

A peer-reviewed version of this preprint was published in PeerJ on 26 August 2014.

[View the peer-reviewed version](https://doi.org/10.7717/peerj.536) (peerj.com/articles/536), which is the preferred citable publication unless you specifically need to cite this preprint.

Deeba F, Rapee RM, Prvan T. 2014. Psychometric properties of the Children's Revised Impact of Events Scale (CRIES) with Bangladeshi children and adolescents. PeerJ 2:e536 <https://doi.org/10.7717/peerj.536>

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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 120 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.

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

Farah Deebe¹, Ronald M. Rapee^{1*} and Tania Prvan²

¹ Centre for Emotional Health, Department of Psychology, Faculty of Human Sciences, Macquarie University, NSW 2109, Australia,

² Department of Statistics, Faculty of Science, Macquarie University, NSW 2109, Australia.

*Correspondence should be addressed to Ronald M. Rapee, Centre for Emotional Health, Department of Psychology, Macquarie University, NSW 2109, Australia, (Email: ron.rapee@mq.edu.au)

Ethical approval received from Macquarie University Human Research Ethics Committee (Ref no. 5201001017 dated 5/11/2010).

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 120 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

Introduction

1 In the aftermath of exposure to traumatic events, about 70% of children develop
2 symptoms of Post-Traumatic Stress Disorder (PTSD) within the first month after the
3 incident (Aaron, Zaglul, & Emery, 1999) and almost 20-30% will meet full diagnostic
4 criteria for PTSD within the first 12 months (Dyregrov & Yule, 2006; Schnurr et al.,
5 2007). When children with PTSD are left untreated, the disorder can persist for years
6 limiting their psychosocial functionality and increasing risk for other disorders (Bolton,
7 O'Ryan, Udwin, Boyle, & Yule, 2000; Weber et al., 2008; Yule et al., 2000). Trauma can
8 also produce marked neurobiological consequences and impaired cognitive development
9 that can reduce academic and social performance in a young person's life (Teicher et al.,
10 2003; Yasik, Saigh, Oberfield, & Halamandaris, 2007). In the long run, the impact on
11 individual levels of productivity across the life-span increases burden on the whole society.
12 To help reduce this long-term impact, early identification of post-traumatic stress reactions
13 is very important (Cohen et al., 2010).

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

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

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

49 Given the high frequency of trauma in the country and the particular vulnerability of
 50 children, it is highly likely that a significant proportion of Bangladeshi children will suffer

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

59 Well-developed self-report screening tools to assess children's psychological
60 symptoms require several key characteristics. Such tools need to be brief to ensure that
61 they can be quickly completed with minimum disruption to the individual (Brewin et al.,
62 2002; Stallard, Velleman, & Baldwin, 1999) and items need to be easily understood by
63 children (Yule, 1992). Within communities with few resources, it is also important that
64 instruments are easily administered and able to be scored by non-professionals (Brewin et
65 al., 2002). Several widely used measures of post-trauma reactions among children fail to
66 meet all of these criteria. Among the measures of childhood PTSD, the Children's Revised
67 Impact of Events Scale (CRIES; Children and War Foundation, 2005) fulfils the criteria for
68 good screening instruments and has been used across a large number of countries and
69 cultures (both Western and Eastern). This measure has been translated into more than 15
70 languages and has been used in a number of countries following various large and small
71 scale disasters. Examples include its use with children and adolescents affected by war in
72 Bosnia-Herzegovina (Smith, Perrin, Yule, & Rabe-Hesketh, 2001), earthquakes in Greece
73 (Giannopoulou et al., 2006) and China (Zhao et al., 2009), tsunami in Sri-Lanka (Ketumarn
74 et al., 2009), and also following road-traffic accidents or other emergency medical injuries
75 in the UK (Perrin, Meiser-Stedman, & Smith, 2005) and Australia (Kenardy, Spence, &
76 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. Malmquist, 1986). 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, intrusion, avoidance, and emotional numbing, confirmatory factor analyses failed to support a three-factor structure. Several studies found that most items loaded onto two factors (intrusion and avoidance), 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, intrusion and avoidance. 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).

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, & Dyregrov, 2012) , three distinct but inter-correlated factors (intrusion, arousal and avoidance) (Zhang, Zhang, Wu, Zhu, & Dyregrov, 2011) , and a three-factor structure loading onto a single higher order factor (intrusion, arousal, and avoidance loaded onto PTSD) (Giannopoulou, et al., 2006). Nonetheless, psychometric

properties (for instance, reliability and validity, please see method for detail) for both the CRIES-8 and CRIES-13 have been solid.

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-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 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 (that is, confirmatory factor analyses, internal consistency, reliability and validity) of the CRIES-8 and CRIES-13 in 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 (Deeba & Rapee, 2014) who reported on at least 90% of the items of the CRIES 13 were included in the current sample (Males=467, 34.68% and Females=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

A subsample of 135 children (Males= 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 ($SD=1.96$).

162 *Measures:*163 **Children's Revised Impact of Events Scale-13 (CRIES-13)**

As described above, the CRIES-13 and CRIES-8 (Children and War Foundation, 2005) share the same eight items that constitute two subscales, Intrusion and Avoidance, and the CRIES-13 includes an additional five items that constitutes 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.

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; 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 7-day is good for the total CRIES-13 ($r's=.76-.85$) (Panter-Brick, Goodman, Tol, & Eggerman, 2011; Verlinden et al., 2014), and $r=.75$ for CRIES-8 (Verlinden et al., 2014). However, it is less acceptable for the subscales; Intrusion $r=.58$; Avoidance: $r=.68$ and Arousal: $r=.53$ (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

181 large sample of children affected by war (N=2976) in Bosnia-Herzegovina, scores on the
182 CRIES-13 and all subscales showed small positive correlations ($r=.05-.36$) with self-
183 reported level of traumatic event exposure, and depression (Smith, Perrin, Yule, Hacam, &
184 Stuvland, 2002) and also with ratings of children's distress from parents and teachers and
185 with mothers' levels of trauma exposure and distress (Smith et al., 2001).

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

187 SCAS-20 (S. H. Spence, personal communication, July 26, 2010) is a simple, brief
188 self-report questionnaire to assess symptoms of anxiety. The SCAS-20 is a short form of
189 the more commonly used 38-item SCAS (Spence, 1997). Items are rated on a 4-point
190 Likert-type scale as 0 (never), 1 (sometimes), 2 (often) and 3 (always) and summed to
191 obtain a total score where higher scores indicate higher levels of anxiety. Items for the
192 short version were selected from factor analyses of the full version (Spence, 1997;; Spence,
193 Barrett & Turner, 2003). Although the psychometric properties of the short version have
194 not yet been published, an unpublished evaluation of the SCAS-20 demonstrated strong
195 internal consistency of .89 (Coysh, 2011). The psychometric properties of the SCAS-20
196 among a group of Bangladeshi children and adolescents showed good internal consistency
197 (Cronbach's alpha .84) and satisfactory construct validity for the scale (Deeba, Rapee, &
198 Prvan, 2014).

199 **Short Moods and Feelings Questionnaire (SMFQ)**

200 SMFQ (Angold et al., 1995) was developed to identify DSM-IV-based signs and
201 symptoms of depressive disorders in children and adolescents aged 6-17 years. The scale is
202 scored on a 3- point Likert-type response scale 0 (Never); 1 (Sometimes true) and 2
203 (Always true). The total score is the sum of all items providing possible scores ranging
204 from 0 to 26 with higher scores reflecting lower mood and risk of clinical level depression.
205 The SMFQ has been shown to comprise a single factor and has good criterion-related
206 validity and discriminant validity to identify clinical levels of depression in children and

adolescents (Angold et al., 1995; Thapar & McGuffin, 1998). 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 & 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 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 Macquarie University Human Research Ethics Committee (Ref no. 5201001017 dated 5/11/2010). 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 Deeba & Rapee, 2014). 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

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

Maximum Likelihood (ML; Byrne, 2010) tests were used on the whole sample (N=1342) for model identification, and then two separate multiple group confirmatory factor analyses (MCFA) were run on the best fitting model to evaluate model invariance between gender and age-groups (younger/older) by group affiliation (community and at-risk) following Byrne (2004). Standardized parameter estimates are reported. Model fit statistics in the present study were selected from suggestions by Jackson, Gillaspay, and Purc-Stephenson (2009) and cut-offs for model fit indices were selected as per Kline (2005) and Worthington and Whittaker (2006) as best for clinical measures. These included the goodness-of-fit index (GFI), for which values greater than .90 are acceptable (Hu & Bentler, 1999), the comparative fit index (CFI), and the Tucker-Lewis index (TLI) where values equal to or greater than .90 are considered a good fit (Dumenci &

Achenbach, 2008). To observe differences between observed and predicted covariances, the Root Mean Square Error of Approximation (RMSEA) was chosen. RMSEA values less than .06 (Hu & Bentler, 1999) or .08 (Dumenci & Achenbach, 2008) have been proposed as indicating a good-fitting model, though RMSEA values of .06-.08 are often reported as acceptable or reasonable rather than good (Kline, 2005; McDonald & Ho, 2002). To determine the optimal and most parsimonious model, the Akaike Information Criterion (AIC, Akaike, 1973) and Bayes Information Criterion (BIC; Schwarz, 1978) were checked as per 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 2. The χ^2 value was significant at $p < .001$ for all the models which is common for any large sample (Byrne, 2010), therefore, we considered the other fit indices to decide the best structural model for both the long and short versions of the measure.

285 As can be seen in Table 2, the modification indices for Models 3 and 4 were identical
 286 and these two models for the CRIES-13 produced a better fit than either Model 1 or Model
 287 2. Therefore, based on the “Principle of Parsimony” (Bollen, 1989), we selected Model 3
 288 (see Figure 2), with three correlated factors as the most suitable representation of the factor
 289 structure of the CRIES-13. The correlations shown by the double headed arrows between
 290 the three factors also represent the correlations between the three sub-scales of the
 291 measure. All items were positively correlated and correlation coefficients for the three
 292 latent factors were moderate to strong (.52-.81). All items had standardized estimates that
 293 ranged from .36-.58. None of the multiple R^2 values were below .02 although Item 3 (*Do*
 294 *you have sleep problems?*), Item 11 (*Do you get easily irritable?*) and Item 12 (*Are you*
 295 *alert and watchful even when there is no obvious need to be?*) did not load strongly on
 296 their relevant latent factor (arousal; R^2 =.13-.16). Factor loadings for items on intrusion
 297 (.47-.58) and avoidance (.44-.57) were generally higher than for arousal (.36-.47). Based
 298 on the covariance matrices, a free parameter was needed between the error terms of Item 3
 299 (*Do you have difficulties paying attention or concentrating?*) and Item 13 (*Do you have*
 300 *sleep problems?*). When these error terms were permitted to vary together (constrained
 301 under the same latent variable) improvements were shown in the fit for Model 3:
 302 CMIN=132.33, DF=61, GFI=.98, CFI=.96, TLI=.95, RMSEA=.03 (95% CI .02-.04),
 303 AIC=192.22, BIC=348.28. Therefore, it was evident that a slightly modified Model 3
 304 provided the best factor structure for the measure.

305 Consequently we decided to use the modified Model 3 as the hypothesised baseline
 306 model to examine model invariance with gender and age-group, within each sample
 307 (community/ at-risk). Initially, we tested model invariance with the four different groups of
 308 gender (community boy, community girl, at-risk boy and at-risk girl) and then with the
 309 age-groups (community-younger, community older, at-risk younger, and at-risk older). The
 310 results of the model invariance tests for the baseline model and constrained models are

311 reported in Table 4 with both gender and age-groups. Results failed to demonstrate
 312 complete structural invariance across gender and age, which is not unusual. Importantly,
 313 however, for all models (i.e. unconstrained, constrained with measurement weights,
 314 structural covariances and measurement residuals) tests for the modified Model 3 yielded
 315 an acceptable range of model fit indices for each subgroup. Factor loadings for individual
 316 items on the three factors (Intrusion, Avoidance and Arousal) were reasonable for
 317 community males (.27-.64), community females (.24-.64), at-risk males (.22-.59), and at-
 318 risk females(.26-.64) and also for community younger (.29-.55), community older (.11-
 319 .67), at-risk younger (.15-.60), and at-risk older (.35-.65) children. Hence these results
 320 indicate that the modification of Model 3 provided the best fit for the data consistently
 321 across all subgroups.

322

323 *Reliability*

324 Cronbach's alpha for the total CRIES-13 was $\alpha=.74$ and for the total 8-item version
 325 was $\alpha=.70$. Internal consistencies for the three subscales of the two versions of the
 326 CRIES were moderate: Intrusion ($\alpha=.60$), Avoidance ($\alpha=.58$) and Arousal (α
 327 $=.50$). Cronbach's alphas within the different sub-groups are reported in Table 4.

328 Pearson product moment correlation coefficients were calculated between
 329 questionnaire scores on the two versions of the measure separated by 3.5 weeks within a
 330 sub-group of community children ($N=120$). Results showed a significant moderate
 331 relationship for the total score on the CRIES-13 ($r=.72, p<.001$), and for the CRIES-8
 332 ($r=.62, p<.01$). Test-retest reliability for each sub-scale was also moderate (Intrusion .67
 333 [$p<.01$], Avoidance .50 [$p<.01$], and Arousal .67 [$p<.01$]).

334

335 *Validity*

336 *Convergent validity*

337 The relationship between scores on the two versions of the CRIES and the SCAS-20
338 and SMFQ were calculated. All correlations were positive and significant at $p < .01$.

339 Specifically the following correlations were demonstrated with the SCAS-20: CRIES-13
340 ($r = .58$), CRIES-8 ($r = .48$), Intrusion ($r = .36$), Avoidance, ($r = .20$), Arousal ($r = .41$).

341 Similarly, correlations with the SMFQ were as follows: CRIES-13 ($r = .42$), CRIES-8
342 ($r = .34$), Intrusion ($r = .44$), Avoidance, ($r = .34$), Arousal ($r = .53$).

343 Discriminant validity

344 Scores on the CRIES-13 and CRIES-8 (as well as each subscale) were compared
345 between the two samples of children: community children (selected primarily from schools
346 in the general community) and at-risk children (selected from social support centres). In
347 each case, at-risk children scored significantly higher on the various measures than
348 community children (all p 's $< .01$), see Table 5.

349 *Demographic differences on CRIES* Total scores on the CRIES-13 and CRIES-8 and
350 also each sub-scale were compared between gender and age groups using a series of 2X2
351 ANCOVAs¹, with the two samples (community and at-risk) included as a covariate. On the
352 CRIES-13, there were significant main effects for gender, $F(4, 1337) = 17.99$, $p < .001$,
353 $\eta_p^2 = .01$ and age-group, $F(4, 1337) = 26.65$, $p < .001$, $\eta_p^2 = .02$, but the interaction between
354 gender and age group was not significant, $F(4, 1337) = .001$, $p = .94$, $\eta_p^2 = .01$. Similarly, for
355 the CRIES-8, there were significant main effects for gender, $F(4, 1337) = 9.37$, $p < .01$,
356 $\eta_p^2 = .01$, and age-group, $F(4, 1337) = 25.48$, $p < .001$, $\eta_p^2 = .02$, but no significant interaction
357 between gender and age group, $F(1, 1334) = .08$, $p = .78$, $\eta_p^2 = .00$. Means and SDs for the
358 groups by gender and age-groups are given in the Table 6. On average, younger males
359 scored lower on the total scales and subscales when adjusting for group affiliation.

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

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, $F(4, 1337) = 12.31, p < .001, \eta_p^2 = .01$ and age-group, $F(4, 1337) = 49.70, p < .001, \eta_p^2 = .04$ were significant, but interaction between gender and age group was not significant, $F(4, 1337) = .38, p = .54, \eta_p^2 = .01$.

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 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 et al., 2006). Therefore, future work may benefit from identification of stronger items reflecting the arousal symptoms of PTSD. However, the overall factor structure suggests that items on the CRIES sufficiently represent symptoms related to post-trauma reactions among children from Bangladesh, further supporting the universality of these symptoms (Goenjian et al., 1995; Smith et al., 2003).

The factor structure of the measure was largely consistent across various subgroups of children, including younger and older as well as females and males both within community and at-risk samples, as the model fit indices were within expected ranges. However, tests of model invariance indicated some significant differences between factor structures for particular subgroups suggesting some minor differences in the ways in which younger/older and male/ female children verbalize or express PTSD symptoms. The differences between groups may be due to common response patterns, for example young females with limited literacy might respond more consistently with each other than with the broader population (Gregorich, 2006). These differences may also be reflected in the differences between subgroups on mean scores. On the other hand, the factor structure for the CRIES appeared largely similar for both community and at-risk children, supporting the universal characteristics of post-trauma symptoms irrespective of the types of traumatic exposure. The breadth of the sample in this study adds to the existing literature, which has mostly been conducted on samples following a specific type of traumatic experience, for instance, war (Smith et al., 2003), earthquake (Giannopoulou et al., 2006), or flood (Zhang et al., 2011).

As expected, the measure correlated highly with measures of anxiety and depression (see, Table 6) 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, & 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, females and older children obtained higher scores on both versions of the CRIES than males, results that are consistent with other studies (Stallard et al., 1999; Voges & Romney, 2003). From factor analysis it seems that our participants' primary responses to trauma are reflective of the three-factor structure of PTSD symptom clusters as represented in DSM-IV (APA, 1994). However, one of our findings is most interesting in the sense that there were gender differences on both avoidance and arousal sub-scales but not on intrusion. It is possible that these results show the universality of intrusion as a characteristic of PTSD (Green et al., 1991) given that girls scored higher on the other two symptom clusters but not on intrusion. As the higher scores from females on avoidance and arousal are more consistent with typical findings that females tend to report higher levels of psychological reactions to -traumatic events (Giaconia et al., 1995), as well as more generally higher levels of anxiety and depression (Davis, 2000). Moreover, in a patriarchal culture like Bangladesh it is also likely males will report less avoidance and arousal symptoms due to the influence of social roles.

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

463 reactions. Many studies have shown that although males experience a greater number of
 464 traumatic events, females and older children report higher levels of classic symptoms of
 465 PTSD as reactions to these events (Dyregrov et al., 1996; Giannopoulou et al., 2006; Yule,
 466 1999). Other authors have suggested that the three main criteria of PTSD better represent
 467 older children's post-traumatic stress reactions than younger (Broman-Fulks et al., 2009).
 468 This indicates the need for extensive studies on stress reactions in younger children in
 469 future studies. However, before administering the scale with any children, researchers
 470 should take care to familiarize themselves with the symptoms of PTSD in children and
 471 adolescents as per diagnostic criteria. Given the large and diverse sample of Bangladeshi
 472 children included in this study, the scores obtained by various sub-groups (such as different
 473 ages, genders or risk status) will allow mental health professionals or researchers in
 474 Bangladesh to compare their samples with the relevant subgroup.

475 One of the main limitations of this study was the lack of diagnostic data. Diagnoses
 476 provide the gold standard against which to evaluate the validity of a measure of
 477 psychopathology (Jaeschke, Guyatt, & Sackett, 1994) and the lack of this standard means
 478 that it was not possible to determine the ability of the CRIES to identify likely cases. This
 479 limits the conclusions we can draw regarding the use of the Bangla CRIES for population
 480 screening (Dow et al., 2012; Kenardy et al., 2006).

481 Nevertheless, the current data suggest that the Bangla CRIES is a potentially useful
 482 instrument to assess post-trauma reactions among young Bangladeshi people. Given the
 483 impact on functioning of experiences with severe trauma among children (Abdel-
 484 Mawgoud & al-Haddad, 1997; Almqvist & Brandell-Forsberg, 1997; Caffo, Forresi, &
 485 Lievers, 2005; Laor et al., 1996; Terr, 1983)), identification of distress in response to these
 486 experiences as early as possible is important in a developing country like Bangladesh.
 487 These measures should be of value in both clinical settings and at a community level to
 488 assess the need for services. The short CRIES-8 is likely to be especially useful in acute

489 crisis situations. The particular strengths of the CRIES, including brevity, simplicity, and
 490 low cost, means that this measure will be of tremendous value for identification,
 491 assessment, and appropriate intervention for young people in Bangladesh. Such a tool will
 492 be useful for professional mental health workers as well as semi-skilled professionals who
 493 work with emergencies or in crisis-affected areas.
 494

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 750

Table 1 (on next page)

Demographic variables within the two sub-samples

	Community (N=562)	At-risk (N=780)
<i>Mean Age (SD)</i>	12.27 (1.89)	12.26 (2.26)
<i>Males (n, %)</i>	228 (40.56)	239 (30.64)
<i>Educational and Work status (n, %)</i>		
<i>Education</i>	547 (97.32)	450 (57.69)
<i>Work</i>	1 (0.18)	58 (7.44)
<i>Education & Work</i>	14 (2.50)	240 (30.77)
<i>Others</i>	-	32 (4.10)
<i>Religion (n, %)</i>		
<i>Muslim</i>	474 (84.34)	735 (94.23)
<i>Hindu</i>	86 (15.30)	36 (4.62)
<i>Others</i>	2 (0.36)	9 (1.05)
<i>Frequency of traumatic events experience</i> <i>(% within group)</i>		
<i>Single event</i>	28 (4.98)	46 (5.90)
<i>2-3 events</i>	109 (19.40)	133 (17.05)
<i>4-6 events</i>	213 (37.90)	206 (26.41)
<i>7 to more events</i>	212 (37.72)	395 (50.64)

Table 2 (on next page)

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

	χ^2	<i>df</i>	<i>p</i>	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.

Table 3 (on next page)

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

		χ^2	df	p	RMSEA (95% CI)	$\Delta\chi^2$	Δdf	Statistical significance
<i>Four groups by gender^a</i>								
	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
<i>Four groups by age-group^b</i>								
	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.

Table 4 (on next page)

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
<i>By types of organizations</i>	Community	.70	.62	.53	.60	.47
	At-risk	.72	.67	.63	.55	.49
<i>By gender</i>	Males	.68	.60	.57	.53	.45
	Females	.74	.68	.62	.59	.51
<i>By age-groups</i>	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.

Table 5 (on next page)

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)	
<i>CRIES-13</i>	25.12 (11.87)	22.08 (10.97)	27.30 (12.02)	$t(1340)=-8.15, p<.001$
<i>CRIES-8</i>	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	8.01 (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,

Table 6 (on next page)

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

		Community				At-risk				Total			
		Males		Females		Males		Females		Males		Females	
		N	M (SD)	N	M (SD)	N	M (SD)	N	M (SD)	N	M (SD)	N	M (SD)
<i>CRIES-13</i>	Younger	114	19.44 (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)
<i>CRIES-8</i>	Younger	114	13.65 (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)
<i>Intrusion</i>	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	8.25 (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)
<i>Avoidance</i>	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)
<i>Arousal</i>	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.

Figure 1

Flow-chart to demonstrate sample sizes of participants in the study at different steps

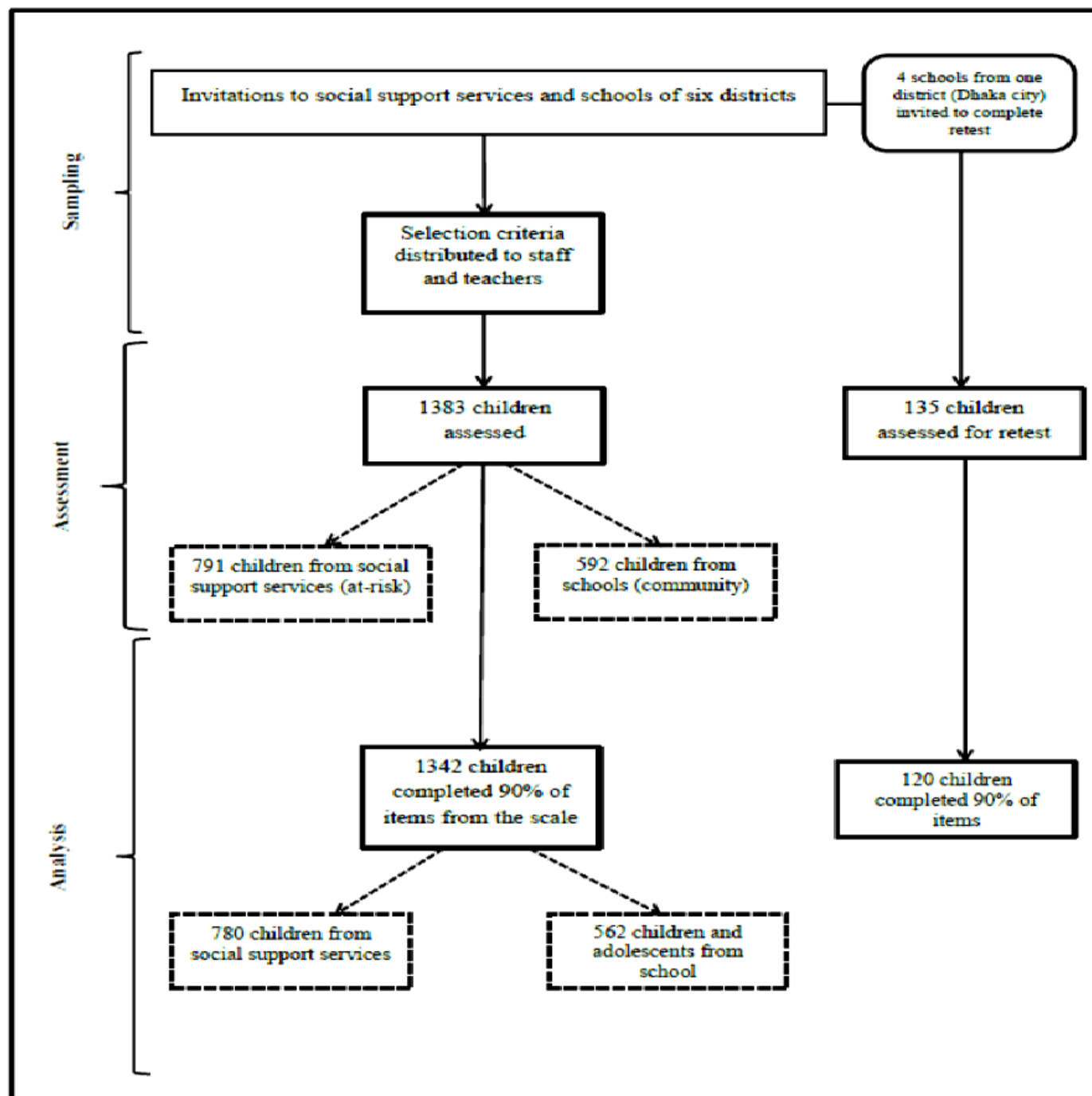


Figure 2

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

