been associated with the development of PTSD (i.e., experiencing a natural disaster, a road traffic accident, childhood neglect and sexual victimisation) to determine whether differential associations emerged between the PTSD rates and the alternative models.

Results

A total of 378 (71.2%) of participants reported either direct or indirect exposure to a natural disaster, 334 (62.9%) reported experiencing a transportation accident, 39 (7.3%) reported experiencing childhood neglect and 11 (2.1%) endorsed lifetime sexual victimisation. There were no significant gender differences between exposure to a natural disaster χ^2 (1) =1.42, p =.234; sexual victimisation χ^2 (1) =0.37, p =.847 or childhood neglect χ^2 (1) = 0.19, p =.663. Males were significantly more likely to endorse a transportation accident χ^2 (1) =12.44, p <.001.

The fit statistics for the seven competing CFA models are presented in Table 3. Although the chi-square statistics were statistically significant this should not lead to the rejection of the models as the large sample size increased the power of the test (Tanaka, 1987). Using WLMSV estimation all models met the criteria for an excellent model fit based on the CFI and TLI, and RMSEA criteria. However, only the Anhedonia, Externalising Behaviours and Hybrid models met the recommended WRMR criteria of ≤ 1. For models based on MLR estimation all demonstrated acceptable model fit with the Hybrid model

providing the lowest BIC value. We further examined the BIC differences from the Anhedonia and Externalising Behaviours and found that the Hybrid was superior based on BIC differences of 8.44 and 11.9 respectively. On this basis, the Hybrid model was considered the superior model using both estimators. The estimated diagnostic rates corresponding to the seven symptom algorithms are also presented in Table 3. The seven symptom profiles demonstrated considerable variation with the DSM-5 model producing the highest diagnostic rates (22.8%) and the Hybrid model producing the lowest (10.4%). The difference in the two models was statistically significant ($z = 5.45$, $p < .05$). In comparing the prevalence estimates derived from the DSM-5 and the Anhedonia (15.3%) and Externalising Behaviours (11.9%) models there was a significant difference ($z=3.13$, $p =< .05$) and ($z =4.70$, $p=< .05$) respectively. There was a significant difference in prevalence estimates for the Anhedonia model and the Hybrid models ($z=2.39$; $p < .05$) however not for the Externalising Behaviour model and the Hybrid ($z=0.78$; $p < .05$).

Insert Table 3 here

Table 4 presents the results of the bivariate associations between pre-established risk factors of PTSD and the seven PTSD models. Exposure to a natural disaster was only significantly associated with a PTSD diagnosis in the Alternative Dysphoria model but the magnitude of this risk was similar across all models. Whilst, experiencing a road traffic accident and sexual victimisation were significantly associated with PTSD in all models, the magnitude in risk for sexual victimisation varied depending on each model with odds ratios ranging from 4.23 for the DSM-5 model to 7.83 for the Hybrid model. Notably, childhood maltreatment was only significantly associated with PTSD in the DSM-5 and Dysphoria models.

Insert Table 4 here

Discussion

The overall aim of this study was to examine diagnostic rates of PTSD based on the existing factor analytical models in a sample of Malaysian young adults exposed to a range of traumatic events. Firstly, seven alternative DSM-5 PTSD models were estimated and findings revealed that all models provided good fit to the data, with the 7-factor Hybrid model providing the best fit to the data based on a slightly lower WRMR and significantly

lower BIC value using both MLR and WLSMV estimation. This result is consistent with recent studies supporting the superiority of the Hybrid model (Armour et al., 2016; Armour et al., 2015; Bovin et al., 2015; Mordeno et al., 2016; Seligowski & Orcutt, 2015; Shevlin et al., 2017) across a range of different clinical and non-clinical populations.

The current findings support those reported by Shevlin and colleagues (2017) and demonstrate considerable variation in diagnostic rates derived from the different models. Further, both studies found that the highest diagnostic rates were evident from the DSM-5 model and lowest rates were seen in the Hybrid model. Findings indicated that 22.8% of the sample met the diagnostic threshold for PTSD using the DSM-5 model compared to 10.4% in the Hybrid model, this represents a 54.3% reduction in prevalence between the two models. The Externalising Behaviours model, Alternative Dysphoria model, and the Anhedonia further signified a substantial reduction in PTSD prevalence equating to 47.8%, 40.3% and 32.9% respectively relative to the DSM-5 model. The reduction in prevalence for the Dysphoric Arousal and the Dysphoria models were attenuated but still noteworthy with 16.6% and 10.9% respectively.

The issue of different conceptualisations of PTSD has been debated since its inclusion in the DSM-III. Prior to the release of the DSM-5 and the suggested modifications to the diagnostic criteria, several researchers investigated the impact of these different conceptualisations would have on prevalence estimates. For example, Elhai and colleagues (2012) found that PTSD prevalence was higher, using the DSM-5 versus the DSM-IV criteria, however, not significantly higher in a sample of college students. Conversely, Kilpatrick and colleagues (2013) did find that prevalence estimates for lifetime PTSD were significantly different using DSM-5 compared to DSM-IV criteria (9.4% and 10.6% respectively). Notably, the differences in these prevalence estimates were small. When these studies are compared to the current findings it is evident that the increasingly complex models of PTSD (e.g., the Hybrid model) adds substantial variation to the overall prevalence. For example, our findings show that over 50% of those who met the DSM-5 criteria do not meet the criteria derived from the Hybrid model which draws attention to the clinical implications these more complex models have on traumatised individuals accessing and gaining treatment. It appears increasing the number of factors associated with PTSD has the effect of increasing the diagnostic threshold of the disorder. This raises a challenge for future research as based on the current findings and those of Shevlin and colleagues, PTSD prevalence appears markedly different according to the which model is used. Ultimately this

may increase the likelihood of many individuals not receiving a PTSD diagnosis and therefore restricting their recovery process. It is important therefore that future research aims at reconciling the diagnostic implications based on these models and work towards achieving consensus on what accurately represents the disorder. Consequently, it is pertinent that researchers move beyond replicating these alternative factor structures in a variety of different populations and rather examine at the implications that these models actually propose in clinical and research settings.

When examining the diagnostic accuracy of specified models, other factors need to be considered, for example, whether previously established risk factors confer relatively similar risk estimates. The second aim of this study addressed this issue and found mixed evidence. Findings indicated that exposure to a natural disaster was consistently not associated with a diagnostic rate of PTSD for any of the alternative models. Involvement in a road traffic accident was significantly associated with a PTSD diagnosis in all models and the magnitude of this risk was relatively similar. However, it is noteworthy that childhood neglect was only a significant predictor of a PTSD diagnosis in the DSM-5 and Dysphoria models. Finally, in terms of sexual victimisation, whilst being a significant predictor for a PTSD diagnosis in all models the magnitude of this risk differed substantially, depending on which model was used with odds ratios ranging from 4.23 to 7.83 for the DSM-5 and Hybrid models respectively. These findings support those reported in Shevlin and colleagues study that also found substantial variation in the magnitude of risk associated with childhood maltreatment and each of the alternative PTSD models. Future research is therefore clearly warranted to examine the association between established PTSD risk factors and the alternative factor models.

Furthermore, when comparing the all DSM-5 models to the upcoming ICD-11 the complexity of these issues is exemplified. The upcoming ICD-11 is proposing to simplify the structure of PTSD into three factors; re-experiencing, avoidance and hyperarousal all of which have two symptoms. This narrower definition is intended to direct clinicians to the core elements of the disorder and use functional impairment rather than a specific traumatic experience to determine diagnostic threshold (Maercker et al., 2013) which greatly contrasts to all models representing DSM-5. Two previous studies have demonstrated that the DSM-5 symptom profile resulted in significantly higher diagnostic rates (30.4%) compared to (22.6%) than the proposed ICD-11 in a sample of CSA survivors (Hansen et al., 2015) and

6.7% compared to 3.3% in a sample of individuals hospitalised for physical injury (O'Donnell et al., 2014).

The findings of this study should be considered in light of some methodological limitations. Firstly, there are many different ways the diagnostic algorithms could have been developed and applied therefore alternative specifications may generate different diagnostic rates. Secondly, the sample is based on a Malaysian young adult population that reported on a range of traumatic experiences rather than being tailored towards a particular traumatic event. Thirdly, the analyses are based on self-reported PTSD symptoms and not by a clinician administered scale which may have inflated the current prevalence estimates. Fourthly, the predictive utility of the symptom clusters could not be validated against other forms of psychopathology. Finally, the cell counts for sexual victimisation were small, and the confidence intervals were large, meaning that the resulting estimates may not be reliable. Findings relating to sexual victimisation and PTSD should be interpreted with this in mind.

To conclude, this study has supported previous theoretical and empirical findings that identify seven dimensions of PTSD that has been replicated across different samples and cultures. Overall, this study found considerable variation between prevalence rates and the alternative factor analytic models of PTSD that ranging from 22.8% to 10.4%. Additionally, we found that the relationship between different types of traumatic experiences and were differentially associated with a PTSD diagnosis based on the diagnostic algorithm applied in the current study. Future research should focus on different correlates and risk factors of the outlined factors that may advance our understanding regarding the conceptualisation of PTSD.

References

American Psychiatric Association. (2013). Diagnostic and statistical manual of mental disorders (DSM-5®). American Psychiatric Pub.

Armour, C., Elhai, J.D., Layne, C.M., Shevlin, M., Duraković-Belko, E., Djapo, N., &

Pynoos, R.S. (2011). Gender differences in the factor structure of posttraumatic stress disorder symptoms in war-exposed adolescents. Journal of Anxiety Disorders, 25(4), 604–611.

Armour, C., Műllerová, J., & Elhai, J. D. (2016). A systematic literature review of PTSD's latent structure in the Diagnostic and Statistical Manual of Mental Disorders: DSM-IV to DSM-5. *Clinical Psychology Review, 44,* 60-74.

Armour, C., Tsai, J., Durham, T.A., Charak, R., Biehn, T.L., Elhai, J.D., & Pietrzak, R.H. (2015). Dimensional structure of DSM-5 posttraumatic stress symptoms: Support for a hybrid Anhedonia and Externalizing Behaviors model. Journal of Psychiatric Research, 61, 106–113.

Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin*, *107*(2), 238-246.

Blevins, C. A., Weathers, F. W., Davis, M. T., Witte, T. K., & Domino, J. L. (2015). The Posttraumatic Stress Disorder Checklist for DSM-5 (PCL-5): Development and initial psychometric evaluation. *Journal of Traumatic Stress, 28*, 489–498.

Bovin, M. J., Marx, B. P., Weathers, F. W., Gallagher, M. W., Rodriguez, P., Schnurr, P. P., & Keane, T. M. (2015). Psychometric properties of the PTSD Checklist for Diagnostic and Statistical Manual of Mental Disorders-Fifth Edition (PCL-5) in veterans. *Psychological Assessment*. http://dx.doi.org/10.1037/pas0000254

Cao, H., McFarlane, A. C., & Klimidis, S. (2003). Prevalence of psychiatric disorder following the 1988 Yun Nan (China) earthquake. *Social Psychiatry and Psychiatric Epidemiology*, *38*(4), 204-212.

Elhai, J.D., Biehn, T.L., Armour, C., Klopper, J.J., Frueh, B.C., & Palmieri, P.A. (2011). Evidence for a unique PTSD construct represented by PTSD's D1–D3 symptoms. *Journal of Anxiety Disorders, 25*(3), 340–345.

Elhai, J.D.., Miller, M.E., Ford, J.D., Biehn, T.L., Palmieri, P.A., & Frueh, B.C. (2012).

Posttraumatic stress disorder in DSM-5: Estimates of prevalence and symptom structure in a nonclinical sample of college students. Journal of Anxiety Disorders, 26(1), 58–64.

Elhai, J. D., & Palmieri, P. A. (2011). The factor structure of posttraumatic stress disorder: A literature update, critique of methodology, and agenda for future research. *Journal of Anxiety Disorders, 25*(6), 849-854.

Fergusson, D. M., McLeod, G. F., & Horwood, L. J. (2013). Childhood sexual abuse and adult developmental outcomes: Findings from a 30-year longitudinal study in New Zealand. *Child Abuse & Neglect, 37*(9), 664-674.

Galea, S., Brewin, C. R., Gruber, M., Jones, R. T., King, D. W., King, L. A., ... & Kessler, R. C. (2007). Exposure to hurricane-related stressors and mental illness after Hurricane Katrina. *Archives of General Psychiatry, 64*(12), 1427-1434.

Hansen, M., Hyland, P., Armour, C., Shevlin, M., & Elklit, A. (2015). Less is more? Assessing the validity of the ICD-11 model of PTSD across multiple trauma samples. *European Journal of Psychotraumatology*, 6.

Jonas, S., Bebbington, P., McManus, S., Meltzer, H., Jenkins, R., Kuipers, E., et al. (2011). Sexual abuse and psychiatric disorder in England: Results from the 2007 adult psychiatric morbidity survey. *Psychological Medicine*,*41*(04), 709-719.

Joreskog K.G, Sorbom D. (1981). LISREL V: analysis of linear structural relationships by the method of maximum likelihood. Chicago: National Educational Resources, Inc., 1981.

Kilpatrick, D. G., Resnick, H. S., Milanak, M. E., Miller, M. W., Keyes, K. M., & Friedman, M. J. (2013). National estimates of exposure to traumatic events and PTSD prevalence using DSM- IV and DSM- 5 criteria. *Journal of Traumatic Stress*, *26*(5), 537-547.

King, D.W., Leskin, G.A., King, L.A., &Weathers, F.W. (1998). Confirmatory factor

analysis of the clinician-administered PTSD Scale: Evidence for the dimensionality of posttraumatic stress disorder. Psychological Assessment, 10(2), 90–96.

Liu, P.,Wang, L., Cao, C.,Wang, R., Zhang, J., Zhang, B., ... Elhai, J.D. (2014). The underlying dimensions of DSM-5 posttraumatic stress disorder symptoms in an epidemiological sample of Chinese earthquake survivors. Journal of Anxiety Disorders, 28(4), 345–351.

Maercker, A., Brewin, C. R., Bryant, R. A., Cloitre, M., Reed, G. M., van Ommeren, M., ... & Saxena, S. (2013). Proposals for mental disorders specifically associated with stress in the International Classification of Diseases-11. *The Lancet, 381*(9878), 1683-1685

Mordeno, I. G., Carpio, J. G. E., Nalipay, M. J. N., & Saavedra, R. L. J. (2016). PTSD's underlying dimensions in typhoon Haiyan survivors: Assessing DSM-5 symptomatology-based PTSD models and their relation to posttraumatic cognition. *Psychiatric Quarterly*, 1-15.

Murray, J., Ehlers, A., & Mayou, R. A. (2002). Dissociation and post-traumatic stress disorder: two prospective studies of road traffic accident survivors. The British *Journal of Psychiatry, 180,* 363-368.

Muthen LK, Muthen BO. MPlus user's guide, 7th edn. Los Angeles, CA: Muthen & Muthen, 1998–2013.

O'Donnell, M. L., Alkemade, N., Nickerson, A., Creamer, M., McFarlane, A. C., Silove, D., ... & Forbes, D. (2014). Impact of the diagnostic changes to post-traumatic stress disorder for DSM-5 and the proposed changes to ICD-11. *The British Journal of Psychiatry, 205*(3), 230-235.

Raftery, A. E. (1996). Approximate Bayes factors and accounting for model uncertainty in generalized linear models. *Biometrika*, 83, 251–266.

Schwarz, G. (1978). Estimating the dimension of a model. Annals of Statistics, 6,461–464.

Seligowski, Antonia V., and Holly K. Orcutt. (2016). Support for the 7-factor hybrid model

of PTSD in a community sample. Psychological Trauma: *Theory, Research, Practice, and Policy 8,* (2) 218.

Steiger, J. H. (1990). Structural model evaluation and modification: An interval estimation approach. *Multivariate Behavioral Research, 25*, 173–180.

Shevlin, M., Hyland, P., Karatzias, T., Bisson, J. I., & Roberts, N. P. (2017). Examining the disconnect between psychometric models and clinical reality of posttraumatic stress disorder. *Journal of Anxiety Disorders, 47*, 54-59.

Simms, L.J., Watson, D., Doebbeling, B.N. (2002). Confirmatory factor analyses of posttraumatic stress symptoms in deployed and non-deployed veterans of the Gulf War. Journal of Abnormal Psychology,111, 637–647, http://dx.doi.org/10.1037/0021-843X.111.4.637.

Tsai, J., Harpaz-Rotem, I., Armour, C., Southwick, S. M., Krystal, J. H., & Pietrzak, R. H. (2015). Dimensional structure of DSM-5 posttraumatic stress disorder symptoms: results from the National Health and Resilience in Veterans Study. The Journal of clinical psychiatry, 76(5), 546-553.

Tucker, L. R., & Lewis, C. (1973). A reliability coefficient for maximum likelihood factor analysis. Psychometrika, 38(1), 1-10.

Neria, Y., Nandi, A., & Galea, S. (2008). Post-traumatic stress disorder following disasters: a systematic review. *Psychological Medicine*, *38*(4), 467–480. http://doi.org/10.1017/S0033291707001353

Watson, D. (2005). Rethinking the mood and anxiety disorders: A quantitative hierarchical model for DSM-V. *Journal of Abnormal Psychology*, *114(*4), 522–536.

Watson, D. (2009). Differentiating the mood and anxiety disorders: A quadripartite model. *Annual Review of Clinical Psychology, 5*, 221–247.

Weathers, F. W., Blake, D. D., Schnurr, P. P., Kaloupek, D. G., Marx, B. P.,& Keane, T. M.

(2013a). The Life Events Checklist for DSM-5 (LEC-5). Retrieved from the National Center for PTSD website: http://www.ptsd.va.gov.

Weathers, F. W., Blake, D. D., Schnurr, P. P., Kaloupek, D. G., Marx, B. P.,& Keane, T. M. (2013b). The PTSD Checklist for DSM-5 (PCL-5). Retrieved from the National Center for PTSD website: http://www.ptsd.va.gov.

Yuan, K. H., & Bentler, P. M. (2000). Three likelihood- based methods for mean and covariance structure analysis with non-normal missing data. *Sociological methodology*, *30*(1), 165-200.

Yufik, T., & Simms, L. J. (2010). A meta-analytic investigation of the structure of posttraumatic stress disorder symptoms. *Journal of Abnormal Psychology, 119* (4), 764-776.

Table 1. Item mappings of the alternative models of DSM-5 PTSD

Symptom	DSM-5	Dysphoria	Dysphoric Arousal	Externalising Behaviours	Anhedonia	Hybrid
B1. Intrusive thoughts	R	R	R	R	R	R
B2. Nightmares	R	R	R	R	R	R
B3. Flashbacks	R	R	R	R	R	R
B4. Emotional cue reactivity	R	R	R	R	R	R
B5. Physiological cue reactivity	R	R	R	R	R	R
C1. Avoidance of thoughts	A	A	A	A	A	A
C2. Avoidance of reminders	A	A	A	A	A	A
D1. Trauma-related amnesia	NACM	D	NACM	NACM	NACM	NA
D2. Negative beliefs	NACM	D	NACM	NACM	NACM	NA
D3. Blame of self or others	NACM	D	NACM	NACM	NACM	NA
D4. Negative trauma related emotions	NACM	D	NACM	NACM	NACM	NA
D5. Loss of interest	NACM	D	NACM	NACM	AN	AN
D6. Detachment	NACM	D	NACM	NACM	AN	AN

D7. Restricted affect	NACM	D	NACM	NACM	AN	AN
E1. Irritability/anger	AR	D	DA	EB	DA	EB
E2. Self-destructive/reckless behaviour	AR	AR	DA	EB	DA	EB
E3. Hypervigilance	AR	AR	AA	AA	AA	AA
E4. Exaggerated startle response	AR	AR	AA	AA	AA	AA
E5. Difficulty concentrating	AR	D	DA	DA	DA	DA
E6. Sleep disturbance	AR	D	DA	DA	DA	DA

Note. R =re-experiencing; A=avoidance; NACM = negative alterations in cognitions and mood; AR= alterations in arousal and reactivity; NA = negative affect; AN=anhedonia; EB =externalising behaviours; DA=dysphoric arousal.

Table 2. Number of symptoms required from each cluster for each PTSD symptom profile for diagnostic purposes

PTSD symptom cluster	DSM-5	Dysphoria	Dysphoric Arousal	Anhedonia	Externalising Behaviours	Hybrid
Intrusions	1/5	1/5	1/5	1/5	1/5	1/5
Avoidance	1/2	1/2	1/2	1/2	1/2	1/2
NACM	2/7	-	2/7	1/4	2/7	1/4
Hyperarousal	2/6	1/2	-	-	-	-
Dysphoria	-	3/11	-	-	-	-
Dysphoric Arousal	-	-	1/4	1/4	1/2	1/2
Anxious Arousal	-	-	1/2	1/2	1/2	1/2
Anhedonia	-	-	-	1/3	-	1/3
Externalising Behaviours	-	-	-	-	1/2	1/2
Total symptoms required	6/20	6/20	6/20	6/20	7/20	7/20

Table 3. Model fit statistics for alternative models of DSM-5 PTSD and prevalence rates based on each symptom algorithm

Model	Estimator	Chi Square	Df	CFI	TLI	RMSEA	WRMR SRMR	BIC	DX%
DSM-5	**WLSMV**	**450.029**	**164**	**.962**	**.956**	**.057**	**1.086**		**22.8**
						.051-.064			
	MLR	353.264	164	.933	.922	.047	.047	28400.289	
						.040-.053			
Dysphoria	**WLSMV**	**497.967**	**164**	**.956**	**.949**	**.062**	**1.156**		**20.3**
						.056-.068			
	MLR	399.927	164	.916	.903	.052	.048	28462.499	
						.046-.059			
Dysphoric Arousal	**WLSMV**	**414.130**	**160**	**.966**	**.960**	**.055**	**1.026**		**19**
						.048-.061			
	MLR	330.052	160	.940	.928	.045	.044	28393.031	
						.038-.052			
Anhedonia	**WLSMV**	**375.006**	**155**	**.971**	**.964**	**.052**	**.961**		**15.3**
						.045-.058			
	MLR	298.909	155	.949	.937	.042	.042	28381.462	
						.035-.049			
Externalising Behaviours	**WLSMV**	**377.536**	**155**	**.971**	**.964**	**.052**	**.963**		**11.9**
						.045-.059			

	MLR	300.598	155	.948	.937	.042 .035-.049	.042	28384.809	
Alternative Dysphoria	WLSMV	420.159	155	.965	.957	.057 .050-.063	1.032		**13.6**
	MLR	334.413	155	.936	.922	.047 .040-.054	.043	28429.577	
Hybrid	**WLSMV**	**333.932**	**149**	**.976**	**.969**	**.048 .041-.055**	**.889**		**10.4**
	MLR	264.589	149	.959	.948	.039 .031-.046	.040	28373.020	

Table 4. Bivariate associations between trauma variables and risk of diagnosis for each model

	Natural Disaster			Road Traffic Accident			Childhood Neglect			Sexual Victimisation		
Model	**N**	χ^2 (df)	OR	N	χ^2 (df)	OR	N	χ^2 (df)	OR	N	χ^2 (df)	OR
	%	p	95% CI	%	p	95% CI	%	p	95% CI	%	p	95% CI
DSM-5	**79**	2.66 (1)	0.70	**88**	6.49(1)	1.78	**14**	4.11(1)	2.02	**6**	6.44 (1)	4.23
	20.9	.103	(0.45-1.08)	26.3	0.11	(1.14-2.79)	35.9	.043	(1.01-4.01)	54.5	0.11	(1.27-14.09)
Dys	**71**	1.96 (1)	0.73	**78**	5.05(1)	1.70	**13**	4.39(1)	2.09	**6**	8.11(1)	4.92
	18.8	.161	(0.46-1.41)	23.4	.025	(1.07-2.70)	33.3	.036	(1.06-4.22)	54.5	.004	(1.47-16.43)
DA	**67**	1.43 (1)	0.75	**75**	6.89(1)	1.91	**11**	2.31(1)	1.75	**6**	9.20(1)	5.37
	17.7	.232	(0.47-1.20)	22.5	.009	(1.71-3.09)	28.2	.129	(0.84-3.66)	54.5	.002	(1.61-17.96)
Anhed	**52**	2.28(1)	0.68	**61**	6.31(1)	2.00	**10**	3.51(1)	2.06	**5**	7.93(1)	4.87
	13.8	.131	(0.41-1.12)	18.3	.012	(1.15-3.39)	25.6	.061	(0.96-4.38)	45.5	.005	(1.45-16.35)
EB	**39**	3.00(1)	0.62	**47**	4.20(1)	1.85	**6**	0.50(1)	1.39	**5**	12.12(1)	6.64
	10.3	.083	(0.36-1.07)	14.1	.041	(1.02-3.37)	15.4	.480	(0.56-3.46)	45.5	.001	(1.96-22.44)
ADYS	**44**	4.12(1)	0.59	**53**	4.09(1)	1.78	**8**	1.74(1)	1.73	**5**	9.75(1)	5.63
	11.6	.042	(0.35-0.99)	15.9	.043	(1.01-3.08)	20.5	.188	(0.76-3.92)	45.5	.002	(1.67-18.96)
Hybrid	**34**	2.63(1)	0.62	**42**	4.77(1)	2.04	**6**	1.15(1)	1.64	**5**	14.90(1)	7.83
	9.0	.105	(0.35-1.11)	12.6	.029	(1.06-3.90)	15.4	.284	(0.66-4.12)	45.5	<.001	(2.31-26.59)