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Psychometric Assessment of Adverse Childhood Experiences International Questionnaire (ACE-IQ) with Adults Engaging in Non-Suicidal Self-Injury

*Rania Christoforou [1] *, Nuno Ferreira [1]*

Abstract

Background: The current study aimed to investigate the psychometric properties of the Adverse Childhood Experiences – International Questionnaire (ACE-IQ) with individuals engaging in non-suicidal self-injury. Numerous studies have supported the association of adverse childhood experiences with non-suicidal self-injury. However, the majority of the measures used were limited to basic forms of abuse and neglect, indicating a need for the use of a more inclusive measure, such as the ACE-IQ. The psychometric properties of the measure though have only been briefly investigated with other populations, suggesting that a more thorough examination might be beneficial before its use.

Method: Two hundred eighty-four adult participants (77.5% females) with a mean age of 23.4 (SD=5.7) were recruited online via specific self-harm groups on social media platforms. Participants were asked to complete an online survey consisting of three self-report measures regarding early childhood experiences and engagement in non-suicidal self-injury.

Results: The findings of this study supported ACE-IQ's reliability (Cronbach's alpha = 0.854), convergent validity (r= 0.85, p<0.001 with the CTQ-SF), predictive validity (R^2 = 0.12, p=0.001 of the SHI total score) and discriminant validity (F-value = 13.90, p<0.001). An exploration of the factor structure demonstrated a 5-factor solution (physical abuse, sexual abuse, emotional abuse, exposure to violence, family environment).

Conclusions: It was concluded that ACE-IQ is a reliable and valid measure to be used for research or clinical purposes with individuals engaging in non-suicidal self-injury, although further research is needed on its factor structure. Research and clinical implications are discussed.

[1] Department of Social Sciences, University of Nicosia, 46 Makedonitissas Avenue, CY-2417, Nicosia, Cyprus

E-mail corresponding author: rania.chri@gmail.com

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Key Points

- The ACE-IQ demonstrated good internal-consistency (Cronbach's alpha=0.854).
- The ACE-IQ showed good convergent, predictive and discriminant validity.
- A 5-factor structure was suggested, although not all items loaded onto the factors.

1. Introduction

Adverse childhood experiences or otherwise known as childhood adversities are broad terms of unfortunate circumstances, which have been associated throughout the years with numerous risk behaviours, chronic diseases and mental health difficulties, having a lasting impact both on a personal and societal level (Danese & McEwen, 2012; Dube et al., 2003; Merrick et al., 2017; Rosenblat et al., 2020; Samia et al., 2020; Subramaniam et al., 2020; Thomas et al., 2020; Zhang et al., 2020). Therefore, there is great emphasis on the importance of assessing adverse childhood events, in order to identify possible risk pathways for each difficulty, which could be used for the development of prevention strategies. Although individual incidences of childhood abuse contribute to the development of the above difficulties, the cumulative effect of childhood adversities seems to be detrimental too (Chartier et al., 2010). Consequently, considering a variety of childhood experiences when investigating their contribution might have additional benefits to the outcomes, such as the identification of more risk factors within a pathway.

Adverse childhood experiences can be described as experiences, which are not expected to occur within a nurturing environment and that require significant adaptation by an average child (under the age of 16 years old) to cope (McLauglin, 2016). The most commonly addressed childhood experiences are sexual, physical and emotional abuse and physical and emotional neglect (Gratz, 2003; Serafini et al., 2017). However, there are several other experiences, such as bullying, which could also be considered as childhood adversities (Copeland et al., 2014) and are not incorporated into commonly used childhood maltreatment measures, such as the Childhood Trauma Questionnaire (CTQ; Bernstein et al., 1994). A variety of childhood experiences are included though within the Adverse Childhood Experiences - International Questionnaire (ACE-IQ), such as parental neglect, dysfunctional family environment, loss of a parent, verbal abuse, physical abuse, sexual abuse, peer violence, community violence and exposure to war/collective violence (World Health Organization, 2018). Although there are still some types of childhood adversities, which are not included in the ACE-IQ and have been found to be associated with increased risk for lung diseases, gout, joint diseases, visual, hearing and mobility impairments, such as assumption of the adult role and forced childhood labour contribution (Dorji et al., 2020), the development of ACE-IQ opens a door for investigating more childhood adversities. The inclusion of this broad spectrum of adversities can potentially be useful for researchers and clinicians for the identification of risk factors, not commonly addressed when investigating childhood traumatic experiences.

Despite the fact that it can be challenging to disentangle the impact of each individual childhood adversity assessed in the ACE-IQ on future mental and physical health conditions (Seery et al., 2010), studies have associated specific adversities with presenting difficulties. Marital conflicts have been found to influence the quality of parenting (assessed in ACE-IQ), which can influence the attachment style of the child with his/her parents, which in turn influences the emotion regulation of the child, increasing his/her risk for worrying, alexithymia and hence, childhood anxiety (Benedetto et al., 2013; Benedetto & Ingrassia, 2015; Leonardi et al., 2013; Midolo et al., 2020). Examining a variety of childhood adversities, offers us the possibility to identify pathways, like the one previously described, offering the possibility to target a risk factor, for which a prevention strategy might be easier to implement, preventing in this way the continuation of the pathway. For example, in this scenario, it might be easier to target the parenting style than the marital conflict, by organizing psychoeducational groups in schools, to educate parents of the possible risks for children when marital conflicts occur. This could encourage parents to protect their children despite their conflict, and hence, the risk pathway might be disrupted, preventing in this way the potential development of childhood anxiety. Additionally, sexual abuse has been associated with increasing levels of shame, which can be exacerbated when the family is unsupportive towards the victim (i.e. unsympathetic and guilt reaction), impacting future social interactions (Bouzidi, 2018). Therefore, it might be more fruitful again to target parents' attitudes towards sexual abuse, than relying only on psychotherapy for victims. A particularly worrying outcome was reported by Marx et al. (2020), who found that victims of emotional and sexual abuse were more likely to have a paedophilic sexual preference compared to a sample of psychotherapy outpatients and of the general population. These findings suggest that being exposed to childhood maltreatment, might be related to increased risk of being the reason, someone else might be exposed to a childhood adversity, perpetuating in this way the issue with adverse childhood experiences, highlighting the need to explore the impact of adverse childhood experiences in a variety of settings and with a variety of individuals.

The ACE-IQ measure has been developed by the World Health Organization (WHO, 2018) with the intent to measure adversities presented in all countries and this is reflected in its wide use within the literature. However, although the ACE-IQ has been used to conduct research in a variety of countries (Almuneef et al., 2014; Al-Shawi & Lafta, 2015; Chang et al., 2019; El Mhamdi et al., 2018; Goodman et al., 2017; Kim, 2017; Mall et al., 2018; Soares et al., 2016; Tran et al., 2015), its psychometric properties have only been evaluated by a limited number of studies (Ho et al., 2019; Kazeem, 2015; Kidman et al., 2019; Quinn et al., 2018; van der Feltz-

Cornelis et al., 2019). Evaluating thoroughly the psychometric properties of a measure before its use is essential to ensure that the outcomes are reliable and valid, which means that they are consistent and accurate to draw conclusions from.

According to the studies investigating the psychometric properties of ACE-IQ, the ACE-IQ demonstrated satisfying internal consistency; a concurrent validity with the CTQ questionnaire in a sample of prisoners in Nigeria (Kazeem, 2015); a good test-retest reliability (0.90) in a sample of young adults in Hong Kong (Ho et al., 2019); a moderate predictive validity in a sample of adolescents living in rural Malawi; with individuals diagnosed with anxiety and depressive disorders (Kidman et al., 2019; van der Feltz-Cornelis et al., 2019) and an adjustable cultural competency for adult residents of Munsieville (Quinn et al., 2018). However, Kazeem (2015) investigated the internal consistency of the measure based on the six proposed subcategories of ACE-IQ, without confirming its factor structure. According to Kidman et al. (2019), a principal components analysis suggested a three-factor solution (household dysfunction, abuse, neglect), which does not reflect the satisfying internal consistency of the measure based on the original six subcategories; suggesting that further investigation of the factor structure and internal consistency of the measure might be needed. No other studies have investigated to our knowledge the factor structure of the measure. Since the ACE-IQ investigates a variety of childhood adversities, determining its factor structure is paramount before investigating the internal consistency of the measure, which might have been affected by the diversity of the adversities addressed.

Additionally, there is a lack of evaluation of its psychometric properties within high-risk groups, which have already been associated with childhood adversities, such as with individuals engaging in non-suicidal self-injury (NSSI). Non-suicidal self-injury is defined as a non-socially sanctioned deliberate act, which leads to the destruction of body tissue (Favazza, 1998) or an alteration of the biochemistry of one's body without conscious suicidal intent. Numerous studies have associated childhood maltreatment with NSSI (Liu et al., 2018), but the majority of them have used measures with a particular focus on sexual, physical and emotion abuse (Arens et al., 2012; Bornovalova et al., 2011), limiting in this way the scope of childhood adversities and their true effect on NSSI behaviour. Therefore, the current study aims to explore the psychometric properties of ACE-IQ in a sample of individuals engaging in NSSI in order to demonstrate its reliability and validity for potential use. Specifically, the study aimed to investigate ACE-IQ's factor structure, internal consistency, convergent validity, predictive validity and discriminant validity.

2. Materials and Methods

2.1 Participants

A sample of 284 individuals engaging in NSSI was recruited for the purposes of this study (77.5% females). Inclusion criteria included being 18 years old or above, have at least one experience of NSSI and have good knowledge of the English language to ensure good understanding of the questions. The age of the participants ranged from 18 to 51 years old (M = 23.4, SD = 5.7). Participants' level of education ranged from no formal education (0.7%) to having a Post-graduate degree (8.8%). The majority of the participants completed high school by the time of the survey (54.2%). Participants were automatically excluded from the study if they reported any suicidal thoughts and they were advised to contact their family doctor, mental health professional or local health system to seek help.

2.2 Measures

Adverse Childhood Experiences – International Questionnaire (ACE-IQ; WHO, 2018). The ACE-IQ is a self-report measure, consisting of 45 items;14 questions are demographics, 30 items explore adverse childhood experiences and one item is used for clarification purposes regarding bullying. For the purposes of this study, only the items exploring adverse childhood experiences were investigated for their reliability and validity (see Appendix A). The items investigate participants' family environment, parental neglect, parental loss, verbal abuse, physical abuse, sexual abuse and violence within a peer setting, community setting or collective setting. They are rated on a 4-point Likert scale, except for seven items (two rated on a 5-point Likert scale and five require a "Yes" or "No" answer). Higher scores indicate greater exposure to childhood adversities. The psychometric properties of this questionnaire have been discussed in the introduction.

Childhood Trauma Questionnaire – Short form (CTQ-SF; Bernstein et al., 2003). The CTQ-SF is a self-report measure developed by reducing the items of the original Childhood Trauma Questionnaire (Bernstein et al., 1994; Bernstein & Fink, 1998). It consists of 28 items, which have a focus on emotional, physical and sexual abuse and emotional and physical neglect. CTQ and CTQ-SF are very commonly used within the NSSI literature in order to investigate the impact of childhood experiences (Bornovalova et al., 2011; Franzke et al., 2015; Howard et al., 2017). The items are rated on a 5-point Likert scale (from Never True to Very Often True). Higher scores indicate greater exposure to adverse childhood experiences (Range: 28-140). The CTQ-SF has been translated and psychometrically tested in several countries, showing good internal consistency, good criterion-related validity, convergent and concurrent validity

(Bernstein et al., 2003; Gerdner & Allgulander, 2009; Kim et al., 2013). Although the Cronbach's alpha score for this measure has not been reported in the original study, Kazeem's (2015) study, which was used to validate the ACE-IQ in Nigeria and hence, it will allow a direct comparison to be made, found a Cronbach's alpha score of 0.91, demonstrating excellent reliability. Similarly, to Kazeem study, the Cronbach's alpha score of CTQ-SF in this study was excellent (Cronbach's alpha = 0.95).

Self-harm Inventory (SHI; Sansone et al., 1998). A modified version of the SHI was used composing of all items that referred to deliberate destructive action towards body tissue to match the definition of NSSI adopted for this study. The SHI is a self-report measure, consisting of 22 items investigating distinct NSSI behaviours. However, it includes several items, which do not refer to deliberate destruction of body tissue, such as "tortured yourself with self-defeating thoughts". These items were removed for the purposes of this study. Participants were required to respond with a "Yes" or "No" in order to report whether they have ever deliberately engaged in those behaviours without having the intention to die. The SHI was selected due to its variety of NSSI behaviours, which are not included in other measures (e.g. the Deliberate Self-harm Inventory; Gratz, 2001). A total number of 10 items were included, leaving a maximum total score of 10. Higher scores demonstrate greater engagement in NSSI. Its psychometric properties were investigated before its inclusion in the analysis and findings showed that the revised version of the SHI was a reliable measure to be used (Cronbach's alpha = 0.71).

2.3 Procedure

After ethical approval was granted, an online survey was created using Google Forms. Information about the study was placed at the beginning of the survey and was followed with an online informed consent form. Only participants who provided their informed consent were included in the survey. The survey included questions on demographic characteristics, such as age, gender, years of education and presence of suicidal ideation and the three self-report measures mentioned above (ACE-IQ, CTQ-SF, & SHI). The survey's duration was approximately 10-15 minutes for each participant. The link to the study was distributed through specific NSSI groups on social media platforms (e.g. the subreddit r/AdultSelfHarm on Reddit and Facebook groups), after obtaining approval from the moderators. Therefore, participants were recruited from several countries, they were following these self-harm groups and their participation was completely voluntary. The link remained active for six months before extracting the data for analysis.

2.4 Statistical Analysis

The data was analysed using the Statistical Package for Social Sciences (SPSS version 25; IMB Corp, 2017). Exploratory Factor Analysis (EFA) was performed in order to explore the factor structure of the measure. Since the data was non-parametric, principal axis factors extraction was used with direct oblimin rotation (Delta=0; Costello & Osborne, 2005). Cronbach's alpha scores were calculated to determine ACE-IQ's internal consistency. Convergent validity was explored by examining the correlation between ACE-IQ and CTQ-SF using Pearson's Correlation Coefficient test. Simple linear regression was conducted to investigate the predictive validity of ACE-IQ on NSSI behaviour. One-way between subjects ANOVA test was used to examine differences between individuals scoring low (less than 45), medium (45-65) or high (more than 65) on ACE-IQ for discriminant validity. Due to the presence of non-parametric data, all analyses were run with the 1,000 bootstrapped re-samples method to overcome any normality issues (Dwivedi et al., 2017; Field, 2013).

2.5 Ethical considerations

Ethical approval was obtained by the Social Sciences Ethics Review Board at the University of Nicosia, Cyprus (SSERB 45). Participants were informed about the study and provided an informed consent before participating. Withdrawal from the study was allowed at any time. Identification information was not collected and hence, confidentiality was maintained throughout.

3. Results

3.1 Demographic characteristics

A sample of 284 individuals provided usable data for the study. The majority of the participants were females, with chronic engagement in NSSI behaviours and with one or more of the following diagnoses: borderline personality disorder, posttraumatic stress disorder, anxiety-related disorder, depression, schizophrenia, eating disorders and bipolar disorder (see Table 1). None of the participants reported suicidal thoughts at the time of data collection. Participants' scoring on ACE-IQ ranged from 31 to 88 and the average score was 51.7 (SD=10. 97). The childhood adversities reported by most of the participants were verbal abuse by a family member (88%), bullying (82.7%) and physical abuse by a parent (67.3%). The average score on CTQ-SF was 65.9 (SD = 23.28). Most of the participants (72.9%) reported engagement in more than five different NSSI behaviours. Self-cutting (91.5%), self-scratching (83.1%) and self-hitting (70.8%) were three of the most prominent behaviours.

Table 1. Participants' demographic characteristics (N=284).

Variable	***M***	***SD***
Age	23.4	5.7
Variable	***N***	***%***
Gender		
Females	220	77.5
Males	45	15.8
Non-binary/Genderqueer or Transgender	19	6.7
Mental health diagnosis		
Yes	182	64.1
No	102	35.9
Previous suicide attempts		
Yes	107	37.7
No	145	51.0
Maybe	32	11.3
Formal education		
Yes	282	99.3
No	2	0.7
ACE-IQ		
Low	81	28.5
Medium	170	59.9
High	33	11.6

3.2 Factor Structure

Exploratory Factor Analysis. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy was 0.79 and the Barlett's Test of Sphericity was significant ($p<0.001$), indicating that the data had patterned relationships amongst the variables and was suitable for factor analysis (Yong & Pearce, 2013). Based on Eigen values (>1) and inspection of the scree plot (Figure 1), a 5-factor model was suggested (see Table 2). The variance explained by the 5-factor model was 49%. Factor 1 (5 items) was named physical abuse, since it meant to reflect experiences that might cause harm to one's body and accounted for 20.7% of the variance.

Factor 2 (4 items) was named sexual abuse since it reflected unwanted sexual contact and accounted for 9.9% of the variance. Factor 3 (6 items) accounted for 7.7% of the variance and was named exposure to violence. It reflected several events of violence that someone might experience within a community or during war. Factor 4 (5 items) accounted for 5.4% of the variance and was named dysfunctional family environment, since it meant to reflect description of individuals living in the house and their behaviour. Lastly, factor 5 (4 items) reflected experiences that could cause high emotional distress and hence, it was named as emotional abuse. Factor 5 accounted for 5.3% of the variance. All the factors showed weak associations with each other (see Table 3), indicating low overlap between them and hence, possible independence of the constructs. However, six items did not load on either factor. Items 1, 2, 9, 10, and 23 reflected important adversities, such as insecure attachment, parental separation or death and bullying, which have significant impact on mental health in adulthood and in engaging in NSSI behaviour (Buckmaster et al., 2019; Egeland & Carlson, 2004; Esposito et al., 2019; Maier & Lachman, 2000; Takizawa et al., 2014; Trujillo & Servaty-Seib, 2018). Additionally, item 29 (being beaten up by soldiers, police, militia, or gangs) had a very low endorsement (N=1) and this might have interfered with its loading on Factor 3. Consequently, due to their importance and the low endorsement of item 29, all items were retained for the following analyses, since none of the other items examined the same adversities. Item 16 loaded on both Factor 1 and Factor 5, but it was placed under Factor 1, since its correlation with the factor was stronger (see Table 2).

Figure 1. Scree Plot for Principal Axis Factor Analysis.

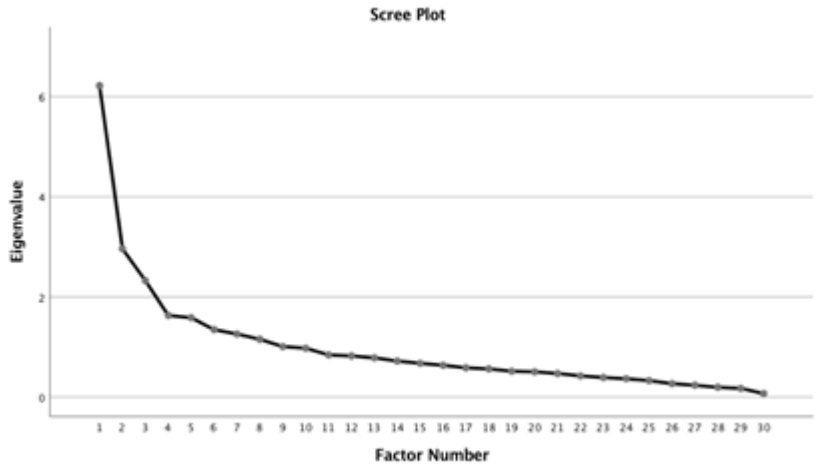

Table 2. Five Factor model loadings by Principal Axis Factor Analysis.

Items	Factor 1: Physical Abuse	Factor 2: Sexual Abuse	Factor 3: Exposure to Violence	Factor 4: Dysfunctional Family Environment	Factor 5: Emotional Abuse
1. Parental understanding	-	-	-	-	-
2. Parental knowledge of activities	-	-	-	-	-
3. Not given enough food even when they could	0.416	-	-	-	-
4. Parents too drunk or intoxicated to take care of you	-	-	-	0.693	-
5. Not sent to school even if available	-	-	-	0.391	-
6. Lived with a household member who was alcoholic, or misused drugs	-	-	-	0.815	-
7. Lived with someone who was depressed or mentally ill or suicidal	-	-	-	0.361	-
8. Lived with someone sent to jail or prison	-	-	-	0.424	-
9. Parental separation or divorce	-	-	-	-	-
10. Death of a parent/guardian	-	-	-	-	-
11. Experience of seeing/hearing someone being yelled at, screamed at, sworn at etc in the house	-	-	-	-	0.718
12. Experience of seeing/hearing someone being slapped, kicked, punched or beaten up in the house	0.469	-	-	-	-
13. Experience of seeing/hearing someone being hit or cut with an object in the house	0.784	-	-	-	-
14. Experience of being yelled, screamed etc by a parent	-	-	-	-	0.814
15. Being threatened or actually abandoned by a parent/guardian	-	-	-	-	0.388
16. Being spanked, slapped, kicked etc by a parent/guardian	0.458	-	-	-	0.344
17. Being hit or cut with an object by a parent/guardian	0.723	-	-	-	-
18. Touched or fondled by someone in a sexual way without wanting to	-	0.758	-	-	-
19. Made to touch someone's body in a sexual way without wanting to	-	0.827	-	-	-
20. Someone attempted oral, anal, vaginal intercourse without you wanting it	-	0.937	-	-	-
21. Someone had oral, anal, or vaginal intercourse without you wanting it	-	0.891	-	-	-
22. Bullied	-	-	-	-	0.359
23. Involved in a physical fight	-	-	-	-	-
24. Seen or heard someone being beaten up	-	-	0.422	-	-
25. Seen or heard someone being stabbed or shot in real life	-	-	0.552	-	-
26. Seen or heard someone being threatened with a knife or gun in real life	-	-	0.582	-	-
27. Forced to go and live in another place	-	-	0.645	-	-
28. Experience of deliberate destruction of home	-	-	0.548	-	-
29. Being beaten up by soldiers, police, militia, or gangs	-	-	-	-	-
30. Family member or friend being killed or beaten up by soldiers, police, militia or gangs	-	-	0.334	-	-

Table 3. Correlations between factors.

Factor	1: Physical Abuse	2: Sexual Abuse	3: Exposure to Violence	4: Dysfunctional Family Environment	5: Emotional Abuse
1	1.00	-	-	-	-
2	0.09	1.00	-	-	-
3	0.08	0.09	1.00	-	-
4	0.26	0.16	0.23	1.00	-
5	0.32	0.22	0.03	0.33	1.00

3.3 Reliability

Internal consistency. The ACE-IQ's Cronbach's alpha for the total scale (i.e. including all items) was 0.854, indicating a generally good internal consistency within the scale. Two items were found to increase the Cronbach's alpha score once deleted, but the change would be minimal (0.857 if the item 1 referring to parental understanding is removed and 0.855 if the item 10 referring to parental death is removed; see Table 4), suggesting that all items can be retained within the measure. Nevertheless, inter-item correlations ranged from 0 to 0.92, which demonstrated that not all items were homogenous and not all items had sufficiently unique variance (see Appendix B). Item-total correlations ranged from 0.02 to 0.62 (see Table 4). Almost half of the items (47%) were correlated with the total of the scale for more than 0.40 and two items barely correlated with the total (item 10 examining parental death and item 29 examining being beaten up by soldiers, police, militia or gangs). Taking into consideration only the items loaded on the previously extracted factors, the Cronbach's alpha scores for each factor were: Factor 1 = 0.814, Factor 2 = 0.918, Factor 3 = 0.599, Factor 4 = 0.676 and Factor 5 = 0.748, indicating poor internal consistency for Factors 3 and 4.

Table 4. Item-total correlations and items' impact on Cronbach's alpha score.

Item	Item-Total Correlation	Cronbach's alpha if item deleted
1	0.199	0.857
2	0.272	0.854
3	0.457	0.847
4	0.488	0.846
5	0.400	0.849
6	0.422	0.850
7	0.377	0.850
8	0.316	0.852
9	0.303	0.852
10	0.037	0.855
11	0.515	0.845
12	0.619	0.841
13	0.568	0.843
14	0.556	0.843
15	0.574	0.842
16	0.510	0.845
17	0.523	0.845
18	0.471	0.846
19	0.473	0.846

20	0.408	0.848
21	0.381	0.849
22	0.298	0.853
23	0.360	0.850
24	0.332	0.851
25	0.166	0.854
26	0.353	0.850
27	0.137	0.854
28	0.162	0.854
29	-0.019	0.855
30	0.113	0.854

3.4 Validity

Convergent validity. Findings from the Pearson Correlation Coefficient test indicated that the ACE-IQ and CTQ-SF were highly positively related to each other [r=0.850, $p < 0.001$, 95% CI (0.80, 0.89), SE = 0.02]. This strong correlation between the two measures, demonstrates an overlap in concepts, and hence, a good convergent validity of ACE-IQ.

Predictive validity. The findings from simple Linear Regression analysis showed a significant effect of ACE-IQ on SHI total score [$F(1, 282) = 39.10$, p=0.001, 95% CI (0.05, 0.09), SE = 0.01] with an $R^2 = 0.12$. The significant effect demonstrated in this analysis, suggests that ACE-IQ has a predictive utility with individuals engaging in NSSI. Specifically, the ACE-IQ accounts for approximately 12% of the variability of the revised SHI total score, which is a substantial amount of explained variance to suggest predictive validity. When compared to the effect of CTQ on SHI total score [$F(1, 282)=45.95$, p=0.001, 95% CI (0.03, 0.05), SE = 0.005, $R^2 = 0.14$], findings reveal a similar effect, further supporting ACE-IQ's predictive validity with individuals engaging in NSSI.

Discriminant validity. The sample was separated into three groups based on their ACE-IQ total score in order to investigate whether there is a meaningful and significant difference in the outcomes of the revised SHI total score between the ACE-IQ groups (low, medium and high exposure to adverse childhood experiences). Findings from the one-way between subjects ANOVA test demonstrated that there was a significant difference between the groups, which suggests a significant discriminant validity (see Table 5).

Table 5. ACE-IQ group comparisons based on SHI total score for discriminant validity (ANOVA test).

ACE-IQ groups	N	Mean (SD)	Standard Error	95% Confidence Intervals		F-Value (df)	Significance
				Lower	Upper		
Low	81	4.9 (2.3)	0.3	4.4	5.4	13.90	$p < 0.001$
Medium	170	5.6 (2.2)	0.2	5.3	6.0	(2, 281)	
High	33	7.3 (1.9)	0.3	6.6	8.0		

4. Discussion

4.1 Summary of Findings

Overall, the findings of this study suggest that the ACE-IQ is a reliable and valid measure to be used with NSSI populations. However, its proposed 5-factor structure appeared to have some issues, since not all items loaded onto the factors. Therefore, the validity tests were conducted using the total score of the measure. It might be the case that the six items, which did not load onto the factors, need revision to match the suggested factors. Or, it might be the case that more items might be needed in order to form new factors, since two of the five proposed factors did not demonstrate good internal consistency. Nevertheless, the general internal consistency of the questionnaire is good, which demonstrates that almost all items are measuring the same concept (Tavakol & Dennick, 2011). Inter-item correlations indicated that the majority of items were correlated to each other, but the strength of their association was not as strong to suggest an overlap in concepts. There was only one combination, which showed a very strong association (Item 20 and Item 21: r=0.92). This was expected since all individuals who were exposed to inappropriate sexual contact are more likely to report an attempt of inappropriate sexual contact too, indicating a natural overlap.

4.2 Interpretation of Findings

Certain items (N=13 combinations) demonstrated no correlation between them. Interestingly, most item-combinations showing no correlation were with Item 29 (N=9), which refers to being beaten up by soldiers, police, militia, or gangs. This form of adversity is prevalent only in certain countries, which are exposed to war or collective violence. Therefore, the absence of a correlation could be due to the absence of experiences of these types of adversities within the sample. The sample itself was biased due to socio-economic status, since the majority of the participants were educated and had access to Internet, and hence, it is unlikely that they might be living in the circumstances in which this type of violence can occur. Item 29 was barely correlated to the total score too. Consequently, it is suggested that it might be more beneficial to include item 29 only when considering adverse childhood experiences in countries experiencing war or where collective violence exists.

Despite the inclusion of more diverse adversities within the ACE-IQ, the findings demonstrated a strong association with the CTQ-SF, as it is proposed by their theoretical underpinnings. These findings support ACE-IQ's convergent validity. However, it is important to take into consideration that the outcomes of the psychometric assessment of ACE-IQ, particularly with regards to its factor structure and convergent validity with CTQ-SF suggest that the measure mainly operates as a close proxy to CTQ-SF. Therefore, future studies could consider whether

ACE-IQ or CTQ-SF is more suitable for their analyses. The ACE-IQ may have utility in more general populations, where a focus on "adversity" rather than "trauma" could be preferable, although further validation of the ACE-IQ measure appears to be needed. Regarding ACE-IQ's predictive and discriminant validity, the findings of this study suggest that ACE-IQ is a valid measure to be used to predict NSSI and its score has a meaningful impact on the prediction (i.e. different scores have distinct impact on NSSI).

4.3 Findings Compared to Previous Studies

The findings are in accordance to previous studies investigating the psychometric properties of ACE-IQ, which demonstrated good reliability and validity. When compared to the study conducted by Kazeem (2015), the outcomes revealed similar reliability and convergent validity. However, both the Cronbach's alpha score and the association between ACE-IQ and CTQ-SF were stronger in this study [Cronbach's alpha = 0.80, r=0.72 in Kazeem, (2015)]. This difference in findings could be attributed to the five items on marriage, which were included in Kazeem's (2015) analysis, but excluded for this study, since they were not measuring childhood adversities. Limiting the items specifically to childhood adversities (i.e. exclude all demographic items) increases the reliability of the scale and its association with other measures on childhood adversities, which might not include any demographic questions. Although according to our knowledge, no studies have previously investigated the predictive validity of ACE-IQ with individuals engaging in NSSI, the findings of this study demonstrated a very similar positive and moderate predictive validity. A comparable study would be that of Kidman et al. (2019), who found a similar pattern of results in their investigation of the predictive utility of ACE-IQ on depression in an adolescent cohort in Malawi. However, when compared to the predictive validity of ACE-IQ with regards to somatic comorbidity and adverse life events in adulthood in a sample of outpatients with anxiety or depression (van der Feltz-Cornelis et al., 2019), the current study supports a stronger predictive validity. This could be explained by the use of age and gender as covariates in the analysis by van der Feltz-Cornelis et al. (2019). Van der Feltz-Cornelis et al. (2019) used age and gender as covariates in an attempt to investigate their differential effects on the variables being investigated, although no significant difference was reported for age and gender. Consequently, including them in the analysis might have introduced unnecessary interference to the analysis, which reduced the effect of ACE-IQ and hence, its predictive validity. Regarding the factor structure of the questionnaire, Kidman et al. (2019) also reported some issues, since some of the items were excluded from the analysis and not all factors made theoretical sense (i.e. bullying loaded on "neglect"). Therefore, it is suggested that some of the items might need revision in order to improve the factor structure of the ACE-IQ.

4.4 Research Implications

Taking into consideration the findings of this study, it is suggested that ACE-IQ can be a reliable and valid measure to use with individuals engaging in NSSI, when it is considered as a whole and not based on its subscales. Studies investigating the impact or association between adverse childhood experiences and NSSI can use this measure to explore a variety of adversities and possible risk pathways, which can be targeted in the future as part of prevention strategies. Another research implication of this study, is that it indicated areas that require further exploration before using the ACE-IQ subscales, such as its factor structure. Lastly, the study replicated the association of childhood adversities with NSSI engagement.

4.5 Clinical Implications

Within a clinical environment, prevention of NSSI behaviours could lead to a reduction in suicides and improvement in the quality of life (e.g. by eliminating the shame and guilt felt following NSSI) of individuals belonging in the high-risk groups. Therefore, given the predictive validity of the measure, ACE-IQ could be used by clinicians as part of early identification measures to predict potential risk in engaging in NSSI behaviours. Consequently, early prevention strategies, such as providing psychoeducation or psychotherapeutic treatment, can be more effectively employed, decreasing the risk of engaging in NSSI behaviours and improving the quality of life of high-risk groups. Previous studies supported the mediational role of emotion dysregulation in the association between early life experiences and NSSI (Guérin-Marion et al., 2019; Howard et al., 2017), hence, established models of therapy targeting emotion regulation, such as Emotion Focused therapy and Dialectical Behavioural Therapy could form a fruitful prevention strategy. Furthermore, assessing adverse childhood experiences using the ACE-IQ within a clinical setting might aid therapists to identify secondary diagnoses or possible mental (e.g. anxiety disorder) or physical conditions (e.g. high blood pressure, insomnia) that might require further assessment within an NSSI population, providing in this way a more holistic and person-centred medical assessment.

4.6 Limitations

Nevertheless, the study is not without limitations and hence, the results should be interpreted in light of these. The measure used to evaluate NSSI was a modified version of a previously validated measure and its psychometric properties have not been formally investigated. The sample size was quite small for a psychometric assessment suggesting that it might be beneficial to replicate this study in a larger sample. Furthermore, the sample was limited to highly educated individuals engaging in NSSI and therefore, the outcomes might not be generalizable to other populations. Additionally, the use of self-report measures might have introduced biases to the

outcomes of the study (Stone et al., 1999). However, since the psychometric properties of ACE-IQ were evaluated in comparison to other self-report measures (CTQ-SF & SHI), the impact of these biases might have been reduced.

5. Conclusion

In conclusion, this study provided support for the reliability and validity of ACE-IQ with individuals engaging in NSSI, suggesting that it can be used for clinical assessment and research purposes. These findings were in accordance to previous studies investigating the psychometric properties of ACE-IQ with other populations. Therefore, future studies and clinicians might benefit from using ACE-IQ to evaluate adverse childhood experiences. However, further research is needed with regards to its factor structure.

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Appendix A. ACE-IQ's items (WHO, 2018) used to test its psychometric properties

Item number	Item description
1	Did your parents/guardians understand your problems and worries?
2	Did your parents/guardians really know what you were doing with your free time when you were not at school or work?
3	How often did your parents/guardians not give you enough food even when they could easily have done so?
4	Were your parents/guardians too drunk or intoxicated by drugs to take care of you?
5	How often did your parents/guardians not send you to school even when it was available?
6	Did you live with a household member who was a problem drinker or alcoholic, or misused street or prescription drugs?
7	Did you live with a household member who was depressed, mentally ill or suicidal?
8	Did you live with a household member who was ever sent to jail or prison?
9	Were your parents ever separated or divorced?
10	Did your mother, father or guardian die?
11	Did you see or hear a parent or household member in your home being yelled at, screamed at, sworn at, insulted or humiliated?
12	Did you see or hear a parent or household member in your home being slapped, kicked, punched, or beaten up?
13	Did you see or hear a parent or household member in your home being hit or cut with an object, such as a stick (or cane), bottle, club, knife, whip etc.?
14	Did a parent, guardian or other household member yell, scream or swear at you, insult or humiliate you?
15	Did a parent, guardian or other household member threaten to, or actually, abandon you or throw you out of the house?
16	Did a parent, guardian or other household member spank, slap, kick, punch or beat you up?
17	Did a parent, guardian, or other household member hit or cut you with an object, such as a stick (or cane), bottle, club, knife, whip etc?
18	Did someone touch or fondle you in a sexual way when you did not want them to?
19	Did someone make you touch their body in a sexual way when you did not want them to?
20	Did someone attempt oral, anal, vaginal intercourse with you when you did not want them to?
21	Did someone actually have oral, anal or vaginal intercourse with you when you did not want them to?
22	How often were you bullied?
23	How often were you in a physical fight?
24	Did you see or hear someone being beaten up in real life?
25	Did you see or hear someone being stabbed or shot in real life?
26	Did you see or hear someone being threatened with a knife or gun in real life?
27	Were you forced to go and live in another place due to any of these events?
28	Did you experience the deliberate destruction of your home due to any of these events?
29	Were you beaten up by soldiers, police, militia, or gangs?
30	Was a family member or friend killed or beaten up by soldiers, police, militia or gangs?

Appendix B. Inter-item correlations

Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	0.40	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	0.12	0.08	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	0.06	0.21	0.41	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	0.11	0.08	0.41	0.39	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	0.12	0.19	0.23	0.64	0.36	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	0.05	0.18	0.19	0.26	0.26	0.34	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	- 0.01	0.03	0.17	0.27	0.25	0.35	0.26	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	- 0.01	0.03	0.22	0.21	0.13	0.16	0.25	0.17	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	0.01	0.06	- 0.02	0.05	- 0.13	0.01	0.02	0.07	- 0.07	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	0.17	0.18	0.27	0.26	0.23	0.27	0.25	0.19	0.29	- 0.10	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	0.20	0.13	0.43	0.40	0.32	0.30	0.15	0.28	0.23	- 0.03	0.48	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	0.09	0.15	0.45	0.36	0.37	0.21	0.18	0.21	0.15	- 0.07	0.31	0.58	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	0.15	0.18	0.23	0.27	0.23	0.25	0.29	0.16	0.31	- 0.00	0.71	0.43	0.29	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	0.12	0.12	0.31	0.33	0.26	0.21	0.29	0.20	0.24	- 0.01	0.37	0.43	0.36	0.50	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	0.10	0.17	0.27	0.21	0.22	0.14	0.22	0.16	0.23	- 0.05	0.33	0.52	0.42	0.43	0.41	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	0.11	0.12	0.39	0.31	0.30	0.21	0.17	0.21	0.08	- 0.02	0.26	0.45	0.72	0.30	0.36	0.54	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-
18	0.13	0.15	0.13	0.24	0.08	0.23	0.24	0.15	0.14	0.14	0.22	0.17	0.15	0.22	0.26	0.14	0.15	1.00	-	-	-	-	-	-	-	-	-	-	-	-
19	0.10	0.07	0.16	0.23	0.03	0.14	0.24	0.10	0.17	0.11	0.17	0.22	0.20	0.19	0.29	0.15	0.16	0.77	1.00	-	-	-	-	-	-	-	-	-	-	-
20	0.10	0.08	0.05	0.09	0.01	0.02	0.15	0.08	0.16	0.08	0.14	0.15	0.14	0.12	0.24	0.14	0.09	0.69	0.75	1.00	-	-	-	-	-	-	-	-	-	-
21	0.06	0.06	0.01	0.08	0.02	- 0.00	0.13	0.08	0.16	0.09	0.13	0.17	0.17	0.11	0.21	0.13	0.07	0.64	0.70	0.92	1.00	-	-	-	-	-	-	-	-	-
22	0.11	0.08	0.09	0.09	0.10	0.11	0.13	0.03	0.15	0.05	0.22	0.18	0.10	0.30	0.30	0.21	0.10	0.20	0.18	0.15	0.12	1.00	-	-	-	-	-	-	-	-
23	0.01	0.12	0.18	0.16	0.21	0.15	0.10	0.11	0.05	0.05	0.13	0.21	0.32	0.20	0.27	0.23	0.30	0.12	0.11	0.07	0.08	0.21	1.00	-	-	-	-	-	-	-
24	- 0.05	0.14	0.22	-.18	-.26	0.17	0.16	0.21	0.06	- 0.00	0.22	0.24	0.20	0.24	0.20	0.17	0.17	0.04	0.04	0.05	0.04	0.10	0.34	1.00	-	-	-	-	-	-
25	- 0.18	=0.03	0.19	0.10	0.11	0.08	- 0.01	0.90	- 0.00	0.21	- 0.01	0.08	0.10	- 0.00	0.08	0.07	0.15	0.06	0.07	0.06	0.03	- 0.05	0.21	0.27	1.00	-	-	-	-	-
26	- 0.07	0.09	0.22	0.22	0.21	0.24	0.10	0.24	0.02	0.08	0.10	0.27	0.30	0.12	0.20	0.21	0.30	0.07	0.09	0.05	0.04	0.07	0.28	0.41	0.51	1.00	-	-	-	-
27	0.06	0.02	0.10	-0.00	0.05	0.00	- 0.10	- 0.10	- 0.01	0.06	0.08	0.11	0.08	0.04	- 0.00	0.08	- 0.02	- 0.04	0.02	0.06	0.04	0.04	0.15	0.21	0.37	0.32	1.00	-	-	-
28	0.08	0.10	0.09	0.021	0.05	0.15	0.03	- 0.01	0.01	- 0.03	0.05	0.08	.05	0.03	- 0.01	0.06	0.04	0.03	0.06	0.07	0.05	0.12	0.09	0.21	0.22	0.28	0.44	1.00	-	-
29	- 0.04	0.07	- 0.09	0.00	0.00	0.09	0.00	0.13	0.00	0.13	- 0.04	- 0.04	- 0.09	- 0.04	- 0.04	- 0.04	0.00	- 0.08	- 0.13	0.00	0.00	- 0.04	- 0.05	0.13	0.00	0.07	0.00	0.17	1.00	-
30	- 0.03	0.05	0.05	0.07	0.04	0.10	- 0.00	0.01	- 0.04	0.08	0.06	0.07	0.03	0.03	0.08	0.03	0.07	- 0.01	0.02	0.06	0.03	0.04	0.20	0.07	0.08	0.15	0.18	0.24	0.38	1.00