Published in final edited form as:

Child Adolesc Ment Health. 2014 November ; 19(4): 235–242. doi:10.1111/camh.12050.

Post-traumatic stress symptoms and structure among orphan and vulnerable children and adolescents in Zambia

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Abstract

Background—Scant information exists on PTSD symptoms and structure in youth from developing countries.

Methods—We describe the symptom profile and exposure to trauma experiences among 343 orphan and vulnerable children and adolescents from Zambia. We distinguished profiles of post-traumatic stress symptoms using latent class analysis.

Results—Average number of trauma-related symptoms (21.6; range 0–38) was similar across sex and age. Latent class model suggested 3 classes varying by level of severity: low (31% of the sample), medium (45% of the sample), and high (24% of the sample) symptomatology.

Conclusions—Results suggest that PTSD is a continuously distributed latent trait.

Keywords

Trauma; assessment; cross-cultural; post-traumatic stress disorder

Introduction

Epidemiologic studies of child traumatic stress indicate that trauma experiences are common, with exposure prevalence ranging from 20 to 80% (Benjet, 2010; Fairbank & Fairbank, 2009). Children and adolescents from low-income countries live in environments of cumulative and diverse trauma exposure; many are exposed to violence (war-related and domestic), some are orphaned by AIDS, all of which can increase vulnerability (Shetty & Powell, 2003). These orphans and vulnerable children (OVC) are at a substantially greater risk for developmental problems in cognitive, physiological, social, emotional, and behavioral domains. In particular, it has been widely reported that OVC are at increased risk for post-traumatic stress disorder (PTSD), depression and anxiety symptoms (Benjet, 2010; Cluver & Gardner, 2007).

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The authors have declared that they have no competing or potential conflicts of interest.

Our prior qualitative research indicated that trauma and grief are significant problems among youth in Zambia (removed identifier). In another previous study, Murray and colleagues (Murray et al., 2011) reported a mean number of traumas of 2.09 (SD 1.36) in children from an urban community center in Zambia, with the most frequent trauma being sexually touched. Attention to the psychosocial needs of OVC has increased dramatically in Zambia and many Eastern and Southern African countries, mainly driven by the HIV/AIDS agenda (Andrews, Skinner & Zuma, 2006). The result has been an increase in the allocation of resources to psychosocial programs. All too often, these programs are based on anecdotal or ideological principals. Thus, donors, policy makers, and program managers are frequently forced to make decisions in the absence of evidence.

Currently, there is an open debate (Saul et al., 2008) on the applicability of the PTSD criteria in children and adolescents as outlined in the Diagnostic and Statistical Manual of Mental Disorders-IV (DSM-IV) (American Psychiatric Association, 2000), stressing the importance of empirical evidence regarding the symptom structure of PTSD in youth. Understanding the symptom structure of post-traumatic stress in OVC is critical for developing appropriate mental health and psychosocial measurements and interventions. Despite the fact that the majority of OVC reside in low- and middle-income settings, empirical research describing PTSD symptom structure is limited (Benjet, 2010).

Studies on the symptom structure of youth PTSD, mainly from high-income countries, suggest up to four groups of symptoms: re-experiencing, avoidance, numbing, and increased arousal factors that support the current DSM-IV conceptualization (Asmundson et al., 2000; Breslau, Reboussin, Anthony, & Storr, 2005; Fairbank & Fairbank, 2009). A limitation of these studies is their reliance on approaches that assume symptoms function in a consistent manner across individuals. However, the underlying structure of trauma-related symptoms may differ within distinct groups defined by symptom profiles, which call for the use of methods that allow separation along these unobserved covariates.

Despite the vast amount of publications on youth trauma and mental health, little research has been conducted in low and middle-income countries to guide local mental health programs and policies. Findings from high-income, Western settings should not be assumed to apply to these sites.

The aim of this study was to describe the symptom profile and structure of PTSD that includes using latent class analysis (LCA); a method used to identify underlying latent classes using observed response variables (Vermunt & Magidson, 2002). LCA is an attempt to search for departures from homogeneity in the conditional probabilities of symptom experiences, given class membership. The resulting classes can provide useful insights into the co-occurrence of trauma symptoms among OVC, thus informing policy and program development.

Methods

Subjects and Procedure

Data for this study come from the monitoring and evaluation (M&E) activities of existing HIV palliative care programs run by Catholic Relief Services (CRS) in Lusaka and Kabwe, Zambia. A full description of the interventions and the M&E results are presented elsewhere (Burrows, Jere, & Murray, 2011). The sample presented here is a convenience sample of children ages 5 to 18 years involved through a home based caregiver (HBC) in CRS programs at a service center. These centers provide services in urban and peri-urban areas within Lusaka and Kabwe to children and adolescents directly (e.g. at high HIV risk, live with chronically ill parents, are orphans, subject to stigma and discrimination) and indirectly affected by HIV/AIDS (e.g. their communities and the services they provide are strained by the consequences of the AIDS epidemic). Exclusion criteria for children in the CRS program included pervasive developmental delays, active and severe substance abuse, or psychotic symptoms.

Data were collected between March 2009 and May 2010 by 46 HBC who had previously been trained by Johns Hopkins Bloomberg School of Public Health (JHSPH) faculty in the CRS program intake process and assessment protocol. Study participants were engaged in their homes or at community centers as part of the HBC standard program. Assessments were conducted either in two of the most common local languages, Nyanja and Bemba, and/or English.

The project was reviewed by the IRB of the JHSPH. All participants were provided with an information form explaining what to expect from the program and how their information would be kept confidential.

Assessment of symptoms and traumas

The adapted and locally validated version of the UCLA Child Post-Traumatic Stress Disorder-Reaction Index (PTSD-RI) was used as trauma-symptoms assessment tool (Murray et al., 2011). The PTSD-RI (Frederick, Pynoos, & Nader, 1992) is a self-report tool widely used across countries to evaluate trauma exposure and post-traumatic stress in children and adolescents (Laor et al., 2002; Layne et al., 2001). The measure contains three parts, 1) a section on exposures to different traumatic events; 2) a section on the objective and subjective experiences and memories of the traumatic event; and 3) a section on the frequency of occurrence of specific post-traumatic stress symptoms during the past month. The original version of PTSD-RI scale includes 20 symptom questions (section 3) where child respondents are asked to rate the frequency with which they experienced each symptom in the previous month using a 5-point Likert scale (0=None of the time, 1=Little, 2= Some, 3= Much and, 4= Most of the time). A global score is obtained adding all responses, and score ranges from 0-148. For the latent class analysis, the Likert scale responses to the PTSD-RI items were collapsed into binary indicators. Symptom experience was considered positive if the recorded response in the Likert scale was: *Some, Much, or Most of the time*. Absence of a symptom was defined by a response of *None or Little of the*

time. A sensitivity analysis was carried out to compare different collapsing strategies (results not presented). Results were comparable to the results presented.

Details of the development, adaptation, and validation of the PTSD-RI Zambia version can be found elsewhere (removed identifier). Briefly, adaptation of the measure was informed with results from a qualitative study carried out by one of the authors (removed identifier), coupled with a revision of the PTSD-RI with local collaborators from the University of Zambia (faculty members with experience on child sex abuse, and psychiatrists) and stakeholders from local mental health services. This resulted in 18 locally relevant signs and symptoms added to the PTSD-RI, yielding a measure with a total of 38 defining symptoms (Table 3). Cronbach's alpha scores for the 20-item PTSD-RI and the 18-item locally specific scale were .93 and .94, respectively. The complete PTSD-RI was translated to Nyanja and Bemba (the most common local languages) through a three-step process: 1) translation-back translation, 2) group translation and 3) for locally specific items, checking the translation results using the local vocabulary. Local testing of the PTSD-RI (removed identifier) indicated that a cut-off score of 39 or higher warranted referral to mental health treatment and was used to define caseness.

Statistical Analysis

We calculated descriptive statistics for the sample (mean, standard deviation, range), frequency analyses, and reliability analyses (Cronbach's alpha) (Cronbach, 1951). We used chi-squared tests to tests for differences in proportions.

We applied LCA to the 38 trauma-related symptoms from the adapted PTSD-RI (section 3) and compared the relative fit of models with up to five classes. We used three relative fit indices to compare competing models; the Bayesian information criterion (BIC) (Schöve, 1987), the Akaike information criterion (AIC) (Akaike, 1987), and the Lo-Mendell-Rubin approximation to likelihood ratio test (LMR LRT) (Lo, Mendell, & Rubin, 2001). For the BIC and AIC, lower values indicate better fit. The LMR LRT was used to compare models with different numbers of latent classes, where a non-significant chi-square test ($p > 0.05$) suggests that a model with one less class ($k-1$ classes) fits the data no better than a model with accepted classes. Entropy was calculated to evaluate how accurately respondents were classified (Ramaswamy, DeSarbo, Reibstein, & Robinson, 1993). Entropy values can range from 0 to 1 with higher values indicating better classification.

Individuals were assigned to a latent class based on the highest posterior probability of class membership or modal frequency classification (Vermunt & Magidson, 2002). We used multinomial logistic regression to examine the association between class membership and sex, age (categorized as children ages 5-12 years vs. adolescents ages 13-18 years), and number of different types of traumatic events experienced. In the regression models, the total number of reported traumas was modeled using the square root to account for the non-normal distribution. Class membership was the dependent variable and sex, age and number of traumas were entered as independent variables in separate models.

LCA models were carried out with Mplus 5.21 (Muthen & Muthen, 2004) and odds ratios (OR) were generated from logistic regressions using STATA 12 (College Station, TX: StataCorp LP, 2010).

Results

Sample Description

Data from 343 children and adolescents from CRS palliative care program in Lusaka (N=186, 54.2%) and Kabwe (N=157, 45.8%) were analyzed. Mean age was 11.9 years (SD= 3.22), females comprising 53.1% (180) of the sample.

The mean number of different types of traumas reported in the sample was 4.17 (SD= 2.3), and with similar frequency across sex, except for “*Being in an accident*”, which was significantly higher in males (63.6%) compared to females (36.4%) ($p=0.016$). Twelve different types of traumatic experiences were recorded in the assessment. Almost all children interviewed had reported at least one type of trauma (99.7%), while 233 (69.5%) children noted 6 or more. Sixty-five (19.6%) children reportedly stopped going to school due to a trauma experienced.

The average number of trauma-related symptoms reported was 15.9 (range 0-38), without significant differences between males and females (15.9 vs. 15.6, respectively; $p=0.487$). The most frequently reported symptoms were: When something reminds me what happened I get very upset, sad or afraid (67.6%), *I am afraid that the bad thing will happen again* (60.1%), and When something reminds me of what happened, I have strong feelings in my body like my heart beats fast, my head aches, or my stomach aches (58%) (Figure 1).

For the total sample, the mean PTSD-RI score was 49.6 (SD= 28.6) with no significant differences noted by sex (males: 51.3, females: 47.8; $p=0.44$). Using the locally validated cut-off score of 39 for the PTSD-RI, 202 children (58.9%) were considered as PTSD cases and referred for mental health treatment. The average number of symptoms reported by children with a PTSD-RI score less than 39 points was 13.3, while those above 39 points reported an average of 27.6 symptoms.

Latent class analysis

Based on the fit criteria, the 3-class solution was considered the best model. The BIC is lower for the 3-class (14959.75) solution compared with the 2- (15273.20), 4- (15007.72), and 5-class solutions (15086.45), and the LMR LRT indicates that the 4-class solution is not significantly better than the 3-class ($p=0.39$) (signaling that the 3-class should be preferred based on parsimony). The AIC and SSABIC fit statistics for the 3-class (AIC= 14514.57; SSABIC= 14591.77) are higher than for the 4-class (AIC= 14412.88; SSABIC= 14516.03) although this difference is small. The entropy for the 3-class (0.93) indicates an excellent classification of individuals, which we verified visually by plotting posterior probabilities of class membership over the most likely class (results available upon request).

This 3-class solution resulted in a dimensional representation of trauma-symptoms. The conditional probabilities of symptoms for this solution, interpreted as the percentage of class

members reporting each symptom are presented in Table 2. Class-1 individuals showed a relatively low probability of experiencing all the items, so it was considered as a low symptomatology group (N=106, 31%). Class-2 was the largest class (N=155 individuals, 45%) and was characterized by a 50% probability of experiencing any of the items. Class-3 was the smallest class (N=82, 24%) and was characterized by high probability of experiencing of each symptom (Figure 2).

Each symptom's prevalence increased progressively from class-1 to class-3 resulting in dimensionally different, rather than categorically different, classes (Table 2). Class-1 members had almost 6 symptoms, on average, while Class-2 and Class-3 had 16 and 29, respectively. Overall, the most prevalent symptom across classes was “*Something reminds me and I get upset*” (with a conditional probability of 0.36, 0.75 and 0.94, through classes 1, 2, and 3 respectively). The most frequent type of PTSD symptoms reported across all classes corresponded to the DSM-defined clusters of increased arousal and re-experiencing, representing approximately 30% of all symptoms endorsed for that class.

Fit indices of LCA applied separately by sex suggest that the 3-class model was the best solution for males compared with a 2- (p=0.01) and a 4- (p=0.67) class solution. In females, improved fit statistics were obtained for a 4-class (AIC= 6986.12; BIC=7465.65; SSABIC=6974.94) compared to a 3-class (AIC= 7047.50; BIC= 7406.37; SSABIC= 7039.13) solution. However, the LMR LRT comparing these two solutions was non-significant (p=0.67). Overall, analyses of the sample by age group were also in support of a 3-class model. For young children, the LMR LRT was significant comparing the 3- with a 2-class (p=0.01) but did not support a 4-class (p=0.57). In adolescents, the 3-class model was sustained by the LMR LRT compared to 2- (p=0.001) and 4-class (p=0.83) solutions (Table 3).

The probability of reporting a symptom in these subpopulations by sex and age increased from one class to the next and the most prevalent class was the moderate severity class (or class-2), representing 35% and 45% of individuals, respectively.

Associations between latent class membership and sex, age, and number of traumas reported

Using the low severity class as the reference class, there were no significant effects of sex on class membership (OR= 1.1, 95%CI=.65-1.8 and OR=.94, 95%CI=.52-1.7 for class 2 and 3, respectively). Adolescents had a slightly higher likelihood of being in the high severity class than in the low severity class when compared to younger children (OR=1.1, 95%CI .62-2.1), but results did not reach statistical significance (p=0.68).

In the regression models, total number of traumas was not a significant predictor of class membership ($\chi^2=0.69$). Each individual trauma was assessed as a potential correlate of class membership. Of the 12 traumatic experiences, 7 were more likely to have been reported in either class-2 or class-3 when compared to class-1, although not reaching statistical significance.

Discussion

Despite the majority of children around the world exposed to armed conflict and adversity living in low and middle-income countries, empirical research on the structure and characteristics of traumatic stress symptoms is limited (Benjet, 2010). This study is among few to provide a detailed account of PTSD symptoms in a sample of OVC targeted by a local NGO (Bryant et al., 2012; Martin, Remington, Seedat, 2012). Child assessment for this study was carried out using a locally validated measure (PTSD-RI) including trauma-related cultural symptoms and covering a range of potential traumatic exposures. Results from this investigation indicate that traumatic stress symptomatology is prevalent among OVC from urban communities in Zambia; we found an average PTSD-RI score of 49.6 and using the validated cut-off score for caseness established at 39 points (Murray et al., 2011), this translates into 58.9% (N=202) of the sample.

Findings from LCA are in support of a continuous conceptualization of PTSD symptoms. The probability of symptom experience increased monotonically across the classes with no evidence of specific types of symptoms occurring in a given class. Although previous reports by Breslau and colleagues (Breslau et al., 2005) and Bal and Jensen (Bal & Jensen, 2007) have reported similar 3-class PTSD structures, our results contrast with theirs because we found no evidence of specific profiles of symptoms occurring preferentially in a specific class. The dimensional conceptualization of PTSD as a continuous construct is supported by epidemiological studies, highlighting that while traumatic events are common through lifetime, the majority of individuals will display symptoms that fall within a range of distress reactions of varying severity (Pynoos et al., 1993; Saul et al., 2008). In line with this thinking, one possible explanation for the differential configuration in PTSD symptoms is the addition of the cultural items to the PTSD-RI. This extended list of symptoms might be representative of a more local expression of trauma-related psychopathology, reinforcing the importance of culturally adapting measures.

Another possibility involves the relative saliency of PTSD clusters across cultural groups, where the avoidance/numbing items, in particular, were the least consistent across cultural settings (de Jong et al, 2001). Comparably, avoidance and numbing items were the least experienced symptoms in our sample. Variability in the presentation of symptom clusters can have diagnostic implications. If the items in an assessment tool do not fully capture local expressions of psychopathology, under- or over-reporting of symptoms can ensue. Implications for therapy can also be meaningful. Modular types of psychotherapy that focus on a set of symptoms have shown positive results for the treatment of depression, anxiety, and behavior problems in youth (Weisz et al., 2012), representing a form of tailored treatment that can build upon the characterization of trauma symptoms in a given setting.

The mean number of types of traumas reported here (4.17) was two times what we found in our previous validation study (2.09) (removed identifier) using a similar sample of OVC. Although these should be interpreted taking into account the fact that this is a targeted OVC sample of youth and estimates might represent the upper-bound limit, the fact that we found higher rates of PTSD symptoms as those reported previously suggests that traumatic stress

symptoms continue to be a relevant issue in OVC from urban centers in developing countries like Zambia.

Unlike prior studies in adults (Asmundson et al., 2000) and adolescents (Anthony et al., 2005) that consistently report females more likely than males to meet PTSD criteria, in our sample sex was not a significant predictor of latent class membership or rates of symptom experience. In a working class community-based sample of adolescents from the US, Giaconia et al (Giaconia et al., 1995) found equal rates of traumatic events and risk of PTSD development between males and females, suggesting that exposure to traumatic events can be widespread among certain communities and that sex may not be an important predictor.

In contrast with other studies (Bal & Jensen, 2007; Pynoos et al., 1993), age categorized by child/adolescent (and age as continuous, data not shown) was not a significant correlate of latent class. However, in the LCA models of females and adolescents separately, we found a better fit for a 4-class model compared to the 3-class model. This might be due to subtle qualitative differences of age and sex in symptom reporting patterns. Overall, the current literature is limited regarding the applicability of distress models to youth of different developmental stages, and thus warrants further research.

Correlates of PTSD-related symptoms in this sample of Zambian youth could be different from those described in the predominantly Western-trauma literature for several reasons. While community and interpersonal violence are problematic in Zambia, other important sources of psychological distress are also present. The vast majority of children and adolescents included in this study live in communities characterized by poverty, substance abuse, and lack of basic services. These circumstances may foster and sustain chronic stress, forcing individuals from the community to live in conditions of deprivation, fear, hate, and helplessness. Studies from African and Middle-Eastern countries suggest that factors such as poverty, forced displacements, serious accidents, and painful illnesses without medical care can be significant stressors associated with the development of PTSD symptoms (Operario, Cluver, & Gardner, 2009; Panter-Brick, Eggerman, Gonzalez, & Safdar, 2009). We did not collect data on additional potential risk/resiliency factors that may be associated with class membership, reducing our ability to elaborate hypothesis in this matter with the present study and that should be an aim of future research.

This study has several limitations. First, we used a purposive sample of children and adolescents participating in a CRS program directed at OVC. Our sample cannot be assumed to be representative of the population of Zambia and the characteristics of OVC might not be similar to other low-resource contexts, restricting the generalizability of our results. However, program evaluation and research in OVC populations should remain a critical area of appraisal, given the associated risks and health needs (Benjet, 2010; Cluver & Gardner, 2007; Operario et al., 2009). Another limitation relates to using LCA in a relatively small (N=343) sample. We attempted to address the possible instability of the model by running LCA in subgroups of the sample (e.g. by sex and age categories) and obtained similar solutions. However, LCA is an exploratory procedure for characterizing heterogeneity in symptom profiles using categorical latent variables. Results presented here are not intended to be an exhaustive characterization of traumatic stress in Zambian youth. Rather, we aim to

provide valuable insight into the PTSD symptom structure of OVC that can inform programs seeking to integrate mental health to their package of services.

Despite these limitations, results reported in this paper are important in several ways. We used a locally validated measure of PTSD that included an expanded list of symptoms, reflecting the local symptoms related to trauma. In a context of community trauma, we found differences in the severity of PTSD symptoms across subgroups with otherwise generally comparable demographic correlates and symptom profiles. Overall, results suggest that PTSD symptoms in OVC from these urban centers in Zambia, exposed to multiple and ongoing trauma, are probably shaped by cultural and contextual factors that would benefit from interventions that move beyond a categorical conceptualization of PTSD.

Conclusions

Symptom characterization and structure based on locally validated approaches to symptom measurement can allow for stronger evidence-based assessments of mental health issues in cross-cultural settings. The current study suggests that PTSD can be conceptualized on a continuous dimensional basis in this sample of OVC that does not vary qualitatively in particular subgroups, strongly arguing in favor of using diagnostic measures with locally validated cut-off points to determine treatment needs.

Acknowledgments

The authors wish to thank the partners working with CRS-Zambia and all the families that participated in this study. Grant support: The National Institute of Mental Health grant K23MH77532 to Dr. Murray funded this study.

References

- Akaike H. Factor analysis and AIC. *Psychometrika*. 1987; 52(3):317–332.
- American Psychiatric Association. Diagnostic and statistical manual of mental disorders IV. 4th ed.. American Psychiatric Association; Washington DC: 2000.
- Andrews G, Skinner D, Zuma K. Epidemiology of health and vulnerability among children orphaned and made vulnerable by HIV/AIDS in sub-Saharan Africa. *AIDS Care*. 2006; 18(3):269–276. [PubMed: 16546789]
- Anthony JL, Lonigan CJ, Vernberg EM, Greca AML, Silverman WK, Prinstein MJ. Multisample cross - validation of a model of childhood posttraumatic stress disorder symptomatology. *Journal of Traumatic Stress*. 2005; 18(6):667–676. [PubMed: 16382435]
- Asmundson GJG, Frombach I, McQuaid J, Pedrelli P, Lenox R, Stein MB. Dimensionality of posttraumatic stress symptoms: A confirmatory factor analysis of DSM-IV symptom clusters and other symptom models. *Behaviour Research and Therapy*. 2000; 38(2):203–214. [PubMed: 10661004]
- Bal A, Jensen B. Post-traumatic stress disorder symptom clusters in Turkish child and adolescent trauma survivors. *European Child & Adolescent Psychiatry*. 2007; 16(7):449–457. [PubMed: 17876513]
- Benjet C. Childhood adversities of populations living in low-income countries: Prevalence, characteristics, and mental health consequences. *Current Opinion in Psychiatry*. 2010; 23(4):356–362. [PubMed: 20520546]
- Breslau N, Reboassin BA, Anthony JC, Storr CL. The structure of posttraumatic stress disorder: Latent class analysis in 2 community samples. *Archives of General Psychiatry*. 2005; 62(12):1343–1351. [PubMed: 16330722]

- Burrows, E.; Jere, E.; Murray, LK. Catholic Relief Services (Ed.), Promising practices III: HIV and AIDS integrated programming. Catholic Relief Services; Baltimore, MD: 2011. Trauma-focused cognitive behavioral therapy. pilot project..
- Bryant M, Beard M, Sabin L, Brooks MI, Scott N, Larson BA, et al. PEPFAR's support for orphans and vulnerable children: Some beneficial effects, but too little data, and programs spread thin. *Health Affairs*. 2012; 31(7):1508–1518. [PubMed: 22778340]
- Cluver L, Gardner F. The mental health of children orphaned by AIDS: A review of international and southern African research. *Journal of Child & Adolescent Mental Health*. 2007; 19(1):1–17.
- Stata statistical software: Release 11. StataCorp LP; College Station, TX: 2010.
- Cronbach LJ. Coefficient alpha and the internal structure of tests. *Psychometrika*. 1951; 16(3):297–334.
- de Jong JT, Komproe IH, Van Ommeren M, El Masri M, Araya M, Khaled N, et al. Lifetime events and posttraumatic stress disorder in 4 postconflict settings. *JAMA : The Journal of the American Medical Association*. 2001; 286(5):555–562.
- Fairbank JA, Fairbank DW. Epidemiology of child traumatic stress. *Current Psychiatry Reports*. 2009; 11(4):289–295. [PubMed: 19635237]
- Frederick C, Pynoos R, Nader K. Child post traumatic stress disorder reaction index (CPTS-RI). Available from Robert Pynoos, MD, Trauma Psychiatry Service. UCLA. 1992; 300:90024–96968.
- Giaconia RM, Reinherz HZ, Silverman AB, Pakiz B, Frost AK, Cohen E. Traumas and posttraumatic stress disorder in a community population of older adolescents. *Journal of the American Academy of Child and Adolescent Psychiatry*. 1995; 34(10):1369–1380. [PubMed: 7592275]
- Laor N, Wolmer L, Kora M, Yucel D, Spirman S, Yazgan Y. Posttraumatic, dissociative and grief symptoms in Turkish children exposed to the 1999 earthquakes. *The Journal of Nervous and Mental Disease*. 2002; 190(12):824. [PubMed: 12486370]
- Layne CM, Pynoos RS, Saltzman WR, Arslanagi B, Black M, Savjak N, et al. Trauma/grief-focused group psychotherapy: School-based postwar intervention with traumatized Bosnian adolescents. *Group Dynamics: Theory, Research, and Practice*. 2001; 5(4):277.
- Lo Y, Mendell NR, Rubin DB. Testing the number of components in a normal mixture. *Biometrika*. 2001; 88(3):767.
- Martin L, Remington N, Seedat S. The 39-item child exposure to community violence (CECV) scale: exploratory factor analysis and relationship to PTSD symptomatology in trauma-exposed children and adolescents. *International Journal of Behavioral Medicine*. 2012 [Epub ahead of print].
- Murray LK, Bass J, Chomba E, Imasiku M, Thea D, Semrau K, et al. Validation of the child post traumatic stress disorder-reaction index in Zambia. *International Journal of Mental Health Systems*. 2011; 5(1):24. [PubMed: 21943178]
- Murray LK, Haworth A, Semrau K, Singh M, Aldrovandi GM, Sinkala M, et al. Violence and abuse among HIV-infected women and their children in Zambia: A qualitative study. *The Journal of Nervous and Mental Disease*. 2006; 194(8):610–615. doi:10.1097/01.nmd.0000230662.01953.bc. [PubMed: 16909070]
- Muthen, LK.; Muthen, BO. User's Guide. Muthen & Muthe; Los Angeles CA.: 2004. Mplus: The comprehensive modeling program for applied researchers..
- Operario D, Cluver L, Gardner F. Poverty and psychological health among AIDS-orphaned children in Cape Town, South Africa. *AIDS Care*. 2009; 21(6):732–41. [PubMed: 19806489]
- Panther-Brick C, Eggerman M, Gonzalez V, Safdar S. Violence, suffering, and mental health in Afghanistan: A school-based survey. *Lancet*. 2009; 374(9692):807–816. [PubMed: 19699514]
- Pynoos RS, Goenjian A, Tashjian M, Karakashian M, Manjikian R, Manoukian G, et al. Post-traumatic stress reactions in children after the 1988 Armenian earthquake. *The British Journal of Psychiatry : The Journal of Mental Science*. 1993; 163:239–247. [PubMed: 8075917]
- Ramaswamy V, DeSarbo WS, Reibstein DJ, Robinson WT. An empirical pooling approach for estimating marketing mix elasticities with PIMS data. *Marketing Science*. 1993; 12(1):103–124.
- Saul AL, Grant KE, Carter JS. Post-traumatic reactions in adolescents: How well do the DSM-IV PTSD criteria fit the real life experience of trauma exposed youth? *Journal of Abnormal Child Psychology*. 2008; 36(6):915–925. [PubMed: 18330689]

- Sclove SL. Application of model-selection criteria to some problems in multivariate analysis. *Psychometrika*. 1987; 52(3):333–343.
- Shetty AK, Powell G. Children orphaned by AIDS: A global perspective. *Seminars in Pediatric Infectious Diseases*. 2003; 14(1):25–31. [PubMed: 12748919]
- Vermunt JK, Magidson J. Latent class cluster analysis. *Applied Latent Class Analysis*. 2002:89–106.
- Weisz JR, Chorpita BF, Palinkas LA, Schoenwald SK, Miranda J, Bearman SK, et al. Testing standard and modular designs for psychotherapy treating depression, anxiety, and conduct problems in youth: A randomized effectiveness trial. *Archives of General Psychiatry*. 2012; 69(3):274. [PubMed: 22065252]

Key Practitioner Message

- Zambian youth from our sample represented classes of post-traumatic stress symptoms of varying severity with no evidence of specific types of symptoms occurring in a given class.
- These children may benefit from mental health interventions that address the different needs for support.
- The use of a locally validated version of a traumatic stress diagnostic measure is a valuable model that other researchers could use to move this field forward in other areas of the world.

Figure 1.

Prevalence of the 38 trauma-related symptoms included in the PTSD-R1 among Zambian children and adolescents (N=343)

Figure 2.

Estimated prevalence of posttraumatic stress disorder symptoms for the 3-class model in Zambian youth. The y-axis represents the class specific mean symptom prevalence. The x-axis contains the 38-symptoms of the PTSD-RI scale.

Table 1General characteristics of Zambian children and adolescents sample ($N=343$)

Characteristics	Total N (%)
Sex	
Male	161 (46.9)
Female	182 (53.1)
Age (years)	
5	8 (2.3)
6-11	133 (38.8)
>12	202 (58.9)
Education	
Currently in school	257 (75.2)
Not in school	86 (25.1)

Table 2

Symptom prevalence and conditional probabilities of 343 trauma-exposed children and adolescents from Zambia

SYMPTOM	Symptom prevalence %	Class 1, Conditional Probability (SD)	Class 2, Conditional Probability (SD)	Class 3, Conditional Probability (SD)
I watch out for danger or things that I am afraid of	60.6	0.31 (0.05)	0.71 (0.04)	0.78 (0.05)
When something reminds me what happened I get very upset, sad or afraid	67.6	0.36 (0.05)	0.75 (0.04)	0.94 (0.03)
I have upsetting thoughts, pictures, or sounds of what happened come into my mind when I do not want them to	52.2	0.18 (0.04)	0.63 (0.04)	0.76 (0.05)
I feel grouchy, angry, or mad	43.7	0.18 (0.05)	0.46 (0.04)	0.72 (0.06)
I have dreams of what happened or other bad dreams	48.4	0.19 (0.04)	0.51 (0.04)	0.80 (0.05)
I feel like I am back at the time when the bad thing happened, living through it again	49.3	0.14 (0.04)	0.58 (0.04)	0.79 (0.05)
I feel like staying by myself and not being with my friends	29.4	0.04 (0.02)	0.26 (0.04)	0.70 (0.06)
I feel alone inside and not close to other people	32.1	0.06 (0.03)	0.29 (0.04)	0.71 (0.06)
I try not to talk about, think about, or have feelings of what happened	53.6	0.17 (0.05)	0.61 (0.04)	0.85 (0.04)
I have trouble feeling happiness or love	40.2	0.10 (0.03)	0.39 (0.04)	0.80 (0.05)
I have trouble feeling sadness or anger	40.5	0.05 (0.02)	0.43 (0.04)	0.82 (0.05)
I feel jumpy or startle easily, like when I hear a loud noise or when something surprises me	57.1	0.24 (0.05)	0.68 (0.04)	0.79 (0.05)
I have trouble going to sleep or I wake up often during the night	39.1	0.19 (0.04)	0.34 (0.04)	0.75 (0.05)
I think that some part of what happened is my fault	25.9	0.13 (0.03)	0.22 (0.04)	0.50 (0.06)
I have trouble remembering important parts of what happened	40.8	0.14 (0.04)	0.42 (0.04)	0.74 (0.05)
I have trouble concentrating or paying attention	40.5	0.11 (0.03)	0.42 (0.04)	0.76 (0.05)
I try to stay away from people, places, or things that make me remember what happened	46.4	0.16 (0.04)	0.51 (0.05)	0.77 (0.05)
When something reminds me of what happened, I have strong feelings in my body like my heart beats fast, my head aches, or my stomach aches	58.0	0.24 (0.04)	0.64 (0.04)	0.90 (0.04)
I think that I will not live a long life	39.9	0.07 (0.03)	0.42 (0.04)	0.79 (0.06)
I am afraid that the bad thing will happen again	60.1	0.30 (0.05)	0.66 (0.04)	0.88 (0.04)
I cry *	40.5	0.13 (0.03)	0.39 (0.04)	0.80 (0.05)
I think too much *	53.6	0.09 (0.03)	0.62 (0.04)	0.94 (0.03)
I have stopped going to school because I think I will be laughed at or teased *	16.6	0.05 (0.02)	0.10 (0.03)	0.45 (0.07)
I feel used *	17.8	0.01 (0.01)	0.13 (0.03)	0.48 (0.06)
Do not like myself *	22.4	0.04 (0.02)	0.16 (0.03)	0.59 (0.06)

SYMPTOM	Symptom prevalence %	Class 1, Conditional Probability (SD)	Class 2, Conditional Probability (SD)	Class 3, Conditional Probability (SD)
I am reserved *	32.9	0.11 (0.03)	0.29 (0.04)	0.70 (0.06)
I am damaged psychologically *	27.4	0.04 (0.02)	0.19 (0.03)	0.74 (0.06)
I feel rejected, like everyone is against me *	31.8	0.08 (0.03)	0.22 (0.04)	0.82 (0.05)
I feel shy *	36.2	0.08 (0.03)	0.39 (0.04)	0.67 (0.06)
I sleep too much *	45.2	0.33 (0.05)	0.45 (0.04)	0.62 (0.06)
I do not feel at ease *	44.3	0.10 (0.03)	0.46 (0.04)	0.86 (0.05)
I do not feel free *	41.4	0.12 (0.03)	0.37 (0.04)	0.88 (0.04)
I am surprised *	53.1	0.24 (0.04)	0.57 (0.04)	0.83 (0.04)
I am ever quiet *	41.7	0.12 (0.03)	0.39 (0.04)	0.85 (0.04)
I am unhappy or sad *	46.9	0.17 (0.04)	0.47 (0.05)	0.86 (0.04)
I am nervous *	46.1	0.09 (0.03)	0.51 (0.04)	0.85 (0.05)
I have an unsettled mind, no peace of mind *	41.7	0.03 (0.02)	0.44 (0.04)	0.88 (0.04)
I run if I see the abuser *	28.9	0.09 (0.03)	0.30 (0.04)	0.53 (0.06)
Class prevalence (%)	-	0.31	0.45	0.24
Class count (# of individuals)	-	106	155	82
Average # of symptoms (SD)	21.6 (9.33)	5.48 (0.73)	16.49 (0.85)	28.79 (0.67)

* Locally specific items added to the PTSD-RI

Table 3

Fit indices for the latent class analyses of the Zambian-PTSD items

Full sample (n=343)	AIC	BIC	SSABIC	Lo Mendell Rubin LRT (<i>p</i>)	Entropy
2 class	14978.00	15273.5	15029.24	2131.45 (<0.0001)	0.94
3 class	14514.57	14959.75	14591.77	539.06 (<0.0001)	0.93
4 class	14412.88	15007.72	14516.03	178.80 (0.39)	0.95
5 class	14341.93	15086.45	14471.03	148.30 (0.77)	0.91
Females (n=163)					
2 class	7209.13	7447.35	7203.58	977.82 (<0.0001)	0.95
3 class	7047.50	7406.37	7039.13	238.43 (0.77)	0.93
4 class	6986.12	7465.65	6974.94	138.68 (0.67)	0.94
5 class	6966.30	7566.49	6952.31	92.83 (0.77)	0.94
Males (n=184)					
2 class	8054.04	8301.59	8057.71	1230.82 (0.01)	0.93
3 class	7780.57	8153.50	7786.10	349.75 (0.06)	0.96
4 class	7758.07	8256.38	7765.46	99.92 (0.75)	0.94
5 class	7723.50	8347.20	7732.75	100.89 (0.77)	0.94
Young children (n=192)					
2 class	8250.14	8500.97	8257.06	1239.45 (<0.0001)	0.94
3 class	7989.19	8367.06	7999.61	337.30 (0.01)	0.96
4 class	7968.54	8473.46	7982.46	97.90 (0.57)	0.97
Adolescents (n=167)					
2 class	7426.27	7666.36	7422.56	1035.72 (0.001)	0.93
3 class	7217.40	7579.09	7211.82	285.44 (0.06)	0.95
4 class	7208.92	7692.21	7201.46	86.05 (0.83)	0.94