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Title of the paper: Psychometric properties of the Children's Revised Impact of Events Scale (CRIES) with Bangladeshi children and adolescents

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Abstract

Identification of possible cases suffering post-traumatic stress disorder (PTSD) is important, especially in developing countries where traumatic events are typically prevalent. The Children's Revised Impact of Events Scale is a reliable and valid measure that has two brief versions (13 items and 8 items) to assess reactions to traumatic events among young people. The current study evaluated the psychometric properties of both versions of the CRIES in a sample of 1342 children and adolescents aged 9-17 years (*M*=12.3 years, *SD*=2.12) recruited from six districts of Bangladesh. A sub-group of 135 children from four schools was re-tested on the measures within 3.5 weeks. Confirmatory factor analysis supported factor structures similar to those found in other studies for both versions of the CRIES. Multiple group confirmatory factor analysis showed gender and age-group differences within the sample, supporting established age and gender differences in prevalence of PTSD symptoms. Analyses also indicated moderate to excellent internal consistency and test-retest reliability and clear discriminant and convergent validity. These data support use of both the CRIES-13 and CRIES-8 to provide quick and psychometrically sound assessment of symptoms of PTSD among children and adolescents from Bangla-speaking communities.

Keywords: Trauma; assessment; post-traumatic stress; children; Bangla; Bangladesh

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Introduction

In the aftermath of exposure to traumatic events, about 70% of children develop symptoms of Post-Traumatic Stress Disorder (PTSD) within the first month after the incident (Aaron, Zaglul, & Emery, 1999) and almost 20-30% will meet full diagnostic criteria for PTSD within the first 12 months (Atle Dyregrov & Yule, 2006; Schnurr et al., 2007). When children with PTSD are left untreated, the disorder can persist for years limiting their psychosocial functionality and increasing risk for other disorders (Bolton, O'Ryan, Udwin, Boyle, & Yule, 2000; Weber et al., 2008; Yule et al., 2000). Trauma can also produce marked neurobiological consequences and impaired cognitive development that can reduce academic and social performance in a young person's life (Teicher et al., 2003; Yasik, Saigh, Oberfield, & Halamandaris, 2007). In the long run, the impact on individual levels of productivity across the life-span increases burden on the whole society. To help reduce this long-term impact, early identification of post-traumatic stress reactions is very important (Cohen et al., 2010).

Unfortunately traumatic events are more common in the lives of children from developing or low and middle income countries than those of developed countries creating a greater vulnerability to mental health problems (Matzopoulos, Bowman, Butchart, & Mercy, 2008; Patel & Kleinman, 2003; Whetten, 2011). Despite the frequency of traumatic events in developing countries, a lack of standard assessment and screening tools to identify young people suffering distress is a common problem that limits the efficiency of service delivery. Direct interviews and more importantly, structured diagnostic interviews require resources that are simply not available in most developing countries, especially following large-scale traumas (e.g. Ahmed, Hossain, RajaChowdhury, & Bhuiya, 2011; Rousham, 1996). Therefore, increased availability of free and well validated measures that have been translated and evaluated in developing countries, is vitally important.

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Bangladesh is one developing country where children's lives are continually affected by a variety of traumatic events. The range of traumatic events includes natural traumas, accidents, and man-made traumas. Bangladesh is well known to the rest of the world for its frequent natural disasters and has been identified as the country with the highest number of natural disasters in the world (Government of the People's Republic of Bangladesh, 2008). Young people are typically most severely affected by natural disasters through death, disability, loss of family, and displacement. A large number of subsequent problems add to the vulnerability of children including, neglect, abuse, human trafficking, or loss of education (UNICEF, 2008). In addition to frequent natural traumas, large numbers of children in Bangladesh are traumatised each year due to a variety of accidents (Linnan et al., 2007). More than 82 children die every day in Bangladesh as a result of unintentional traumatic injury, one of the highest rates in the world (Rahman, 2005). Many young people also face a range of man-made traumatic events, including trafficking (Ali, 2005), rape (Al-Azad et al., 2012), acid attack (Zafreen, Wahab, Islam, & Rahman, 2010) and many other serious forms of violence (UNICEF, 2012).

Despite mounting recognition of the quantity of traumatic events in the lives of young Bangladeshi people which point to the need for both physical and mental health support, there are few reliable data in the country regarding childhood post-traumatic stress reactions. In one large-scale survey, children showed higher levels of aggression and enuresis following a major flood compared to levels before the flood (Durkin, Khan, Davidson, Zaman, & Stein, 1993). Similarly, high levels of traumatic reactions were reported following a tornado (13 May 1996) where among 150 victims (both adult and children), 66% were found to be psychologically traumatized (Choudhury, Quraishi, & Haque, 2006).

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Given the high frequency of trauma in the country and the particular vulnerability of children, it is highly likely that a significant proportion of Bangladeshi children will suffer post-traumatic stress reactions. Yet no formal reports are currently available that quantify levels of traumas in the country. This gap in knowledge partly reflects the decreased importance given by policy makers and the public to mental health issues, combined with a lack of resources to address these problems. Being able to quantify psychological reactions to trauma through the use of brief, valid and easily administered self-report measures would assist in redressing this situation (Ohan, Myers, & Collett, 2002). Availability of such measures will not only be useful for epidemiological surveys, but would also be of value for clinical practice or research.

Well-developed self-report screening tools to assess children's psychological symptoms require several key characteristics. Such tools need to be brief to ensure that they can be quickly completed with minimum disruption to the individual (Brewin et al., 2002; Stallard, Velleman, & Baldwin, 1999) and items need to be easily understood by children (Yule, 1992). Within communities with few resources, it is also important that instruments are easily administered and able to be scored by non-professionals (Brewin et al., 2002). Several widely used measures of post-trauma reactions among children fail to meet all of these criteria. Among the measures of childhood PTSD, the Children's Revised Impact of Events Scale (CRIES; Children and War, 2005) fulfils the criteria for good screening instruments and has been used across a large number of countries and cultures (both Western and Eastern). This measure has been translated into more than 15 languages and has been used in a number of countries following various large and small scale disasters. Examples include its use with children and adolescents affected by war in Bosnia-Hercegovina (Smith, Perrin, Yule, & Rabe-Hesketh, 2001), by earthquakes in Greece (Giannopoulou, Strouthos, et al., 2006) and China (Zhao et al., 2009), tsunami in Sri-Lanka

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(Ketumarn et al., 2009), and also following road–traffic accidents or other emergency medical injuries in the UK (Perrin, Meiser-Stedman, & Smith, 2005) and Australia (Kenardy, Spence, & Macleod, 2006). The CRIES has shown good reliability, satisfactory face and construct validity, a stable factor structure, and has been used to screen large samples of at-risk children following a wide range of traumatic events (Smith, Perrin, Dyregrov, & Yule, 2003). Particular advantages of the CRIES include its brevity, simple scoring that requires minimal training, clear adherence to PTSD diagnostic criteria in the DSM, and it can be used even with children as young as five (e.g. Uemoto, Asakawa, Takamiya, Asakawa, & Inui, 2012). Above all, the CRIES is a free resource that is made available through the website of the Children and War Foundation, a Norwegian-based non-profit organisation.

Although the original 15-item CRIES (Malmquist, 1986; Yule & William, 1990) was designed to cover the three components of PTSD, avoidance, arousal, and emotional numbing, confirmatory factor analyses failed to support a three-factor structure. Several studies found that most items loaded onto two factors (avoidance and arousal), and several items did not load on either factor or on more than three factors (Dyregrov, Kuterovac, & Barath, 1996; Sack, Seeley, Him, & Clarke, 1998; Yule, Bruggencate, & Joseph, 1994). In response, Yule (1997) removed seven items from the original scale and developed a short, eight-item version, the CRIES-8 comprised of the two factors, avoidance and arousal. Finally, to better reflect DSM-defined PTSD symptoms (American Psychiatric Association, APA, 2000), five additional items were added to the CRIES-8 to represent the third cluster of PTSD symptoms, arousal (Perrin et al., 2005; Smith et al., 2003). These additional items completed the CRIES-13 and the three sub-scales were labelled Intrusion, Avoidance and Arousal (Children and War Foundation, 2005).

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The factor structure of the CRIES-13 across several studies has been slightly inconsistent, variously showing a two-factor structure (intrusion and arousal vs avoidance) (Chen, Zhang, Liu, Liu, and Dyregrov, 2012) , three distinct but inter-correlated factors (Zhang, Zhang, Wu, Zhu, and Dyregrov, 2011) , and a three-factor structure loading onto a single higher order factor (Giannopoulou, Smith, et al. 2006). Nonetheless, psychometric properties for both the CRIES-8 and CRIES-13 have been solid. Internal consistencies range from .75-.87 for the total CRIES-13, .75-.84 for the total CRIES-8 and for the three subscales; Intrusion: .70-.90; Avoidance: .62-.82 and Arousal .60-.74 (Dyregrov et al., 1996; Giannopoulou, Smith, et al., 2006; J. T. Lau et al., 2013; Smith et al., 2003; van der Kooij et al., 2013; Yule et al., 1994; Zhang et al., 2011). Test retest reliability up to 6 months is good for the total CRIES-13 (*r's*=.70-.80) (Greenwald, Satin, Azubuike, Borgen, and Rubin, 2001; Panter-Brick, Goodman, Tol, & Eggerman, 2011; van der Kooij et al., 2013), but is less acceptable for the subscales; Intrusion r=.58, p<.01; Avoidance: r=.68, p<.01 and Arousal: r=.53, p<.01(van der Kooij et al. (2013).

Validity for both the CRIES-8 and CRIES-13 has also proven satisfactory (Perrin et al., 2005). For instance, children experiencing symptoms of PTSD have been shown to score higher on the CRIES-8 than children without PTSD (Stallard et al., 1999). Similarly, in a large sample of children affected by war (N=2976) in Bosnia-Hercegovina, scores on the CRIES-13 and all subscales showed small positive correlations (r=.05-.36) with self-reported level of traumatic event exposure, and depression (Smith, Perrin, Yule, Hacam, & Stuvland, 2002) and also with ratings of children's distress from parents and teachers and with mothers' levels of trauma exposure and distress (Smith et al., 2001).

Both versions of the CRIES have shown good utility when used as screening tools for children exposed to traumatic events (Dow, Kenardy, Le Brocque, & Long, 2012; Perrin et al., 2005). A cut-off score of 17 on the CRIES-8 and a cut-off score of 30 on the CRIES-

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13 were found to produce the best balance between sensitivity (.94 and .91) and specificity (.59 and .65) to identify PTSD in a group of children referred for assessment, and sensitivity (1.0 and .86) and specificity (.71 and .73) to identify PTSD in a group of children assessed in a hospital accident and emergency department (Perrin et al., 2005).

Although symptoms of PTSD and post-traumatic reactions have been argued to be universally consistent (Giannopoulou, Smith, et al., 2006), it remains possible that different language and cultural groups will demonstrate differences in perceptions and reactions to a given event (e.g. Anthony & Michael, 2004). Given the importance of having a brief and inexpensive instrument to assess post-traumatic reactions among young people in Bangladesh, the present study aimed to establish the psychometric properties of the CRIES-8 and CRIES-13 among a large sample of children and adolescents from Bangladesh.

Methods

Participants:

A total of 1342 children and adolescents from a larger sample of 1383 participants for a different study (XXX) for which children reported 90% or more of the items on the CRIES-13 were included in the current sample (Boys=467, 34.68% and Girls=875, 65.32%). Children were recruited from 10 schools (primary, secondary and high) and 39 social support centres for children with traumatic experiences, across rural and urban (slum and non-slum) areas from the six districts of Bangladesh. The staff within the various organizations selected the children if they believed that the child did not suffer psychosis or attention deficit hyperactivity, and had no major vision, hearing or intellectual problems. The age range of the sample was 9-17 years (mean age=12.3 years, *SD*=2.12). There were 756 (56.32%) children aged 9-12 years and 586 (43.66%) adolescents aged 13-17 years.

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Children who were recruited from schools comprised a group of community children (N=562, 41.88%) while those who were collected through support centres run by government and non-government organizations constituted an "at-risk" group (N=780, 58.12%). Most of the latter group had experienced at-least one serious traumatic event in their life. Children from the social support centres mostly lived in slum areas or shelter homes. Participation from children in social support centres (90%) was higher than among children from the community group (75%). Most of the children were students only (53%) while a substantial minority were engaged in both education and work (15%), or work only (5%). The remainder were doing neither of these or did not report.

A subsample of 120 children (Boys= 49, 40.83%) from four schools in Dhaka completed the same measures 3-4 weeks (average 3.5 weeks) following initial assessment. Their mean age was 12.92 years (*SD*=1.96).

Measures:

Children's Revised Impact of Events Scale-13 (CRIES-13)

CRIES-13 (Children and War Foundation, 2005) as mentioned earlier the CRIES-8 and CRIES-13 share the same eight items that constitute two subscales, Intrusion and Avoidance and the CRIES-13 includes an additional five items that comprise a third sub-scale, Arousal. Items are scored on a non-linear scale as follows: 0 (not at all), 1 (rarely), 3 (sometimes) and 5 (often). Scores range from 0-40 for the CRIES-8 and 0- 65 for the CRIES-13, and higher scores indicate more PTSD symptoms. Psychometric properties have been described in the introduction to this paper.

Spence Children's Anxiety Scale - 20 (SCAS-20)

SCAS-20 (S. H. Spence, personal communication, July 26, 2010) is a simple, brief self-report questionnaire to assess symptoms of anxiety. The SCAS-20 is a short form of the

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more commonly used 38-item SCAS (Spence, 1997). Items are rated on a 4-point Likert-type scale as 0 (never), 1 (sometimes), 2 (often) and 3 (always) and summed to obtain a total score where higher scores indicate higher levels of anxiety. Items for the short version were selected from factor analyses of the full version (Spence, 1998; Muris, 2000; Spence, Barrett & Turner, 2003; Murris, 2003). Although the psychometric properties of the short version have not yet been published, an unpublished evaluation of the SCAS-20 demonstrated strong overall reliability of .89 (Coysh, 2011). The psychometric properties of the SCAS-20 among a group of Bangladeshi children and adolescents showed good internal consistency (Cronbach's alpha .84) and satisfactory construct validity for the scale (Deeba, Rapee, & Prvan, 2014).

Short Moods and Feelings Questionnaire (SMFQ)

SMFQ (Angold et al., 1995) was developed to identify DSM-IV-based signs and symptoms of depressive disorders in children and adolescents aged 6-17 years. The scale is scored on a 3- point Likert-type response scale 0 (Never); 1 (Sometimes true) and 2 (Always true). The total score is the sum of all items providing possible scores ranging from 0 to 26 with higher scores reflecting lower mood and risk of clinical level depression. The SMFQ has been shown to comprise a single factor and has good criterion-related validity and discriminant validity to identify clinical levels of depression in children and adolescents (Angold et al., 1995; Thapar & McGuffin, 1998; Rhew, Simpson, et al., 2010). Cronbach's alpha for the SMFQ has been reported ranging from .87 to .90 (Angold et al., 1995). For the Bangladeshi children and adolescents, Cronbach's alpha was strong at .80 (Deeba, Rapee and Prvan, 2014).

Translation of measures

Standard guidelines accepted for the successful translation of instruments for research purposes (e.g. (Brislin, 1986) were used. The bilingual investigator translated the English

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version of the CRIES to Bangla. Then another bilingual professional psychologist not associated with the measure translated it back from Bangla to English. Back translation was checked by the second author of the study, who is a native English speaker. Differences in the two versions were resolved by the joint agreement of both translators.

Procedure:

Ethical issues in the study were reviewed and approval granted by the XXX Human Research Ethics Committee. Written permission was sought from every institution and organization where the study was to be conducted. Individual consent was collected for each child from their parents or caregivers and children provided assent, before all assessment tasks. Issues of voluntary participation, freedom to respond independently, confidentiality and seeking clarification during assessment were discussed with the children at the beginning of the assessment sessions. Assessments were conducted at a time decided by the organisation, in groups of up to 30 children unless children were aged less than 12 years or were illiterate. In such cases the maximum number of children in the assessment group was 10 and items were read aloud by the researcher [along with items for another study, see XXX]. A psychology post-graduate research student was recruited to assist the first author to conduct assessment sessions. The assistant was trained in administering the measures and the ethical issues involved with assessment. The test-retest reliability of the measure was checked after 3.5 weeks following the same procedure stated above with 135 school children from four schools in the capital city.

Statistical Analysis

All analyses were conducted using SPSS V.21 and its extension AMOS V.21. Missing data were handled by the Person Mean Substitution method (PMS, (Downey & King, 1998) due to the non-linear scoring of the items. Confirmatory Factor Analysis (CFA) with the 13-item CRIES compared three different measurement models based on previous studies (e.g.

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224 Giannopoulou, Smith, et al., 2006; Smith et al., 2003; Zhang et al., 2011). The models were:
225 Model 1- single-factor (PTSD) model, Model 2- two inter-correlated latent factors, [(i)
226 intrusion/arousal and (ii) avoidance], Model 3 - three inter-correlated latent factors [(i)
227 intrusion (ii) avoidance and (iii) arousal] and Model 4 - three latent factors [(i) intrusion (ii)
228 avoidance and (iii) arousal] loading onto a single higher-order factor (PTSD). We did not
229 run a separate CFA for the CRIES-8 since the items and subscales are embedded in the
230 CRIES-13.

231 Maximum Likelihood (ML; Byrne, 2010) tests were used on the whole sample
232 (N=1342) for model identification, and then two separate multiple group confirmatory
233 factor analyses (MCFA) were run on the best fitting model to evaluate model invariance
234 between gender and age-groups (younger/older) by group affiliation (community and at-
235 risk) following Byrne (2004). Standardized parameter estimates are reported. Model fit
236 statistics in the present study were selected from suggestions by Jackson, Gillaspy, and
237 Purc-Stephenson (2009) and cut-offs for model fit indices were selected as per Kline (2005)
238 and Worthington and Whittaker (2006) as best for clinical measures. These included the
239 goodness-of-fit index (GFI), for which values greater than .90 are acceptable (Hu & Bentler,
240 1999), the comparative fit index (CFI), and the Tucker-Lewis index (TLI) where values
241 equal to or greater than .90 are considered a good fit (Dumenci & Achenbach, 2008). To
242 observe differences between observed and predicted covariances, the Root Mean Square
243 Error of Approximation (RMSEA) was chosen. RMSEA values less than .06 (Hu & Bentler,
244 1999) or .08 (Dumenci & Achenbach, 2008) have been proposed as indicating a good–
245 fitting model, though RMSEA values of .06-.08 are often reported as acceptable or
246 reasonable rather than good (Kline, 2005; McDonald & Ho, 2002). To determine the
247 optimal and most parsimonious model, the Akaike Information Criterion (AIC, Akaike,
248 1973) and Bayes Information Criterion (BIC; Scwarz, 1978) were checked as per

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suggestions by Bozdogan (1987) that lower values indicate better fit. Factor loadings on items found not to be invariant across groups in MCFA were reported.

Reliability of the measures was evaluated by examining both internal consistency and test-retest reliability. Convergent validity was determined by calculating Pearson's product moment correlation coefficients between the CRIES, SCAS-20 and SMFQ and discriminant validity was determined by comparing scores from at-risk children (from support services) and community children (from schools). Finally, to understand the influence of age and sex on the measure, 2 (gender) X 2 (age group) ANCOVAs were conducted on the CRIES-13 and CRIES-8 total and sub-scale scores controlling for group affiliation (at-risk and community children).

Results

Confirmatory Factor analysis

All hypothesised models for the CRIES were identified in the measurement model specification analyses. Results are reported in Table 1. The χ^2 value was significant at $p<$ .001 for all the models which is common for any large sample; therefore we considered the other fit indices to decide the best structural model for both the long and short versions of the measure.

As can be seen in Table 1, the modification indices for Models 3 and 4 were identical and these two models for the CRIES-13 produced a better fit than either Model 1 or Model 2. Therefore, based on the "Principle of Parsimony" (Bollen, 1989), we selected Model 3 (see Figure 1), with three correlated factors as the most suitable representation of the factor structure of the CRIES-13. All items were positively correlated and correlation coefficients for the three latent factors were moderate to strong (.52-.81). All items had standardized estimates that ranged from .36-.58. None of the multiple R^2 values were below .02 although

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Item 3 (*Do you have sleep problems*?), Item 11 (*Do you get easily irritable?*) and Item 12 (*Are you alert and watchful even when there is no obvious need to be?*) did not load strongly on their relevant latent factor (arousal; R^2 =.13-.16). Factor loadings for items on intrusion (.47-.58) and avoidance (.44-.57) were generally higher than for arousal (.36-.47). Based on the covariance matrices, a free parameter was needed between the error terms of Item 3 (*Do you have difficulties paying attention or concentrating?*) and Item 13 (*Do you have sleep problems?*). When these error terms were permitted to vary together (constrained under the same latent variable) improvements were shown in the fit for Model 3: CMIN=132.33, DF=61, GFI=.98, CFI=.96, TLI=.95, RMSEA=.03 (95% CI .02-.04), AIC=192.22, BIC=348.28. Therefore, it was evident that a slightly modified Model 3 provided the best factor structure for the measure.

Consequently we decided to use the modified Model 3 as the hypothesised baseline model to examine model invariance with gender and age-group, within each sample (community/ at-risk). Initially, we tested model invariance with the four different groups of gender (community boy, community girl, at-risk boy and at-risk girl) and then with the age-groups (community-younger, community older, at-risk younger, and at-risk older). The results of the model invariance tests for the baseline model and constrained models are reported in Table 3 with both gender and age-groups. Results failed to demonstrate complete structural invariance across gender and age, which is not unusual. Importantly, however, for all models (i.e. unconstrained, constrained with measurement weights, structural covariances and measurement residuals) tests for the modified Model 3 yielded an acceptable range of model fit indices for each subgroup. Factor loadings for individual items on the three factors (Intrusion, Avoidance and Arousal) were reasonable for community boys (.27-.64), community girls (.24-.64), at-risk boys (.22-.59), and at-risk girls (.26-.64) and also for community younger (.29-.55), community older (.11-.67), at-risk younger (.15-

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299 .60), and at-risk older (.35-.65) children. Hence these results indicate that the modification
300 of Model 3 provided the best fit for the data consistently across all subgroups.
301
302 *Reliability*
303 Cronbach's alpha for the total CRIES-13 was alpha=.74 and for the total 8-item version
304 was alpha= .70. Internal consistencies for the three subscales of the two versions of the
305 CRIES were moderate: Intrusion (alpha =.60), Avoidance (alpha =.58) and Arousal (alpha
306 =.50). Cronbach's alphas within the different sub-groups are reported in Table 3.
307 Pearson product moment correlation coefficients were calculated between
308 questionnaire scores on the two versions of the measure separated by 3.5 weeks within a
309 sub-group of community children (N=120). Results showed a significant moderate
310 relationship for the total score on the CRIES-13 (r=.72, p<.001), and for the CRIES-8 (r=.62
311 p<.01). Test-retest reliability for each sub-scale was also moderate (Intrusion .67 [p<.01],
312 Avoidance .50 [p<.01], and Arousal .67 [p<.01]).
313 *Validity*
314 Convergent validity
315 The relationship between scores on the two versions of the CRIES and the SCAS-20
316 and SMFQ were calculated. All correlations were positive and significant at p<.01.
317 Specifically the following correlations were demonstrated with the SCAS-20: CRIES-13
318 (.58), CRIES-8 (.48), Intrusion (.36), Avoidance, (.20), Arousal (.41). Similarly, correlations
319 with the SMFQ were as follows: CRIES-13 (.42), CRIES-8 (.34), Intrusion (.44),
320 Avoidance, (.34), Arousal (.53).
321 Discriminant validity
322 Scores on the CRIES-13 and CRIES-8 (as well as each subscale) were compared
323 between the two samples of children: community children (selected primarily from schools

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in the general community) and at-risk children (selected from social support centres). In each case, at-risk children scored significantly higher on the various measures than community children (all p's <.01), see Table 4.

Demographic differences on CRIES

Total scores on the CRIES-13 and CRIES-8 and also each sub-scale were compared between gender and age groups using a series of 2X2 ANCOVAs[1], with the two samples (community and at-risk) included as a covariate. On the CRIES-13, there were significant main effects for gender, $F(4, 1337)= 17.99$, $p<.001$, $\eta_p^2=.01$ and age-group, $F(4, 1337)= 26.65$, $p<.001$, $\eta_p^2=.02$, but the interaction between gender and age group was not significant, $F(4,1337)=.001$, $p=.94$, $\eta_p^2=.01$. Similarly, for the CRIES-8, there were significant main effects for gender, $F(4, 1337)= 9.37$, $p<.01$, $\eta_p^2=.01$, and age-group, $F(4, 1337)= 25.48$, $p<.001$, $\eta_p^2=.02$, but no significant interaction between gender and age group, $F(1,1334)=.08$, $p=.78$, $\eta_p^2=.00$. Means and *SD*s for the groups by gender and age-groups are given in the Table 5. On average, younger boys scored lower on the total scales and subscales when adjusting for group affiliation.

Differences on the three sub-scales were tested separately. For Intrusion, there was no significant main effect of gender, $F(4, 1337)= 3.42$, $p=.065$, $\eta_p^2=.01$, but the effect for age-group was significant, $F(4, 1337)= 22.84$, $p<.001$, $\eta_p^2=.02$. The interaction between gender and age group was not significant, $F(4,1337)=.94$, $p=.33$, $\eta_p^2=.01$. For the Avoidance sub-scale there were significant main effects for both gender, $F(4, 1337)= 9.48$, $p<.01$, $\eta_p^2=.01$, and age-group, $F(4, 1337)= 11.55$, $p<.001$, $\eta_p^2=.01$. However, the interaction between gender and age group was not significant, $F(4,1337)=.19$, $p=.66$, $\eta_p^2=.01$. Similarly, for the Arousal sub-scale, main effects for both gender, $F(4, 1337)= 12.31$,

[1] Similar analyses were conducted to examine subgroup differences separately for the two samples, community and at-risk children. Results were very similar to those for the total sample and therefore only the total sample's analyses are reported here.

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p<.001, η_p^2=.01 and age-group, F(4, 1337)= 49.70, p<.001, η_p^2=.04 were significant, but interaction between gender and age group was not significant, F(4,1337)=.38, p=.54.001, η_p^2=.01.

Discussion

The current study reported on the psychometric properties of a Bangla language translation of the CRIES (both 13-item and 8-item versions) among a large sample of children and adolescents from community and social support centres in Bangladesh. Overall, the properties of both versions were found to be solid and broadly consistent with data from other translations of this measure.

The factor structure of the Bangla CRIES was consistent with previous findings that have demonstrated both a simple, three inter-correlated factor structure (e.g. with flood affected Chinese children, Chen, Zhang, Liu, Liu, & Dyregrov, 2012) and a higher order three-factor structure solution (e.g. with earthquake affected Greek children , Giannopoulou, Smith, et al., 2006). Given that a simple three-factor structure is the more parsimonious solution, our data are more consistent with the former results, albeit that allowing the error terms of two items to correlate improved the fit even more. Overall, model fit indices were within acceptable ranges, however at the individual item level some items showed relatively low relationships with their respective factor (Items 3, 11, and 12). Nonetheless, we do not recommend removal of these items since the R^2 values are all above .02 (Hooper, Coughlan, & Mullen, 2008) and conceptually they provide a broader coverage of the relevant construct. In general, the arousal factor (.36-.47) did appear to be the weakest of the three subscales, which is consistent with previous research (Giannopoulou, Smith, et al. , 2006). Therefore, future work may benefit from identification of stronger items reflecting the

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372 arousal symptoms of PTSD. However, the overall factor structure suggests that items on the
373 CRIES sufficiently represent symptoms related to post-trauma reactions among children
374 from Bangladesh, further supporting the universality of these symptoms (Goenjian et al.,
375 1995; Smith et al., 2003).

376 The factor structure of the measure was largely consistent across various subgroups of
377 children, including younger and older as well as girls and boys both within community and
378 at-risk samples, as the model fit indices were within expected ranges. However, tests of
379 model invariance indicated some significant differences between factor structures for
380 particular subgroups suggesting some minor differences in the ways in which younger/ older
381 and male/ female children verbalize or express PTSD symptoms. The differences between
382 groups may be due to common response patterns within subgroups (Gregorich, 2006). These
383 differences may also be reflected in the differences between subgroups on mean scores. On
384 the other hand, the factor structure for the CRIES appeared largely similar for both
385 community and at-risk children, supporting the universal characteristics of post-trauma
386 symptoms irrespective of the types of traumatic exposure. The breadth of the sample in this
387 study adds to the existing literature, which has mostly been conducted on samples following
388 a specific type of traumatic experience, for instance, war (Smith et al., 2003), earthquake
389 (Giannopoulou, Smith, et al., 2006), or flood (Zhang et al., 2011).

390 The data demonstrated that both versions of the CRIES showed good reliability when
391 used with Bangla-speaking children and adolescents. Internal consistencies for the full 13-
392 item and 8-item CRIES and also each sub-scale were acceptable and similar to findings
393 from other cultures (e.g. Dyregrov et al., 1996; Smith et al., 2003; van der Kooij et al.,
394 2013). Test-retest reliability in our study showed acceptable stability of the measures
395 although the modest results were not as strong as stability reported in some previous
396 research (van der Kooij et al. (2013)

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As expected, the measure correlated highly with measures of anxiety and depression (see, Table 5) which is consistent with the results found by Lau et al. (2013) with Chinese adolescents affected by earthquake. Among the three sub-scales, arousal showed higher correlations with the other measures which is also consistent with findings by Lau et al. The moderate correlations with all total and sub-scales of the CRIES with the SCAS-20 and SMFQ indicate that although PTSD is related to both anxiety and depression, it can be identified as a construct that is distinct from both (Yule & Williams, 1990). Importantly, the CRIES-13 and CRIES-8 were able to discriminate between children from the general community and those residing in social support centres. Given that the children from support centres are considerably more likely to have experienced a large number of traumatic events (Deeba & Rapee, 2014), these children were also at likely higher risk for PTSD and related difficulties. Therefore, these results indicate that the Bangla version of the CRIES is able to identify children who are at increased risk for PTSD, demonstrating its construct validity. Unfortunately, it was not possible in this study to obtain actual clinical diagnoses on any groups of children and therefore these conclusions about validity are based on at-risk status rather than clinical status necessitating caution in their interpretation. The lack of a clinically diagnosed group with PTSD also means that we were not able to evaluate diagnostic cut-off scores for the CRIES (Children and War Foundation (2005) among this Bangladeshi group of young people. Examination within other samples (e.g. Australian children (Dow, Kenardy, Brocque, and Long, 2012) has suggested different cut-off scores to those originally suggested by Perrin et al (2005) based on data from children in the UK. Therefore, further research is necessary to determine the best cut-off scores to identify clinical cases among children from Bangla speaking communities.

Among the Bangladeshi sample, girls and older children obtained higher scores on both versions of the CRIES than boys, results that are consistent with other studies (Stallard

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et al., 1999; Voges & Romney, 2003). These gender and age differences are consistent with broader findings relating to gender and age differences in the experience of traumatic events and reporting of stress reactions. Many studies have shown that although boys experience a greater number of traumatic events, girls and older children report higher levels of classic symptoms of PTSD as reactions to these events (A. Dyregrov et al., 1996; Giannopoulou, Smith, et al., 2006; Yule, 1999). Other authors have suggested that the three main criteria of PTSD better represent older children's post-traumatic stress reactions than younger (Broman-Fulks et al., 2009). This indicates the need for extensive studies on stress reactions in younger children in future studies.

One of the main limitations of this study was the lack of diagnostic data. Diagnoses provide the gold standard against which to evaluate the validity of a measure of psychopathology (Jaeschke, Guyatt, & Sackett, 1994) and the lack of this standard means that it was not possible to determine the ability of the CRIES to identify likely cases. This limits the conclusions we can draw regarding the use of the Bangla CRIES for population screening (Dow et al., 2012; Kenardy et al., 2006). Nevertheless, the current data suggest that the Bangla CRIES is a potentially useful instrument to assess post-trauma reactions among young Bangladeshi people. Given the impact on functioning of experiences with severe trauma among children (Terr, 1983; Laor et al., 1996; Abdel-Mawgoud & al-Haddad, 1997; Almqvist & Brandell-Forsberg, 1997), identification of distress in response to these experiences as early as possible is important in a developing country like Bangladesh. The particular strengths of the CRIES, including brevity, simplicity, and low cost, means that this measure will be of tremendous value for identification, assessment, and appropriate intervention for young people in Bangladesh. Such a tool will be useful for professional mental health workers as well as semi-skilled professionals who work with emergencies or in crisis-affected areas.

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669 *Figure -1*

670 Three-factor solution for the CRIES-13 with total group (N=1342)

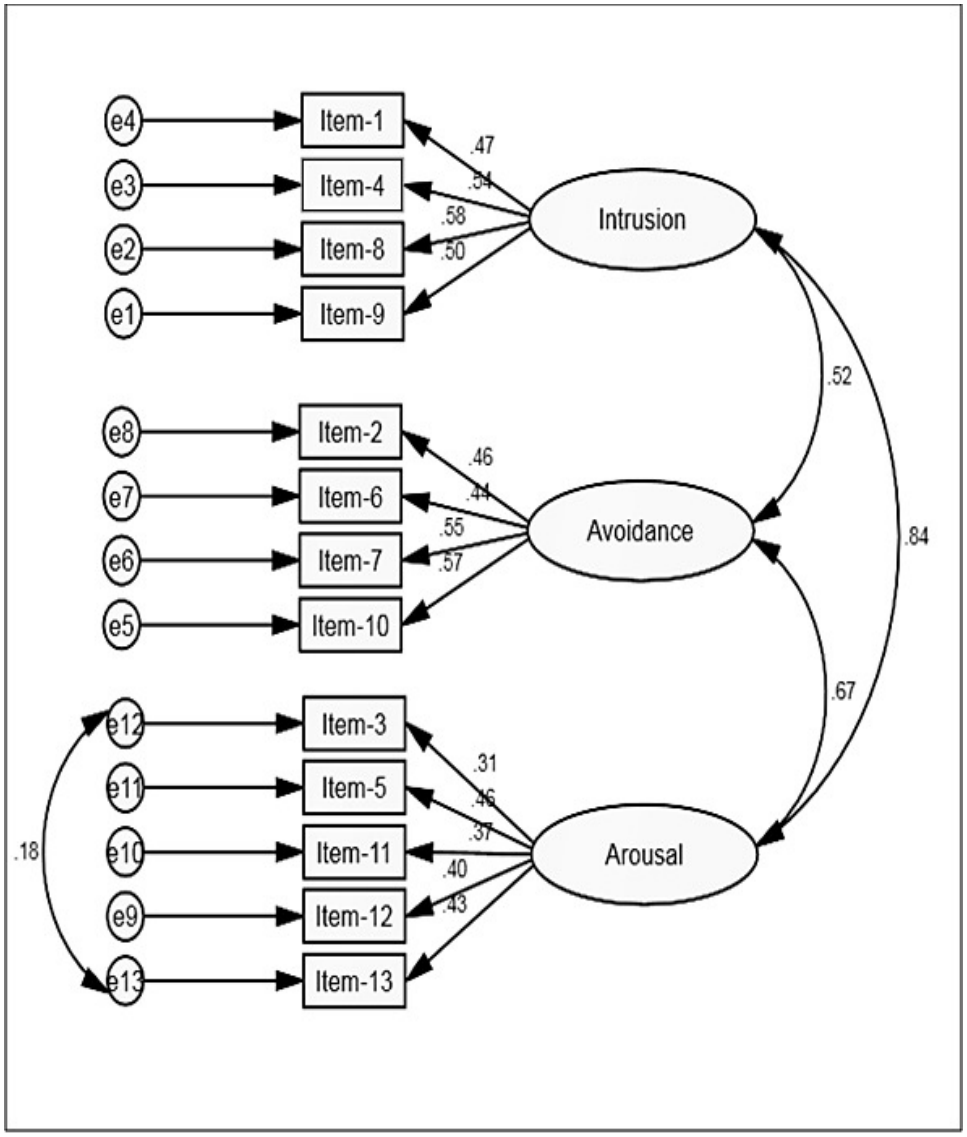

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Table 1

Fit indices for the four hypothesised models on the CRIES-13 based on the total sample.

	$\chi 2$	df	*p*	GFI	CFI	TLI	RMSEA (95% CI)	AIC	BIC
Model 1	363.04	65	.001	1.00	.84	.81	.06 (.05-.06)	415.04	550.29
Model 2	206.11	64	.001	.98	.91	.92	.04 (.04-.05)	260.10	400.55
Model 3	166.33	62	.001	.98	.94	.93	.04 (.03-.04)	224.33	375.18
Model 4	166.33	62	.001	.98	.94	.93	.04 (.03-.04)	224.33	375.18

Note: CRIES-13=Children's Revised Impact of Events Scale, 13-item version.

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Table 2

Multiple group analyses for model invariance for Model 3 of CRIES-13 with four groups of community and at-risk children by gender and age-groups

		χ2	*df*	*p*	RMSEA (95% CI)	*Δχ2*	*Δdf*	*Statistical significance*
Four groups by gender[a]								
	Model A: Unconstrained	366.13	244	.001	.019 (.015-.023)	-	-	-
	Model B: Measurement weights	140.93	274	.001	.019 (.015-.023)	44.80	30	.040
	Model C: Structural covariances	432.94	292	.001	.019 (.015-.023)	66.81	48	.038
	Model D: Measurement residuals	524.56	334	.001	.021 (.017-.024)	158.43	90	.001
Four groups by age-group[b]								
	Model A: Unconstrained	348.51	244	.001	.018 (.013-.022)	-	-	-
	Model B: Measurement weights	394.54	274	.001	.018 (.014-.022)	46.03	30	.01
	Model C: Structural covariances	437.32	292	.001	.019 (.015-.023)	88.82	48	.01
	Model D: Measurement residuals	564.31	334	.001	.023 (.019-.026)	215.80	90	.001

Note: [a] = Community-boy, community-girl, at-risk-boy and at-risk girl, [b]= Community-younger, community-older, at-risk-younger and at-risk older, CRIES= Children Impact of Event Scale;

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Table 3

Internal consistency (Cronbach's alpha) of two versions of CRIES and three sub-scales of the scale with different sub-groups of the sample

Sub-groups of sample		CRIES-13	CRIES-8	Intrusion	Avoidance	Arousal
By types of organizations	Community	.70	.62	.53	.60	.47
	At-risk	.72	.67	.63	.55	.49
By gender	Boys	.68	.60	.57	.53	.45
	Girls	.74	.68	.62	.59	.51
By age-groups	Younger	.70	.61	.56	.54	.50
	Older	.75	.69	.65	.62	.50

Note: CRIES-13= Children Impact of Event Scale-13; CRIES-8= Children Impact of Event Scale-8.

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Table 4

Means, SDs of CRIES-13, CRIES-8 and the three sub-scales, first on the total sample and then comparing the two sub-samples

Measure	Total (N=1342)	Community (N=562)	At-risk (N=780)	t-tests comparing community and at-risk samples
	M (*SD*)	M (*SD*)	M (*SD*)	
CRIES-13	25.12 (11.87)	22.08 (10.97)	27.30 (12.02)	$t(1340)=-8.15$, $p<.001$
CRIES-8	17.11 (8.35)	15.27 (7.88)	18.43 (8.44)	$t(1340)=-6.96$, $p<.001$
Intrusion	8.59 (4.86)	7.61 (4.49)	9.30 (4.99)	$t(1340)=-6.39$, $p<.001$
Avoidance	8.51 (5.44)	7.66 (5.37)	9.13 (5.41)	$t(1340)=-4.91$, $p<.001$
Arousal	8.00 (5.28)	6.80 (4.78)	8.87 (5.45)	$t(1340)=-7.19$, $p<.001$

Note: CRIES-13=13 item Children's Revised Impact of Events Scale, CRIES-8=8-item Children's Revised Impact of Events Scale,

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Table 5

Means, SDs of CRIES-13, CRIES-8 and three sub-scales of the measure by group, gender and age-groups

		Community				At-risk				Total			
		Boys		Girls		Boys		Girls		Boys		Girls	
		N	M (*SD*)	N	M (*SD*)	N	M (*SD*)	N	M (*SD*)	N	M (*SD*)	N	M (*SD*)
CRIES-13	Younger	114	19.14 (11.09)	175	19.81 (10.01)	156	23.53(10.71)	311	27.74(11.23)	270	21.79(11.04)	486	24.88(11.45)
	Older	114	23.73 (10.44)	159	23.30 (11.29)	83	25.19(10.32)	230	30.04 (13.64)	197	24.35 (10.39)	389	28.10 (12.93)
CRIES-8	Younger	114	13.67 (7.84)	175	13.74 (7.24)	156	16.03 (7.41)	311	18.58 (8.04)	270	15.03 (7.67)	486	24.88 (11.45)
	Older	114	16.46 (7.89)	159	17.25 (8.06)	83	17.83 (7.59)	230	20.09 (9.48)	197	17.04 (7.78)	389	18.93 (9.02)
Intrusion	Younger	114	6.72 (4.16)	175	7.32 (4.43)	156	8.14 (4.82)	311	9.05 (4.84)	270	7.54 (4.59)	486	8.43 (4.76)
	Older	114	8.30 (4.66)	159	8.07 (4.59)	83	9.61 (4.35)	230	10.31 (5.34)	197	8.85 (4.57)	389	9.39 (5.16)
Avoidance	Younger	114	6.95 (5.05)	175	6.42 (4.76)	156	7.89 (5.15)	311	9.52 (5.29)	270	7.49 (5.12)	486	8.41 (5.31)
	Older	114	8.17 (5.58)	159	9.18 (5.17)	83	8.21 (5.16)	230	9.77 (5.68)	197	8.19 (5.39)	389	9.53 (5.69)
Arousal	Younger	114	5.75 (4.80)	175	6.07 (4.55)	156	7.50 (5.11)	311	9.16 (5.24)	270	6.76 (5.05)	486	8.05 (5.21)
	Older	114	7.26 (4.43)	159	8.05 (4.97)	83	7.36 (4.54)	230	9.95 (5.94)	197	7.35 (4.47)	389	9.17 (5.63)

Note: CRIES-13=13 item Children Revised Impact of Event Scale, CRIES-8= 8-item Children Revised Impact of Event Scale

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